USE OF IMPROVED SUGARCANE CULTIVATION TECHNOLOGIES BY THE FARMERS

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CERTIFICATE

This is to certify that the thesis entitled, **"USE OF IMPROVED SUGARCANE CULTIVATION TECHNOLOGIES BY THE FARMERS"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN AGRICULTURAL EXTENSION,** embodies the result of a piece of bonafide research work carried out by **Fahmida Rahman, Registration No. 00986** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:

Dhaka, Bangladesh

(Professor Md. Rafiquel Islam)
Supervisor

Dedicated to

My

Beloved Uncle Late Md. Rafiqul Ahsan

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The Author

CONTENTS

CONTENTS (contd.)

CONTENTS (contd.)

CONTENTS (contd.)

CONTENTS (contd.)

CONTENTS (contd.)

LIST OF TABLES

TABLES (contd.)

LIST OF FIGURES

APPENDICES

ABBREVIATIONS AND ACRONYMS

BBS	:	Bangladesh Bureau of Statistics
BRAC	:	Bangladesh Rural Advancement Committee
BSFIC	:	Bangladesh Sugar and Food Industries Corporation
BSRI	:	Bangladesh Sugarcane Research Institute
CDA	:	Cane Development Assistants
CDO	:	Cane Development Officer
DAE	:	Department of Agricultural Extension
df	:	Degrees of Freedom
et al	:	Associates
FAO	:	Food and Agriculture Organization
GO	:	Government Organization
ha	:	Hectare
i.e.	:	That is
IPM	:	Integrated Pest Management
ISUI	:	Improved Sugarcane Cultivation Technologies Use Index
ITK	:	Indigenous Technical Knowledge
NGO	:	Non Government Organization
NS	:	Not-significant
PCI	:	Problem Confrontation Index
r	:	Co-efficient of Correlation
SAARC	:	South Asian Association for Regional Cooperation
SPSS	:	Statistical Package for Social Science
STP	:	Spaced Transplanting
Tk.	:	Taka
TCPH	:	Tons Cane Per Hectare
*	:	Significant at 0.05 level of probability
**	:	Significant at 0.01 level of probability

USE OF IMPROVED SUGARCANE CULTIVATION TECHNOLOGIES BY THE FARMERS

ABSTRACT

A study was undertaken with the aim to determine the extent of use of improved sugarcane cultivation technologies by the farmers in cultivating sugarcane and also to explore the relationship between selected characteristics of the farmers and their extent of use of improved sugarcane cultivation technologies. Attempt was also made to identify the extent of constraints being faced by the farmers regarding their use of improved technologies. Data for the study were collected by interviewing from 115 selected farmers of Mill Gate sub-zone of Pabna Sugar Mills Ltd. under Ishurdi upazila of Pabna district during 25 April 2008 to 22 May 2008. Highest proportion of the farmers covering 46 percent had medium use of improved sugarcane cultivation technologies followed by 37 percent low use and 17 percent high use of technologies. Out of eleven selected characteristics of the farmers such as education, farm size, farming experience, training exposure, organizational participation, extension media contact, innovativeness, input availability and awareness about improved sugarcane cultivation technologies showed positive significant relationship with their use of improved sugarcane cultivation technologies. Age and annual family income had no significant relationship with their extent of using improved sugarcane cultivation technologies. The farmers addressed "High demand and high cost of fertilizer" as the highly severe problem when it was least severe in case of "Lack of power tiller". The other rest problems were "Lack of purjee (permit) for supply sugarcane in time, low price of sugarcane, scarcity of fertilizer supply in time, late payment of cane price, lack of training in adoption of improved technologies, lack of IPM knowledge, inadequate irrigation in dry season, lack of loan from sugar mills and Government, inadequate help from CDA, unavailability of recommended varieties, unavailability of certified seed cane, lack of cattle power for cultivation and problem in carrying sugarcane".

CHAPTER 1

INTRODUCTION

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1.1 General background

Sugarcane (*Saccharum officinarum* Linn.) is an important cash cum industrial field crop covering 2.05 percent (0.17 million hectares) of the country's total cultivable land (BBS, 2005). Sugarcane ranks second among cash crops, next to jute and it is the principal sugar crop in the country. In Bangladesh, it is generally cultivated in low rainfall belt (below 1500 mm) of southwest and northwest part. Of 0.17 million hectares of land under sugarcane in Bangladesh, 0.09 million hectares located in mills zone and 0.08 million hectares located in non-mills zone (BBS, 2005). The average yield of sugarcane is 41.32 ton per hectares (Table 1)

Table 1 Year wise area, production and yield of sugarcane

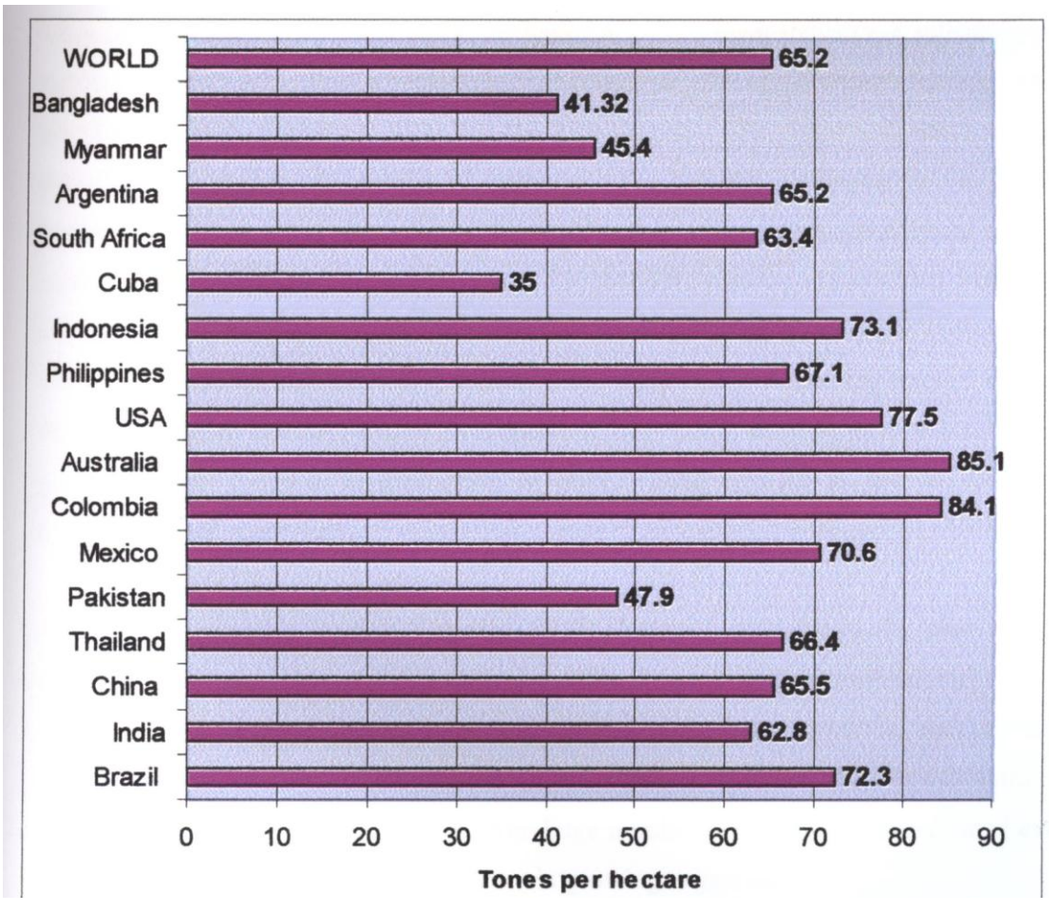
Years	Area of Sugarcane ('000 hectare)		Sugarcane Produced ('000 M/ton)		Yield/ha (M.ton)
	Mills Zone	Non - Mills Zone	Mills Zone	Non - Mills Zone	
1995-96	96	87	4341	3150	40.95
1996-97	87	88	4098	3415	43.04
1997-98	88	80	4191	3189	43.89
1998-99	94	78	4124	2827	40.33
1999-00	86	87	3525	3379	39.86
2000-01	115	85	3362	5403	33.64
2001-02	88	81	4476	3888	39.00
2002-03	105	86	4595	4257	35.72
2003-04	85	79	3948	2536	39.66
2004-05	78	79	3517	2906	40.91
2005-06	75	78	3717	1794	36.01
2006-07	84	NA	4113	NA	48.96
Mean	84.06	81.54	3499.69	3464.17	41.32

Source: BBS, Statistical Bulatine, 2006 and C Report, 2006

In Bangladesh, the place of sugar industries among agro-based industries is next only to jute industries. Sugar industry plays an important role to develop infrastructure in rural areas, rural employment, income of farm families, contribution to national exchequer,

foreign exchange saving, poverty reduction and value addition to the sugar as well as by-roduct industries (Alam, 2007).

Sugarcane occupies an area of **20.42** million ha with a total production of 1333 million metric tons of the world (FAO, 2003). Sugarcane area and productivity differ widely from country to country. Although the climate of Bangladesh is the most suitable for sugarcane cultivation but still the per hectare yield of sugarcane is not satisfactory comparing with other sugarcane growing countries of the world (Figure 1).



Source: Data From: // http://www.sugarcanecrops.com/introduction

Figure 1. Average per hectare yield of some major sugarcane growing countries of the world

Food and Agriculture Organization (FAO) has recommended that minimum per capita consumption of sugar (either in sugar or in the form of gur) should be 13.0 kg for maintaining normal nutritional requirement. Based on this requirement Bangladesh requires 1.69 million tons of sugar or 2.21 million tons of gur. The annual per capita

sugar consumption of Australia, USA and Japan are 57 kg, 50 kg and 30 kg respectively. Even in our neighboring SAARC countries like India, Pakistan and Sri Lanka the same are 20.50 kg, 19.30 kg and 12.50 kg respectively. In Bangladesh the average yearly per capita availability of sugar and gur are 2.44 kg and 4.41 kg respectively which is very low compared to other countries (Kader, 2001).

Sugarcane is a renewable and natural agricultural resource because it provides sugar, besides biofuel, fibre, fertilizer and myriad of by products/co-products with ecological sustainability. Sugarcane is the basic raw material for the sugar industry, a subsidiary raw material for chemical plant, a very important source of cash income to its farmers and an important foreign exchange saver for the Government. The sugar industries are also contributing considerable amount of revenue to the national exchequer in the form of excise duty. During the year 2003-2004 total value added from agricultural crops at constant prices Tk.4,34,500 million where Tk. 16863.52 million value added from sugar crops (BBS,2005). Sugar mills turn out as well as valuables wastes like molasses and bagasses. Molasses, the chief by-product, is the main raw material for alcohol and thus for alcohol-based industries. Excess bagasse is now being used as raw material in the paper industry. Besides, co-generation of power using bagasse as fuel is considered feasible in most sugar mills.

As a labour intensive country, creation of employment opportunity for ever growing population is a gigantic task for reducing poverty. More than 0.06 million farm-families are dependent on sugar industry for their subsistence. These industries are providing employment for nearly 16000 persons (BSFIC, 2005). Besides, due to cultivation of sugarcane which is a labor-intensive crop, huge numbers of jobs are being created every year both for the family and hired laborers in growing sugarcane.

Increasing sugarcane production depends on raising the yield as no additional lands are planned for cane cultivation. It is, therefore, urgently necessary to device ways and means to increase sugarcane production for attainment of self-sufficiency in sweetener (sugar and gur). For increasing sugarcane yield, farmers are required to cultivate latest high yielding recommended sugarcane varieties and use improved sugarcane cultivation technologies. The benefit of the newly recommended technology is actually derived only when it is efficiently utilized by the individual farmers or adopters in their local situation.

It is therefore necessary that concept of benefits of the use of improved sugarcane cultivation technologies should be disseminated to the farmers in a convincing and attractive manner so that farmers response quickly to use those technologies.

1.2 Statement of the problem

Bangladesh is considered as one of the original homes of sugarcane production. The climatic conditions in the sugarcane areas in Bangladesh support yield increase as high as 200-300 tons cane per hectare (TCPH). So, there exists ample prospect and potentiality to increase the yield of sugarcane. It is urgently necessary to devise ways and means to increase sugarcane cultivation for attainment of self-sufficiency in sweetener (sugar and gur). In order to achieve that end it is necessary to diffuse improved sugarcane cultivation technologies among the farmers.

In view of above discussion, the researcher was interested to undertake a research study entitled "Use of improved sugarcane cultivation technologies by the farmers". The purpose of the study was to determine the extent of use of improved sugarcane cultivation technologies and also to ascertain the relationships of the selected characteristics of the farmers with their use of improved sugarcane cultivation practices. The study was concerned with the use of improved sugarcane cultivation technologies, which was a major concern to increase sugarcane production and to save the sugar industries of the country as well as to develop the sugar/gur sector, a promising rural industry. For conducting the research in a planned and appropriate way, the researcher put forwarded the following questions:

- What are the characteristics of the farmers that influenced them to use those technologies?
- To what extent the improved sugarcane cultivation technologies were used by the farmers?
- Are there any relationships between the extent of use of improved sugarcane cultivation technologies and selected characteristics of the farmers?
- What are the problems confronted by the farmers?

1.3 Specific objectives:

The following specific objectives were formulated for giving proper direction to the study:

i) To determine the extent of use of improved sugarcane cultivation technologies by the farmers

ii) To analyze some selected characteristics of the farmers related to sugarcane improved technologies

The selected characteristics are-

- Age
- Education
- Farm size
- Annual family income
- Farming experience
- Agricultural training exposure
- Organizational participation
- Extension media contact
- Innovativeness
- Input availability
- Awareness about improved sugarcane cultivation technologies

iii) To explore the relationship between the extent of use of improved sugarcane cultivation technologies and the selected characteristics of the farmers

iv) To identify the problems faced by the farmers in using improved sugarcane cultivation technologies

1.4 Justification of the study

It has been revealed by different scientific studies that major portion of our farmers are illiterate or slightly educated and most of our farmers are following conventional methods of sugarcane cultivation. Few farmers have the tendency to seek out modem and recent procedures. Due to ignorance of majority of our farmers to recent technologies in the field of sugarcane, our traditional structure of sugarcane cultivation, use of these technologies is of vital importance. We just tried to figure out the response of our farmers' tendency to modern and improved sugarcane cultivation technologies under a selected site. By searching the practical status of the frequency of our farmer's interest we can get an idea about the fact, and thus we can assume the present status and also predict about the probable solutions.

The findings of this study will be applicable particularly in the socio-economical, cultural and environmentally similar regions of Bangladesh. The research findings are expected to be useful to students, teachers, researchers, farmers and other allied group of peoples like extension field workers and particularly for the national policy makers for designing future plans.

1.5 Scope and limitation of the study:

The purpose of the study was to have an understanding of the extent of use of improved sugarcane cultivation technologies by the farmers. However, from the research point of view, it was necessary to impose certain limitations as follows:

1. The study was confined to sub-zone mill gate of Pabna Sugar Mills area under Pabna district.

2. Characteristics of the farmers are many and varied but only 11 characteristics were selected for investigation in this study as stated in the objectives. This was done to complete the study within limited resources and time.

3. Population of the present study was kept confined within the heads of the sugarcane growing farm families. Because they were the major decision maker and knowledgeable family member in the adoption of modem sugarcane cultivation practices.

4. There are many improved sugarcane cultivation technologies. Only 15 latest technologies were included in the present study such as recommended sugarcane varieties, early planting, use of certified seed, seed treatment with chemicals, trench method, STP method, paired row planting, recommended dozes of fertilizer, intercropping with sugarcane, flood irrigation, use of IPM practices, earthing up, spade harvesting, detrashing of dry leaves and ratoon management.

5. The information provided by the respondents, were completely based on their memory and idea. There were no kinds of written documents in favour of the respondent's opinion.

The findings of the study will be especially applicable to sub-zone mill gate of Pabna Sugar mills area. However, the findings will also have the implication for other areas of our country having similarities with the study area. Thus the findings are expected to be useful to the extension workers and planners for preparation of programs for rapid using of improved sugarcane cultivation technologies by the farmers. The findings may also be helpful to the field workers of different nation building departments/organizations to improve their technique and strategy of action for effective working method with the rural people to generate rural employment and to improve rural economy.

1.6 Assumption of the study

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode, 1945). In order to draw any experimental job, some assumptions about the desired situation along with the major factors have to be settled which are basically considered upon some common beliefs without proof. Practically the assumptions may be true or false. In this connection, the researcher had settled the following relative assumptions in mind while carrying on this study:

1. The respondents included in the sample for this study were competent enough to furnish proper responses to the queries included in the interview schedule.

2. The researcher who acted as interviewer was adjusted to social and environmental conditions of the study area. Hence, the data collected by him from the respondents were free from bias.

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

4. Views and opinions furnished by farmers included in the sample were representative views and opinions of the whole population of the study area.

5. The findings of the study will have general application to other parts of the country with similar socio-economic and cultural condition of the study area.

1. 8 Definition of terms

Certain key terms used throughout the study are defined in this section for clarity of understanding.

Age

It is defined as the period of time from the birth of farmers to the time of interview. It was measured in terms of years.

Education

Education of an individual farmer is defined as the formal education received up to a certain level from an educational institute at the time of interview.

Farm size

It is the area of the land from which the farmer obtained crop through farming operation. It is the area being estimated in terms of full benefit to the farmers. A farmer was considered to have full benefit from cultivated area either owned by himself or obtained on lease from others and half benefit from the area which was either cultivated by himself on borga or given to others for cultivation on borga basis.

Annual income

Annual income is the total earning of the members of the respondents' family from agriculture and any other sources (business, service etc.) on a year.

Farming experience

It refers to the period of engagement with sugarcane cultivation and is measured by year of sugarcane cultivation.

Training exposure

Agricultural training exposure is the total number of days of a respondent received training in his entire life under different agricultural training programs.

Organizational participation

Organizational participation of an individual refers to his participation in various organizations as ordinary member, executive committee member or officer of the executive committee within a specified period of time.

Extension media contact

It refers to the exposure of the respondents to extension personnel, mass media and group activities.

Innovativeness

The term innovativeness referred to the degree to which an individual is relatively earlier in adopting new ideas than the other members of a social system (Rogers, 1983). Innovativeness of a respondent is measured on the basis of adoption of fifteen technologies particularly in terms of time.

Input availability

Availability of input refers to the extent of availability of 8 essential inputs for sugarcane cultivation. The essential inputs including seed, fertilizer, insecticide, irrigation water, farm implement, technical assistant, market facilities and credit facility.

Awareness about improved sugarcane cultivation technologies

Awareness about sugarcane technologies is simply knowing the existence of a new technology about sugarcane cultivation by the potential user.

Improved technologies

Improved technologies in respect of cultivation of any crop refer to those technologies, which are recommended by some competent authority. These technologies, if used, are helpful for improving the yield and/ or quality of the crop. In this study, 15 improved technologies of sugarcane cultivation were considered namly, “Recommended sugarcane varieties, early planting, use of certified seed, seed treatment with chemicals, trench method, STP method, paired row planting, recommended dozes of fertilizer, intercropping with sugarcane, flood irrigation, use of IPM practices, earthing up, spade harvesting, detrashing of dry leaves and ratoon management”.

CHAPTER 2

REVIEW OF LITERATURE

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Review of the literatures relevant with this study is presented in this chapter. The present study is concerned with the use of improved sugarcane cultivation technologies by the farmers and its relationship with their selected characteristics. An effort was made to know the findings of the past researches. Accordingly, the researcher made extensive search of past studies that could be made available. Findings of past studies indicate certain relationships between the use of improved sugarcane cultivation technologies and selected individual characteristics. This chapter is divided into three parts. The first part deals with the review of studies related to the use of different technologies, the second part deals with the relationships between farmers' characteristics and their use of improved cultivation technologies and third part deals with the conceptual framework of the study.

2.1 Review of Literature on general context

Haque (1984) investigated the research on the extent of adoption of improved practices in sugarcane cultivation in selected areas of Jessor district. He observed that 62.75 percent respondent growers adopted early time of planting, 60.75 percent of the respondent growers adopted recommended dose of fertilizer and 54.9 percent respondent growers adopted trench method.

Kher (1987) conducted a study on the sugarcane growers of Kodinar and Talata villages found that 67.34 and 72.66 percent of sugarcane growers had medium level of adoption of modern sugarcane cultivation technology respectively.

Sing and Rajendra (1990) found that out of 150 farmers adopted COS 767 variety of sugarcane, while only 45 farmers did not adopt. A high level of adoption was found in nitrogen fertilizer and weeding and interculture (110 percent) followed by plant protection measures (74.3 percent) potassic fertilizer (33.1 percent). Only 28.6 percent adopted ridge planting practices.

Singh *et al.* (1992) undertook a research study in India on factors affecting the adoption of improved sugarcane production technology. They observed that majority of sugarcane growers had the medium level of adoption and were partial adopters of scientific recommendations of sugarcane production technology.

Hoque (1993) conducted an investigation on the adoption of improved practices of sugarcane cultivation in Sreepur upazila of Gazipur district. The study revealed that 31 percent of the cane growers had high adoption while 37 percent had medium and 32 percent had low adoption of improved practices in sugarcane cultivation.

Hussen (2001) conducted an investigation on adoption of modem sugarcane cultivation by the farmers of Dewangonj upazila in Jamalpur district. The study revealed that about 91 percent of the respondents had medium adoption of modem sugarcane cultivation practices compared to 7 percent having low and only 2 percent having high adoption of modem sugarcane cultivation.

Hossain (1971) carried out a research study on the adoption of four improved practices of paddy cultivation in Gazipur of Mymensingh District. The practices were (i) plant protection measure, (ii) recommended variety of paddy, (iii) line transplanting and (iv) recommended dose fertilizer. It revealed that among the responded farmers 57.40 percent adopted plant protection measure, 35.51 percent adopted recommended variety of paddy, 25.36 percent adopted line transplantation and 11.52 percent adopted recommended dose of fertilizers.

Karim (1973) conducted a study on the adoption of fertilizers by transplanting aman growers in former Keyotkhali union of Mymensingh district. He studied on the adoption of three fertilizers-urea, triple super phosphate (TSP) and muriate of pothash (MP). He found that 4 percent of the respondent growers had high adoption of the fertilizer while 9 percent had medium adoption and 41 percent low adoption. Forty six percent (46 percent) of the remaining respondent growers did not use any of the three fertilizers.

Razzaque (1977) studied on the extent of adoption of HYV rice in three villages of Agricultural University Extension Project area. He observed that among the respondent growers, 6.6 percent of the farmers had high adoption of HYV rice, 33.3 percent had medium adoption and 40 percent had low adoption.

Rahman (1986) studied the adoption of four improved practices namely, use of fertilizer, line sowing, irrigation and use of insecticides in transplanted aman rice cultivation in two village of Mymensingh districts. It revealed that 22 percent of the respondent farmers adopted all the four practices in combination against 49 percent adoption three practices, 22 percent adopted two practices, 5 percent adoption one practices and only two percent adopted none of the four practices.

Gogoi and Gogoi (1989) conducted a study on adoption of recommended plant protection practices in rice in Jorhat district of Asam state in India. The recommended practices were seed selection, seed treatment, growing of tolerant or resistant variety, prophylactic measures and chemical protection measures. The study revealed that among the respondents 50 percent had low level of adoption, 36.36 percent had medium level of adoption and 13.64 percent had high level of adoption of recommended plant protection practices.

Ramaswamy *et al.* (1992) in their study on modern rice varieties grown with fertilizer and found that improved technologies have been adopted effectively in favorable areas but the adoption is likely to be limited in unfavorable areas.

Alam (1997) studied the extent of the use of improved farm practices by the rice growers in Anwara thana of Chittagong district. The study revealed that 43 percent of the respondents had medium use of improved farm practices and 50 percent of the respondents had low use of farm practices and only 7 percent of the respondents had high use of improved practices.

Karim and Mahbub (1989) studied of HYV wheat in Kushtia union of Mymensingh district.They found that among the respondent wheat farmers, 74 percent adopted HYV wheat cultivation and 26 percent farmers were non-adopters.

Rahman (1999) studied the adoption of balanced fertilizer by the boro rice farmers of Ishwarganj thana. He found that the extent of use of balanced nitrogenous fertilizer, 48.57 percent of the farmers had optimum adoption and above optimum respectively. In respect of extent of use of balanced phosphoric fertilizer 79.05 percent of the farmers had below optimum adoption compared to 20.95 percent having optimum adoption. Regarding the extent of use of balanced potassic fertilizer 80.95 percent of the farmers had below optimum adoption compared to 18.10 and 0.95 percent having optimum and above optimum adoption, respectively.

Hossain (1999) studied the extent of adoption behavior of contact wheat growers in sadar upazila of Jamalpur district. He found that more than half (52 percent) of the growers had medium adoption of improved farm practices compared to 34 percent having low adoption and only 14 percent high adoption.

Muttaleb (1995) studied that extent of the adoption of improved technologies of potato cultivation by the farmers in Haibatpur union under sadar thana of Jessore district. The study revealed that 8 %, 43% and 49% of the potato growers had high, medium and low adoption of improved technologies respectively.

Sarker (1997) studied the extent of adoption of improved potato cultivation practices by the farmers in Comilla district. The study revealed that more than half (55 percent) of the respondents had medium adoption compared to 23 percent having low adoption and 22 percent high adoption of improved potato cultivation practices.

Muhammad (1974) studied that extent adoption of insect control measures by the farmers in Khamar union of Rajshahi district. He found that among the respondent farmers, 25 percent did not adopt insect control measures, 28 percent had high level of adoption,32 percent had medium level of adoption and 25 percent had low level of adoption.

Sobhan (1975) studied on the extent of adoption of ten winter vegetables namely, tomato, radish, lettuce and potato in Boilor union of Mymensingh district. Overall winter vegetable adoption scores of the farmers could range from 0 to 140 percent. Overall adoption scores indicated that 27 percent of the farmers did not adopt winter vegetables cultivation, 48 percent had low adoption and 25 percent high adoption.

Naika and Rao (1990) concluded that more area was brought under plant protection chemicals after adoption of improved practices. It increased from 45.75 acres to 104.75 acres in an adopted village and 8.00 acres to 11.00 acres in non-adopted village.

Khan (1993) carried out a research study on adoption of insecticides and related issues in the village of Pachon union, Madaripur district, He observed that among the respondent farmers, 7 percent had no adoption, 57 percent had low adoption, 32 percent had medium adoption and only 4 percent had high adoption insecticides.

Nikhade *et al.* (1993) observed in their study on adoption of improved practices of soybean cultivation that cent percent adopted improved varieties. More than 82 percent had complete adoption of pakage practices like time showing, spacing and intercultural operations. Partial adoption was observed in majority of the soyabean growers (74.6 percent) with regard to recommended seed rate.

Hasan (1996) found in his study that the highest proportion (44 percent) of the respondents perceived the existence of medium adoption, compared to 26 percent low adoption and 30 percent high adoption in respect of selected agricultural technologies.

Chowdhury (1997) conducted an investigation on adoption of selected BINA technologies by the farmers of Boyra union in Mymensingh district. The study revealed that the majority (58 percent) of the respondent had no adoption of BINA technologies and 42 percent were adopted BINA technologies.

Podder (1999) concluded a research study on the adoption of Mehersagar banana by the farmers. He found 47 percent of the respondents had medium adoption compared to 14 percent having low and 39 percent having high adoption.

Sardar (2002) studied on adoption of IPM practices by the farmers under PETRA project of RDRS. He found that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high adoption of IPM practices.

2.2 Review of relationship between farmers' characteristics and their use of improved cultivation technologies

2.2.1 Age

Singh and Rajendra (1990) in their study on adoption of improved sugarcane variety found that age had positive and significant association with the adoption of improved sugarcane variety.

Pal (1995) conducted a study on adoption of recommended sugarcane cultivation practices by the farmers. He found that age had significant and negative relationship with the adoption of recommended sugarcane cultivation practices. Similar finding were found by Hasan (1996) and many others.

Hussen (2001) conducted a study which concluded that age of the sugarcane growers had a significant negative relationship with their adoption of modem sugarcane cultivation practices. Rahman (1999) also found similar result in his study.

Rahman (2001) observed that there was no significant relationship between age and adoption of Aalok-6201 hybrid rice cultivation practices. Podder (1999) and Hossain (1999) found similar results in their respective studies.

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He found that ages of the farmers was not related to their adoption of modem agricultural technologies.

Singh (1991) conducted a study to determine the extent of adoption of selected recommended practices by kinnown growers of Ferozepur and Faridkot districts of Punjab. He found no relationship between age of the farmers and their level of adoption of plant protection measures.

Khan (1993) in his study found that age of the farmers was significantly related with their adoption of insecticides. He also found that with the increase of age of the farmers, the adoption of insecticides reduce i.e., age was negatively related with adoption.

Hoque (1993) observed that age had a negative relationship with the adoption of improved practices in sugarcane cultivation.

Muttaleb (1995) reported that age of the farmers had no relationship with overall adoption of potato technologies.

Islam (1996) conducted a study on farmers' use of indigenous technical knowledge (ITK) in the context of sustainable agricultural development. He found that age of the farmers had significant negative relationship with their extent of use of ITK.

Sarker (1997) observed that there was no significant relationship between age of the farmers and their adoption of improved potato cultivation practices. Similar findings were observed by Rahman (1986), Chowdhury (1997) and Kher (1992) in their respective studies.

Sardar (2002) conducted a study on adoption of Integrated Pest Management practices by the farmers under PETRRA project of RDRS. He found that age of the farmers had a negatively significant relationship with their adoption of Integrated Pest Management practices.

2.2.2 Education

Hoque (1993) studied adoption of improved practices in sugarcane cultivation by the sugarcane growers of Sreepur Thana of Gazipur district. He finding of the study indicated a positive relationship between education of farmers and their adoption of improved practices. Beal and Sibley (1967) and Karim (1973) also observed the same results between these concerned variables.

Pal (1995) conducted a study on adoption of recommended sugarcane cultivation practices by the farmers. He found that education had significant and positive relationship with the adoption of recommended sugarcane cultivation practices.

Hussen (2001) conducted a study on farmer's knowledge and adoption of modem sugarcane cultivation practices. He found that education of the growers had a positive significant relationship with their adoption of modem sugarcane cultivation practices.

Hossain (1999) in his study identified a significant and positive relationship between education of wheat growers and their adoption of improved farm practices. Rahman (1999) found the similar findings in his study.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practices in five villages of Comilla district. He found that education of potato growers had significant relationship with their adoption of improved potato cultivation practices.

Hossain and Crouch (1992) studied the relationship of education with adoption of improved farm practices. The study revealed a positive relationship between education and adoption of improved farm practices.

Khan (1993) studied on the adoption of insecticides and related issues in the village of Pachar union, Madaripur district. He observed that education had a significant positive relationship with the adoption of insecticides. The similar findings had also been reported by Bose and Saxena (1965), Hossain (1971), Rahman (1973) and Bashar (1993).

Hasan (1996) conducted a study on adoption of some selected agricultural technologies among the farmers perceived by the frontline GO and NGO workers. He observed that education have no significant relationship with the perceived adoption of selected agricultural technologies. Similar results were found by Kher (1992), Islam (1996) and Hossain (1999).

Alam (1997) observed that the level of education of the farmers had a positive and significant relationship with their use of improve farm practices. Sardar (2002) also found the similar result.

Podder (1999) found that there was no significant relationship of education of farmers with their adoption of Mehersagar banana cultivation in the study area.

2.2.3 Farm size

Bashar (1993) conducted a study on the adoption of intercropping of sugarcane. He observed that there was no relationship between farm size of the respondent farmers and their adoption of sugarcane intercropping. Similar findings were also observed by Sobhan (1975).

Hoque (1993) conducted a research study on adoption of improved practices of sugarcane cultivation by the sugarcane growers of Sreepur thana under Gazipur district. His study revealed that farm size had a negative significant relationship with the adoption of improved practices in sugarcane cultivation.

Hussen (2001) conducted an investigation on adoption of modem sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a significant positive Relationship between farm size of the farmers and their adoption of modern sugarcane cultivation practices.

Alam (1997) studied the use of improved farm practices in cultivation by the farmers. The findings of the study showed that the farm size had a significant relationship with their use of improved practices in rice cultivation.

Hossain (2003) conducted a research study on farmer's knowledge and adoption of modem Boro rice cultivation practices. He found that farm size of the farmers had significant positive relationship within their adoption of modem Boro rice cultivation practices.

Hossain (1999) found that size of farm had no significant relationship with the adoption of improved farm practices in wheat cultivation.

Gogoi and Gogoi (1989) in their study observed that size of land holding of farmers had a significant relationship and positive effect on their adoption of plant protection practices. Khan (1993) in his study observed that the farm size was positively and significantly related to the adoption of insecticides.

Islam (1996) found that the farm size had a significant negative relationship with their extent of use of indigenous technical knowledge (ITK).

Chowdhury (1997) conducted a research study on adoption of selected BINA technologies by the farmers. He indicated that farm size had strongly positive significant relationship with the adoption of selected BINA technologies. Rahman (1986), Hoque (1993), Khan (1993) and Sarker (1997) observed similar findings.

2.2.4 Annual family income

Hoque (1993) observed a negative trend in his study but no relationship between the annual income of the cane growers and their use of recommended dose of fertilizer in sugarcane cultivation.

Hussen (2001) conducted an investigation on adoption of modem sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a significant positive relationship between annual income of the farmers and their adoption of modem sugarcane cultivation practices.

Rahman (2001) conducted an investigation on adoption of modem sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a significant positive relationship between annual income of the farmers and their adoption of modem sugarcane cultivation practices. Hossain (2003) found the similar findings.

Hossain (1999) conducted a research study on the adoption behaviour of contact wheat growers. In the study, he found that there was no relationship between the income of contact growers and the adoption on improved farm practices in wheat cultivation. Beal and Shibley (1967) found the similar finding in their study.

Singh (1991) found that income of the farmers was significantly associated with the level of adoption of plant protection measures. He also found that farmers having low income had greater tendency to apply less than the recommended doses of insecticides.

Khan (1993) found significant relationship between annual income of the farmers and their adoption of insecticides. Similar finding obtained by Alam (1997) and Pal (1995).

Chowdhury (1997) found significant positive relationship between annual income and adoption of selected BINA technologies. Rahman (1986), Islam (1993), Khan (1993) and Sarkar (1997) observed that similar result.

Nuruzzaman (2000) observed in his study that there was no significant relationship between family income of the FFS and non-FFS with their attitude on IPM.

Islam (2002) conducted a study on adoption of modem agricultural technologies by the trainers of Sandwip. He observed that the annual income of the farmers had no relationship with their adoption of modem agricultural technologies.

Sardar (2002) conducted a study on adoption of Intregated Pest Management practices by the farmers under PETRA project of RDRS. He found that the annual income of the farmers had no relationship with their adoption of Integrated Pest Management practices.

2.2.5 Farming experience

Chowdhury (1996) conducted a study in Nowabgonj, Dhaka on the factors affecting adoption behavior of Boro rice growers. He reported that farming experience significantly influenced farmers in accepting production technology.

2.2.6 Agricultural training exposure

Hossain (1981) showed that proper training could raise the knowledge and skilled level of participants significantly.

Verma *et al.* (1989) found there was significant change in attitude of rural women from before training to after training in improved home making tasks. They said that due to gain in knowledge the attitude become more favorable.

Rahman (2001) observed in study that training received of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Islam (2002) conducted a study on farmers' knowledge and adoption of ecological agricultural practices under the supervision of Proshika. He found that agricultural training experience of the farmers had no significant relationship with their adoption of ecological agricultural practices.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA projects of RDRS. He found that training experience of the farmers had a positive significant relationship with their adoption of IPM practices.

Haque (2003) found that training received of the respondent had positive significant relationship with their practices in farmers adoption of modem maize cultivation technologies.

2.2.7 Organizational participation

Hoque (1993) in his study observed a positive relationship between organizational participation of the cane growers and their use of recommended dose of fertilizer. Similar relationship was found in his study in case of adoption of pest management practices.

Hossain (1999) found that organizational participation of the farmers had a positive relationship with their adoption of improved wheat practices.

Kher (1992) carried out a research study on the adoption of improved wheat cultivation practices by the farmers in selected village Rajouri block, India. He observed that there was no significant relationship between the farmers' social participation and their adoption of improved wheat cultivation practices. Hossain (1981), Balasubramaniam and Kaul (1985), Islam (1996) found the similar findings.

Khan (1993) found that organizational participation of the farmers had positive relationship with their adoption of insecticides.

Islam (1996) reported that organizational participation of the farmers had no relationship with their extent of use of indigenous technical knowledge in the context of sustainable agricultural development.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practices in five villages of Comilla District. He observed that organizational participation of the potato growers had no significant relationship with their adoption improved potato cultivation practices. Similar results were observed by Kher (1992), Hossain (1981), Balasubramanian and Kaul(1985), Rahman (1995) and Islam (1996).

Chowdhury (1997) conducted a research study on the adoption of selected BINA technologies by the farmers. He found that there was significant positive relationship between the farmers' Organization participation and their adoption of composite BINA technologies. Karim (1973), Rahman (1986), Bashar (1993), Islam (1993), Khan (1993), Hoque (1993) and Pal (1995) found the similar findings.

2.2.8 Extension media contact

Ali *et al.* (1986) observed that there was no relationship between extension contact of the farmers and their adoption of improved sugarcane cultivation technologies. Bashar (1993) found similar findings.

Hussen (2001) conducted and investigation on adoption of modem sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a positive significant relationship between extension media contact of the farmers and their adoption of modem sugarcane cultivation practices.

Alam (1997) studied use of improved farm practices of rice cultivation by the farmers of Anwara thana of Chittagong district. The study indicated no significant relationship of extension contact of farmers with their use improved farm practices in rice cultivation.

Rahman (2001) conducted an investigation on knowledge, attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymensingh district. He observed that there was a significant positive relationship between extension media contact of the farmers and their adoption of Aalok-6201 hybrid rice. Hossain (2003) also found the similar findings.

Hossain (1999) found that extension contact had a significant and positive relationship with the adoption of improved farm practices in wheat cultivation. Similar positive relationship between extension contact and the adoption of innovations had also been reported by many researchers (Beal and Shibley, 1967; Muhammad, 1974; Naika and Rao, 1990).

Heong (1990) observed a positive and significant relationship between extension contact and adoption of improved potato cultivation practices. Karim (1973), Pathak *et al.* (1992), Kher (1992), Islam (1993) Hoque (1993) and Pal (1995) also found the similar results.

Juliana *et al.* (1991) found that mass media exposure of the farmers were positively associated with their extent of adoption of integrated pest management practices.

Islam (1996) observed in his study that a significant and positive relationship between the modem exposure of respondents and their extent of use of indigenous technical knowledge in the context sustainable agricultural development.

Sarker (1997) found that extension media contact of potato growers had a positive significant relationship with their adoption of improved potato cultivation practices.

Sardar (2002) found that the contact with RDRS personnel had significant positive relationship with their adoption of IPM practices.

Sardar (2002) conducted a study on adoption of Integrated Pest Management practices by the farmers under PETRRA project of RDRS. He observed that contact with RDRS personnel of the farmers had a positive significant relationship with their adoption of IPM practices.

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He found that extension media contact of the farmers had no significant relationship with their adoption of modem agricultural technologies.

2.2.9 Innovativeness

Rahman (1973) found a positive relationship between modernism and adoption of farm practices. He defined modernism as leading for new experience or opener to innovation. So, modernism as used by him is synonymous with the innovativeness of the present study.

Hossain (1999) found a positive significant relationship between innovativeness of the farmer's and their adoption of fertilizer and also observed no relationship with adoption of pesticides. Islam (2002) and Aurangozeb (2002) found the same findings.

2.2.10 Inputs availability

Butzer *et al.* (2002) use a choice of technique framework to characterize the decision to adopt HYVs in India. They find that since HYVs require higher levels of fertilizer and irrigation to realize their yield potential, their introduction corresponded with large jump in the demand for fertilizer and irrigated land. They then concluded that it was this factor accumulation that drove the rapid rate of adoption and subsequent growth in 4 SARAH BAIRD agriculture.

2.2.11 Awareness about improved sugarcane cultivation technologies

No findings were noticed directly on this aspect to the researcher at the time of reviewing literature. However, knowledge of the technologies creates awareness of the farmers.

Moullik *et al.* (1966) conducted a study on predictive values of some factors of adopting nitrogenous fertilizers by north Indian farmers in India. He found a significant positive relationship between agricultural knowledge and adoption of nitrogenous fertilizers among the cultivators. Similar findings concerning relationship between these two variables had also been reported by Bezobra (1980) and Ali *et al.* (1986) and Ali (1993).

Hoque (1993) in his study found that extent of adoption of BR - 14 during Boro season had positive relationship with the agricultural knowledge level of the farmers. The findings indicate that the farmers with higher level of agricultural knowledge could provide crop production practices better than those of the farmers width lower level of agricultural knowledge. Ali (1995), Alam (1997) and Sardar (2002) found the similar findings.

2.3 Conceptual framework of the study

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly contains at least two important elements i.e. “a dependent variable” and an independent variable”. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variables (Townsend, 1953). An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. In view of the prime theme of the study, the researcher constructed a conceptual framework which is self explanatory and is presented in Figure 2.

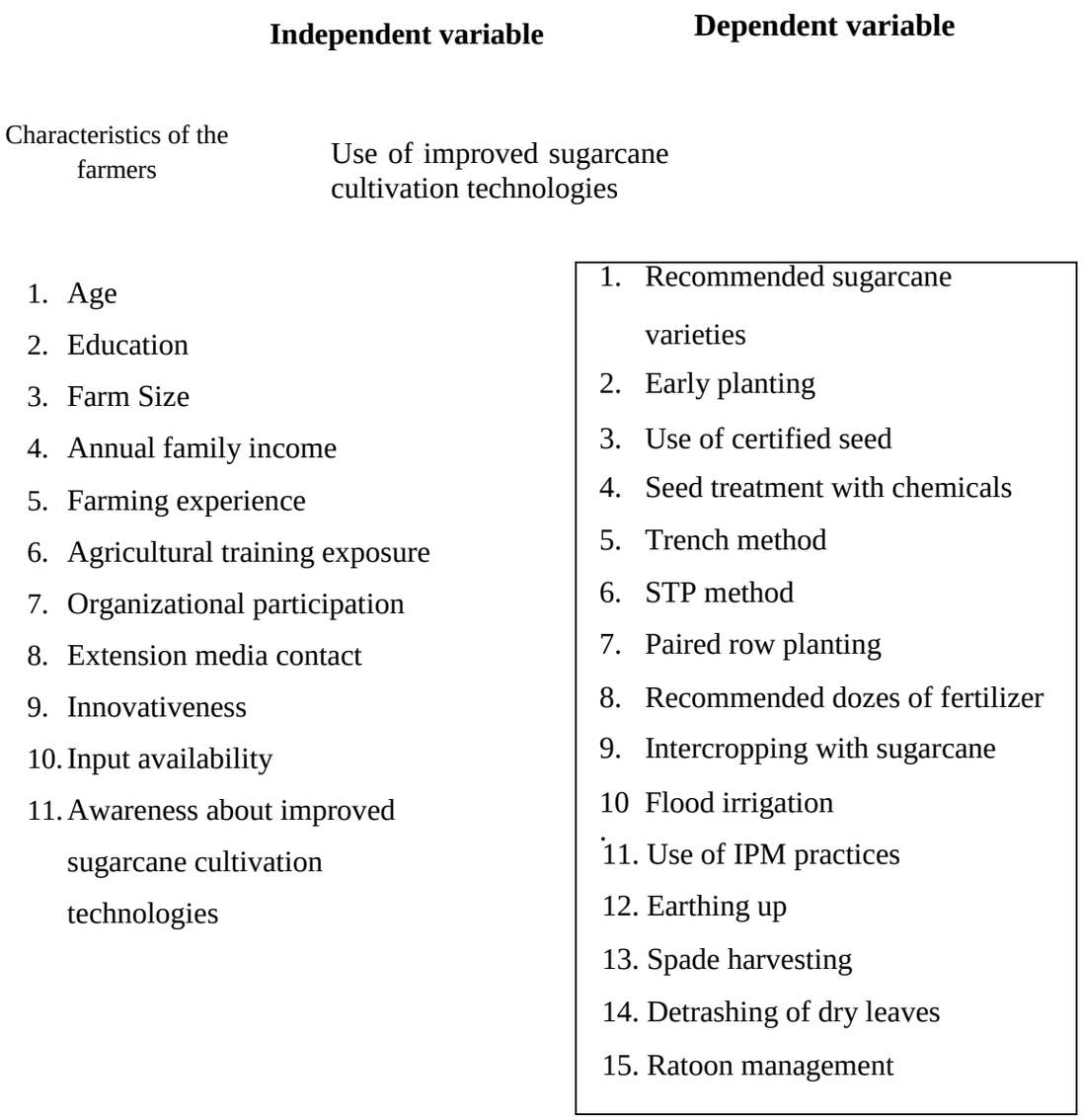

Figure 2. The conceptual framework of the study

CHAPTER 3

METHODOLOGY

CHAPTER 3

METHODOLOGY

Methodology is the most important part for conducting a research. Appropriate methodology used in research helps to collect valid and reliable decision. This chapter delineates the locale of the study followed by source of data, research design, and variables of the study, measurement of variables, categorization and statistical treatment.

3.1 Locale of the study

The population of this study consisted of all the farmers of Mill Gate sub-zone of Pabna sugar mills under Ishurdi Upazila of Pabna district. Under this sub-zone, there were 12 units with the total population of 882 farmers. About 13.04% of farmers were selected proportionately which consisted of 115 farmers. These 115 farmers constituted the sample for the present study. Distribution of farmers in accordance with population and sample is presented in Table 2. The location of the study area has been shown in Figure 3.

A reserve list of farmers was prepared so that the farmers of this list could be interviewed if any farmer included in the original sample was not available during the collection of data.

Table 2 Distribution of the farmers constituting the population, sample and reserve list in the study

Name of the sub zone	Units	Population	Sample	Reserve list
Mills Gate	1. Dashuria	85	11	2
	2. Munsidpur	43	6	1
	3. Athail Shimul	58	8	1
	4. Sonakandor	35	4	1
	5. Pakuria	98	13	2
	6. Varoimari	115	15	2
	7.Anando Bazar	80	10	2
	8. Dadpur	92	12	2
	9. Choruimari	162	21	3
	10. Salimpur	30	4	1
	11. Naodapara	68	9	1
	12. Parkhidirpur	16	2	1
Total		**882**	**115**	**19**

Numbers of farmers for the reserve list from the 12 selected units were 2 percent of original population. Thus the reserve list included 19 farmers.

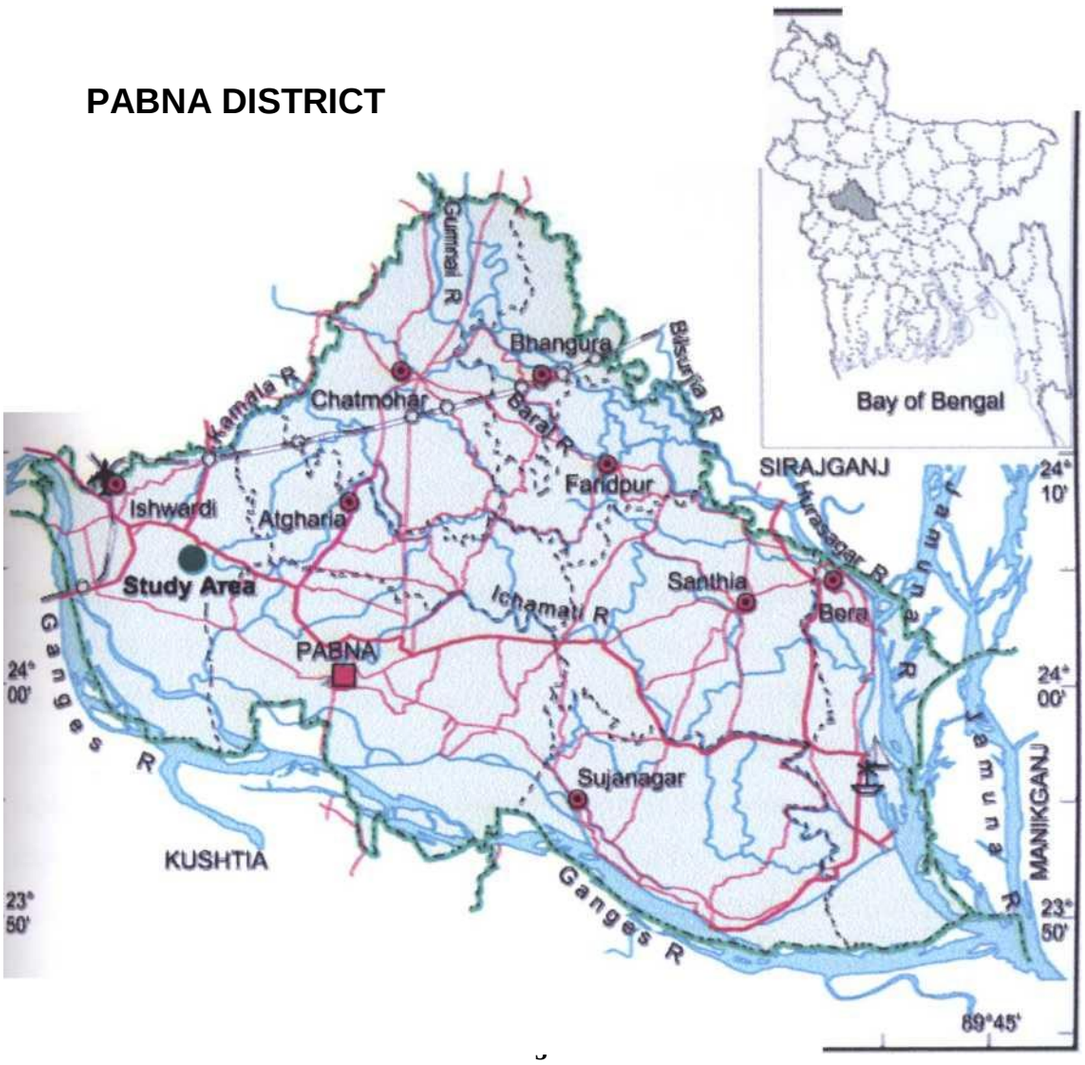

Figure 3. A map of Pabna district showing the study area

3.2 Instrument for collection of data

An interview schedule was used as the research instrument in order to collect relevant information from the respondents. The schedule was carefully designed and prepared in Bengali, keeping the objectives of the study in view. It contained both open and closed form questions. The questions were arranged systematically.

3.3 Pre-testing of the interview schedule

The interview schedule was pre-tested with 25 farmers and then final shape was given to the interview schedule according to the experience of pre-test. The pre-testing facilitated the researcher to examine the suitability of different questions and status of the instrument in general. The final revised version of the instrument was prepared on the basis of suggestions and comments of the appropriate authority.

3.4 Time and procedure of data collection

Data were collected by means of interviewing the sampled farmers. The researcher herself collected data for this study. But to familiarize the researcher with the study area and for getting local support and establishing rapport during conduction of interview with the farmers, the researcher had to seek help from one Cane Development Officer (CDO) and two Cane Development Assistants (CDA) of the study area.

Before going to the respondents of interview, they were informed verbally to ensure their availability at the proper places as per schedule date and time. The places were usually of the respondents' residence and desired rapport was made with the respondents. However, if any respondent failed to understand any question, the researcher took great care to explain the issue. Ten respondents from the reserve list were interviewed because the respondents were repeatedly unavailable for data collection. Excellent co-operation and co-ordination were obtained from all the respondents. Data were collected during 25 April to 22 May 2008.

3.5 Compilation of data

After completion of field survey, data from all the interview schedule were compiled, tabulated and analyzed according to the objectives of the study. In this process, all the responses in the interview schedule were given numerical code values. Local units of measurement were converted into standard units. The responses to the questions in the interview schedule were transferred to master sheet to facilitate tabulation. The data were entered into the computer and analyzed in accordance with the objectives of the study using SPSS.

3.6 Categorization of data

For describing the independent and dependent variables, the respondents were classified into appropriate categories. In developing categories, the investigator was guided by the nature of data and general considerations prevailing in the social system. The procedures for categorization have been discussed while describing the variables in the relevant chapter i.e. chapter 4.

3.7 Variables of the study

In a descriptive social research the selection of variables constitute an important task. In this connection, the investigator looked into the literature to wider his understanding about the nature and scope of the variables involve in the research studies. A variable is any characteristic which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959). A well organized piece of research usually contains at least two important variables, viz. an independent and a dependent variable. An independent variable is that factor which is manipulated by the experimenter in its attempts to ascertain the relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the experimenter introduces, removes or varies the independent variables (Townsend, 1953).The dependent variable is often called the 'criterion' or 'predicted variable' where as the independent variables are called 'treatment', 'experimental' or 'antecedent' variable (Deobold, 1973).

3.7.1 Selection and measurement of independent variables

For selection of independent variables, the researcher reviewed the related literature as far as possible. He had discussion with the relevant fields. Therefore, considering the farmers' behavioral (observed) conditions and other resources available to the researcher, eleven characteristics of the farmers selected as the independent variables for this study. The selected characteristics included age, education, farm size, annual income, farming experience, agricultural training exposure, organizational participation, extension media contact, innovativeness, input availability, awareness about improved sugarcane cultivation technologies. Procedures followed in measuring the independent characteristics are briefly discussed :

3.7.1.1 Age

Age of the respondents was measured in terms of actual years from their birth to the time of interview.

3.7.1.2 Education

Education was measured as the ability of an individual respondent to read and write or the level of formal education received from educational institution. If a respondent did not know how to read and write his education rate was taken as zero (0). A score of 0.5 was given to that respondent who could sign his name only. Besides a respondent got actual score of one for every year of schooling_i.e. 10 for S.S.C, 12 for H. S. C and so on.

3.7.1.3 Farm size:

Farm size refers to the total cultivated area either owned by a farmer or obtained from others on share cropping system or taken from others as mortgage/borga where he/she used to do his/her farming operations during the period of this study. The farm size of the respondent was computed in hectares using the following benefit formula:

$$Fs = A1 + A2 + \mathbf{1/2}\ (A3 + A4) + A5 + A6$$

Where, Fs = Farm size

A1 = Homestead area excluding pond and garden area

A2 = Own land under own cultivation

A3 = Own land given to others on borga

A4 = Land taken from others on borga

A5 = Own land given to/taken others on lease

A6 = Others (Fruit garden, pond etc.)

3.7.1.4 Annual income

Annual income of a respondent was measured on the basis of total yearly income from agriculture and others sources (services, business etc.) earned by the respondent himself/herself and other family members. The income was measured in 'Taka' by multiplying the quantity of those crops with its prevailing market price per unit quantity. In case of business or service, their monthly income was multiplied by twelve to

determine annual income. However, unit score of one (1) was given for each one thousand taka.

3.7.1.5 Farming experience

It is the period that was passed by the respondent in cultivating sugarcane. It was measured in years. If a respondent cultivating sugarcane from the period of his parent his experience was considered as the period of his age excluding fifteen years, i.e. if his age was 50 years his experience scored as 35 (50-15).

3.7.1.6 Agricultural training exposure

Agricultural training exposure was measured by the total number of days of a respondent received training in his entire life under different agricultural training programs.

3.7.1.7 Organizational participation

Organizational participation of the respondent was measured on the basis of the nature of his participation and duration of his participation in different organizations. Organizational participation score was computed in the following manner for participation in each organization.

Organizational participation score =∑P x D

Where,

P = Participation score

D = Duration score

Participation score was computed in the following manner.

Nature of participation	Scores assigned
No participation	0
Participation as ordinary member	1
Participation as executive committee member	2
Participation as president or secretary	3

For measuring the duration of participation, a score of one was assigned for each year of participation in each organization. Thus, organizational participation score for an organization of a respondent was obtained by adding after multiplying the duration with the individual scores for ordinary member, executive committee member and president or secretary. Final organization participation score of a respondent was measured by summing up all the scores for all the organizations.

3.7.1.8 Extension media contact

It was defined as one's extent of exposure to different information sources related to agricultural extension teaching methods. The extent of contact was determined against three (3) point scales as never, occasionally and frequently and score was assigned to represent the same as 0, 1 and 2 respectively. For all the sixteen selected extension media, it has been described as follows:

Extent of contact	Weighting system
Never	0
Occasionally	1
Frequently	2

The extension contact of a respondent was, therefore, determined by adding the total responses against 16 selected extension media. The extension contact score could range from 0 to 32, where 0 indicating no extension contact and 32 indicating very high contact.

3.7.1.9 Innovativeness

Score	Duration of time (in years)
4	For adoption of technologies within 1 years after hearing by the respondent
3	For adoption of technologies within 2 years after hearing by the respondent
2	For adoption of technologies within 3 years after hearing by the respondent
1	For adoption of technologies within 4 years or above after hearing by the respondent
0	For non adoption of technologies

According to Rogers (1995), innovativeness is the degree of adoption a new technology to which an individual or other unit of adoption is relatively earlier than the other

member of the social system. Innovativeness of a respondent was measured by computing a innovativeness score on the basis of his/her extent of use of 8 selected modem agricultural practices. Scores were assigned on the basis of time dimension in the following manner.

Innovativeness score of a respondent was obtained by adding his/her score for all the items. As 8 innovativeness were selected for the study, so the possible innovativeness score of the respondents could range from 0 to 32, 0 indicating no innovativeness and 32 indicating very high innovativeness.

3.7.1.10 Input availability

Availability of input referred to the extent of availability of 8 essential inputs for sugarcane cultivation. The essential inputs included seed, fertilizer, insecticide, irrigation water, arm implement, technical assistance, market facilities and credit facility. This variable was measured by assigning score for each of the 8 selected inputs facilities using a 4 points scale as follows: Always available-3, easily available-2, available at time-1 and not available 0. The total input facilities score of a respondent was computed by adding all the score obtained from each of the 8 available facilities. Thus the input facilities score of a respondent could range from 0-24. 0 indicating lowest and 24 highest level of inputs availability of respondent.

3.7.1.11 Awareness about improved sugarcane cultivation technologies

Awareness of a respondent was measured by asking 15 selected questions related to various improved sugarcane technologies. It was measured in score. The total assigned score of all the questions was 30. A full score was assigned for each correct answer and partial score was assigned for each partial correct answer and 0 for the wrong answer. However, for correct responses to all the questions, a respondent could get a total score of 30, while for no or wrong responses to all the questions a respondent could get ‘O’. As such ‘0’ indicates having no awareness and 30 indicates very high awareness.

3.7.2 Measurement of dependent variable

The extent of use of improved sugarcane cultivation technologies by the farmers was considered as dependent variable in this study. This variable was measured on the basis of

their use of different kinds of improved sugarcane technologies. The scores of the respondents were computed on the basis of the respondents' uses of 15 improved technologies.

The 15 improved technologies are:

1. Recommended sugarcane varieties
2. Early planting
3. Use of certified seed
4. Seed treatment with chemicals
5. Trench method
6. STP method
7. Paired row planting
8. Recommended dozes of fertilizer
9. Intercropping with sugarcane
10. Flood irrigation,
11. Use of IPM practices
12. Earthing up
13. Spade harvesting
14. Detrashing of dry leaves and
15. Ratoon management.

A four-point rating scale such as 'frequently', occasionally, rarely and 'not at all' was used to measure the extent of use of improved sugarcane cultivation technologies.

A four-point scale was used in measuring the 'extent of economic development perceived" by the respondents under Bangladesh Rural Advancement Committee (BRAC) agricultural credit program. In another study of Islam (1996), a similar type of scale was used in determining the "extent of use of Indigenous Technical Knowledge (ITK) in the context of sustainable agricultural development". However, use of four-point scales identical to the above ones was frequently found in many studies employed to ascertain the "extent of use of communication media" by the respondents.

Scoring techniques

The methods of assigning scores to the four alternatives in each statement was as follows:

Extent of use of improved sugarcane cultivation technologies	Scores assigned
Frequently	3
Occasionally	2
Rarely	1
Not at all	0

As 15 improved sugarcane technologies were selected for the study, so the range of improved sugarcane technologies score of a respondent could vary from 0 to 45, where, 0 indicate no use of technologies and 45 indicate frequent use of different improved sugarcane technologies.

However, besides having calculated the "extent of use of improved sugarcane cultivation technologies" score for each of the 115 respondents, an effort was also made to compare the relative use of these practices. An Improved Sugarcane Technologies Use Index for each practice was developed to fulfill this objectives using the following formula:

$$\mathbf{ISUI = N1 \times 3 + N_2 \times 2 + N_3 \times 1 + N_4 \times 0}$$

Where,

ISUI = Improved Sugarcane Cultivation Technologies Use Index

N1 = Number of farmers used improved technologies frequently

N2 = Number of farmers used improved technologies occasionally

N3 = Number of farmers used improved technologies rarely

N4 = Number of farmers used improved sugarcane technologies not at all

The ISUI for each of the improved sugarcane cultivation technology could range from 0 to 345 (respondent no x highest scale; 115×3) while 0 indicating no use of technology and 345 indicate highest use of the technology by each respondent.

3.8 Statement of the hypotheses

As defined by Goode and Hatt (1953) “a hypothesis is a proposition which can be put to test to determine its validity. It may seem contrary to, or in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test.”

In any event, however, it leads to empirical test. Hypothesis may be broadly divided into two categories, namely, research hypothesis and null hypothesis. In studying relationship between variables, an investigator first formulates research hypothesis which states anticipated relationships between the variables. However, for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no relationship between the concerned variables.

3.8.1 Research hypotheses

In the light of the objectives of the study and variables selected, the following research hypotheses were formulated to test them in the present research investigation. The research hypotheses were stated in positive form, the hypotheses were as follows:

“There are relationships between the selected characteristics of the farmers and their use of improved sugarcane cultivation technologies ”

3.8.2 Null hypotheses

In order to conduct statistical tests, the research hypotheses were converted to null form. Hence, the null hypotheses were as follows:

“There are no relationships between the selected characteristics of the farmers and their use of improved sugarcane cultivation technologies ”

3.9 Problems confronted in using improved sugarcane technologies

To find out problems confronted by the farmers in use of sugarcane cultivation technologies, several consultation talks were hold with the relevant personnel. The score obtained from all the problems were added together to got the problems confrontation score for a respondent.

Problem confrontation scores were assigned in the following manner:

Categories	Score assigned
High	3
Medium	**2**
Low	**1**
Not at all	0

Thus, problems confrontation score of a respondent could range from 0 to 45, while '0' indicating no problem and 45 indicating high problem. Again Problem Confrontation Index (PCI) was computed for each of the problems by using the following formula.

Problem Confrontation Index (PCI) = P h x 3 + P n , x 2 + P $_1$ X l + P $_n$ x O

Where,

Ph = Total number of the farmers expressed 'high' problem

P_m = Total number of the farmers expressed 'medium' problem

P_l = Total number of the farmers expressed 'low' problem

P_n = Total number of the farmers expressed 'not at all' problem

Thus, PCI of any problem could range from 0 to 345, where 0 indicating no problem and 345 indicating high problem.

3.10 Statistical treatment

The data after collection were coded, complied, tabulated and analyzed in accordance with the objectives of the study. Various statistical measures such as range, mean, percentage, standard deviation were used in categorization and describing the selected personal characteristics of the respondents. For clarity of understanding tables were used for presentation of data, coefficient of correlation (r) test was used to explore the relationships between independent and dependent variables. Throughout the study five percent (0.05) level of probability was used to accept or reject any null hypothesis.

RESULTS AND DISCUSSION

CHAPTER 4

RESULTS AND DISCUSSION

This chapter has been described on three important aspects. In the first one, independent variables i.e. characteristics of the respondents have been discussed. The second part deals with dependent variable "Use of improved sugarcane cultivation technologies by the farmers". The third part deals with the relationships between the selected characteristics of the farmers and their use of improved sugarcane cultivation technologies.

4.1 Individual characteristics of the farmers

The prudent use of agricultural technologies is the key to agricultural progress. Farmers use modem technologies when they find those useful in their own socio-economic set-up and agro-economic settings. Farmer's individual characteristics and personal make-up play a vital role in adopting any agricultural practice in the overall technology transfer process. A particular technology might be proved beneficial or suitable for a farmer but he may not be in a position to accept it due to his varied mental make-up and situational factors. The individual characteristics of the farmers may greatly vary and the various factors might have great impact on their use of improved technologies.

Eleven characteristics of the farmers were selected to find out their relationship with their use of improved sugarcane cultivation technologies. The selected characteristics included their age, education, farm size, annual family income, farming experience, training exposure, organizational participation, extension media contact, innovativeness, input availability and awareness about improved sugarcane cultivation technologies. These characteristics of the farmers have been described in this section. Descriptive statistics of the individual characteristics have been presented in Table 3.

Table 3 Salient features of the farmers' selected characteristics, their extent of use of improved sugarcane cultivation technologies and problem confrontation

SI. No.	Individual characteristics	Range		Mean	Standard deviation
		Minimum	Maximum		
1	Age	**19**	**75**	**43.44**	**14.152**
2	Education	**0**	**16**	**7.73**	**4.096**
3	Farm size	**0.02**	**11.74**	**1.64**	**1.610**
4	Annual family income	**20.4**	**210**	**72.07**	**36.158**
5	Farming experience	**1**	**60**	**20.76**	**12.281**
6	Training experience	**0**	**44**	**13.49**	**9.678**
7	Organizational participation	**0**	**45**	**8.90**	**8.853**
8	Extension media contact	**9**	**32**	**19.61**	**5.761**
9	Innovativeness	**13**	**34**	**25.99**	**4.597**
10	Input availability	**7**	**28**	**16.53**	**3.416**
11	Awareness about improved sugarcane cultivation technologies	**12**	**32**	**25.39**	**4.205**
12	Use of improved sugarcane cultivation technologies	**24**	**44**	**32.90**	**5.279**
13	Problem confrontation	**11**	**37**	**23.10**	**5.354**

4.1.1 Age

Age of the farmers ranged from 19 to 75 years. The average being 43.44 years and the standard deviation was 14.152. On the basis of age, the farmers were classified into three categories (Table 4).

Table 4 Distribution of the farmers according to their age

Categories (Years)	Farmers	
	Number	Percentage
Young aged (up to 31)	32	28
Middle aged (32 to 56)	61	53
Old aged (above 56)	22	19
Total	115	100

Data presented in Table 4 indicated that the majority proportion (53%) of the farmers fell in the middle aged category compared to 28% young and 19% old aged category. It is also observed that most (81%) of the respondents under study area fell in young to middle-aged categories.

4.1.2 Education

The education score of the respondents ranged from 0 to 16, the average being 7.73 and the standard deviation was 4.096. Based on their level of education, the farmers were grouped into four categories and the distribution of the respondents according to their education scores are presented in Table 5.

Table 5 Distribution of the farmers according to their education

Categories (Years)	Farmers	
	Number	Percentage
No education (0 or 0.5)	11	10
Primary education (1-5)	21	18
Secondary education (6-10)	54	47
Above secondary education(>10)	29	25
Total	115	100

It is evident from Table 5 that a large proportion (47%) of the farmers fell under the category of "secondary education" compared to one-tenth (10%) with no education, about two-fifth (18%) having primary education and one-fourth (25%) having above secondary education. The literacy rate of the country is 65.5% (Annonymous, 2003). The findings indicate that in the study area, the literacy rate seems to be higher than the national average. The reasons may be the respondents had easy access to educational institute in terms of distance and afford.

4.1.3 Farm size

Farm size of the farmers varied from 0.02 to 11.74 hectares. The average farm size was 1.64 hectares with a standard deviation of 1.610. The respondents were classified into three categories (Table 6).

Table 6 Distribution of the farmers according to their farm size

Categories	Farmers	
	Number	Percentage
Small farm (0.02 to 1.00ha)	39	34
Medium farm (1.01 to 3.00ha)	71	62
Large farm (Above 3.00ha)	5	4
Total	115	100

Data in Table 6 show that the highest proportion (62%) of the farmers had medium farm compared to 34% had small farm and 4% having large farm. The most of the farmers had

small to medium farms. The average farm size of the respondent farmers was 1.49, which is higher than the national average (0.91 hectare).

4.1.4 Annual family income

The range of annual income score was 20.4 to 210 with an average of 72.07 and standard deviation 36.158. On the basis of annual income, the respondents were divided into three categories (Table 7).

Table 7 Distribution of the farmers according to their annual income

Categories	Farmers	
	Number	Percentage
Low income (up to 50)	52	45
Medium income (50.50 to 150)	52	45
High income (Above 150)	11	10
Total	115	100

Data shown in Table 7 revealed that a similar proportion (45%) of the farmers had low and medium annual family income and one-tenth (10%) having high annual family income. It may also be revealed that most (90%) of the respondents under study area had low to medium annual income. The average annual income of the farmers of the study area was much higher than the average per capita annual income of the country i. e. 480 U. S. dollar (World Bank Development Indicators 2007).This might be due to the fact that the respondents in the study area were not only engaged in agriculture but also earn from other sources, such as service, business etc.

4.1.5 Farming experience

The computed farming experience score of the farmers ranged from 1 to 60, the average being 20.76 and the standard deviation 12.281. Based on their farming experience score, the farmers were grouped into three categories (Table 8).

Table 8 Distribution of the farmers according to their farming experience

Categories	Farmers	
	Number	Percentage
Low farming experience (up to 20)	65	57
Medium farming experience (21 to 40)	42	36
High farming experience (Above 40)	8	7
Total	115	100

Data shown in Table 8 revealed that about three-fifth (57%) of the respondents had low farming experience compared to about two-fifth (36%) as medium farming experience and less than one-tenth (7%) under high farming experience. Thus most (93%) of the farmers had low to medium farming experience. The findings on farming experience of the farmers have the harmony with that of age. The farming experience of an individual helps him to learn new technologies and may lead him to take correct decisions.

4.1.6 Agricultural training exposure

The computed training experience scores of the farmers ranged from 0 to 44, the average being 13.49 and the standard deviation 9.678. Based on their training experience scores, the farmers were grouped into three categories (Table 9).

Table 9 Distribution of farmers according to their agricultural training exposure

Categories	Farmers	
	Number	Percentage
Low training experience (up to 10)	52	45
Medium training experience (11 to 25)	46	40
High training experience (Above 25)	17	15
Total	115	100

Data contained in Table 9 indicate that about half (45%) of the respondents had low training experience compared to two-fifth (40%) having medium training experience and only 15% had high training experience. Data also revealed that most (85%) of the farmers were under low to medium training exposure.

4.1.7 Organizational participation

The computed organizational participation scores of the farmers ranged from 0 to 45 with an average of 8.90 and standard deviation 8.853. The farmers were classified into four categories on the basis of their organizational participation score (Table 10).

Table 10 Distribution of the farmers according to their organizational participation

Categories	Farmers	
	Number	Percentage
No participation (0)	23	20
Low participation (1 to 10)	49	43
Medium participation (11 to 20)	31	27
High participation (Above 20)	12	10
Total	115	100

Data shown in Table 10 revealed that one-fifth (20%) of the farmers had no organizational participation compared to more than two-fifth (43%) low, 27% medium and one-tenth (10%) high organizational participation. The findings indicate that most of the farmers (80%) had different level of organizational participation (low to high). This means that the respondents of the study area are mostly engaged in their farm works and do not participate in other organizational activities. Organizational participation was very much important for self actualization as well as technological information generation.

4.1.8 Extension media contact

The extension media contact score of the farmers ranged from 9 to 32. The average extension media contact score was 19.61 and the standard deviation of 5.761. Based on the extension media contact scores, the respondents were classified into three categories (Table 11).

Table 11 Distribution of the farmers according to their extension media contact

Categories	Farmers	
	Number	Percentage
Low media contact (up to 15)	24	21
Medium media contact (16 to 20)	36	31
High media contact (Above 20)	55	48
Total	115	100

The findings of the study indicate that most (79%) of the respondents had medium to high extension media contact. The findings impiled that the respondents are more eager to exposed themselves to different information sources related to sources.

4.1.9 Innovativeness

Innovativeness scores of the farmers ranged from 13 to 34 with an average of 25.99 and standard deviation 4.597. On the basis of innovativeness, the respondents were classified into three categories (Table 12).

Table 12 Distribution of the farmers according to their innovativeness

Categories	Farmers	
	Number	Percentage
Low innovativeness (up to 25)	45	39
Medium innovativeness (26 to 30)	47	41
High innovativeness (Above 30)	23	20
Total	115	100

These findings indicate that majority (61%) of the respondents had medium to high innovativeness.

4.1.10 Input availability

Input availability scores of the farmers ranged from 7 to 28 with an average of 16.53 and standard deviation 3 .416. On the basis of input availability, the farmers were classified into three categories (Table 13).

Table 13 Distribution of the farmers according to their input availability

Categories	Farmers	
	Number	Percentage
Low input availability (up to 12)	8	7
Medium input availability (13 to 18)	86	75
High input availability (Above 18)	21	18
Total	115	100

Data presented in Table 13 show that three-fourth (75%) of the farmers having medium input availability compared to 18% having high and 7% having low input availability. Data also revealed that most (93%) of the farmers were medium to high input availability.

4.1.11 Awareness about improved sugarcane cultivation technologies

The awareness about improved sugarcane cultivation technologies of the farmers ranged from 12 to 32 with an average of 25.39 and standard deviation 4.205. Based on awareness about improved sugarcane cultivation technologies scores, the respondents were classified into three categories (Table 14).

Table 14 Distribution of the farmers according to their awareness about improved sugarcane cultivation technologies

Categories	Farmers	
	Number	Percentage
Low awareness (up to 20)	27	23
Medium awareness (21 to 28)	59	51
High awareness (Above 28)	29	26
Total	115	100

Data in Table 14 revealed that the majority (51%) of the farmers fell in the medium awareness category compared to 26% high and 23% low awareness category. It may also be revealed that most (77%) of the respondents had either medium to high awareness about improved sugarcane cultivation technologies.

4.1.12 Problem confrontation

The computed problem confrontation scores of the farmers ranged from 11 to 37 with an average of 23.10 and standard deviation 5.354. The farmers were classified into three categories on the basis of their problem confrontation scores (Figure 4).

Figure 4 revealed that 33% of the farmers had low problem confrontation compared to 31% having medium and 36% having high problem confrontation. The findings of using sugarcane cultivation technologies by the farmers are diagrammatically shown in Figure 4.

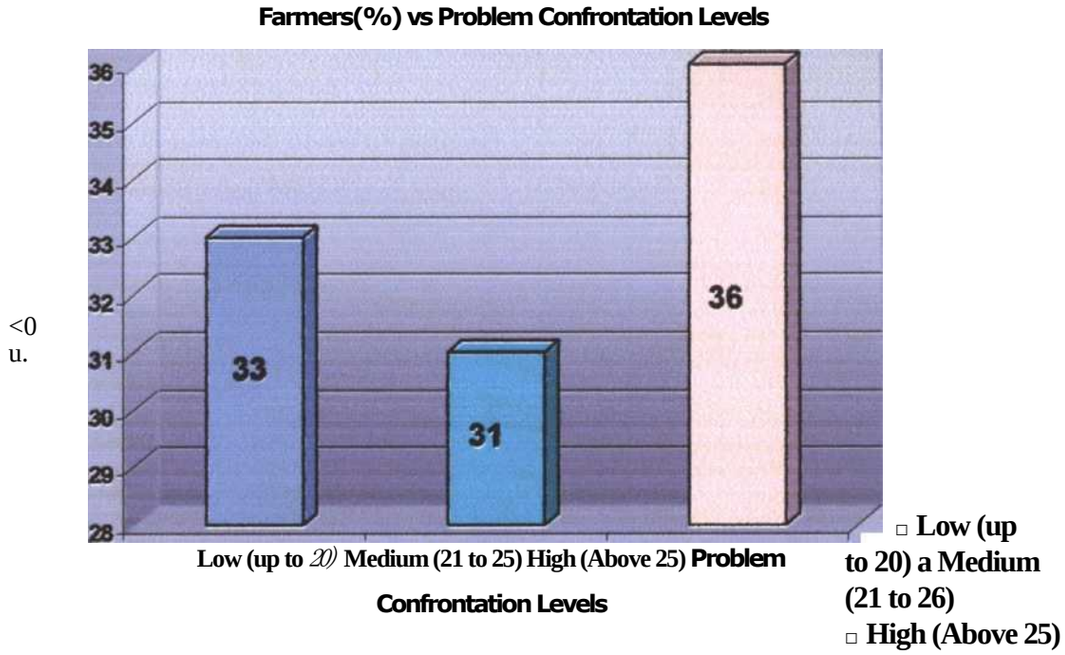

Figure 4. Bar graph showing the extent of overall problem confrontation of the farmers in using improved sugarcane cultivation technologies

4.2 Dependent Variables

As mentioned in the earlier (Chapter 3), the extent of use of improved sugarcane cultivation technologies by the farmers was considered as the dependent variable of the study.

4.2.1 Comparison among the extent of use of selected improved sugarcane cultivation technologies

In order to compare the extent of use among the selected technologies, an Improved Sugarcane Cultivation Technologies Use Index (ISUI) was developed following the

formula as described in chapter 3. The ISUI along with their associated ranks appear in Table 16.

Table 15 Comparison of improved sugarcane cultivation technologies used by the farmers

SL. NO	Technologies	Frequency of extent of use (N = 115)					
		F	O	R	N	ISUI	Rank
1	Recommended sugarcane varieties	75	40	0	0	305	2
2	Early planting	40	55	15	6	245	8
3	Use of certified seed	34	45	23	15	215	12
4	Seed treatment with chemicals	50	22	25	18	219	11
5	Trench method	67	34	15	0	284	4
6	STP method	45	35	26	10	231	9
7	Paired row planting	25	20	26	45	141	15
8	Recommended dozes of fertilizer	50	47	19	0	263	7
9	Intercropping with sugarcane	65	33	11	7	272	5
10	Flood irrigation	32	55	20	9	226	10
11	Use of IPM practices	29	50	21	16	208	13
12	Earthing up	73	25	18	0	287	3
13	Spade harvesting	40	23	12	41	178	14
14	Detrashing of dry leaves	59	40	12	5	269	6
15	Ratoon management	84	32	0	0	316	1

Abbreviation: F= Frequently, 0= Occasionally, R= Rarely, N= Not at
ISUI= Improved Sugarcane Cultivation Technologies Use Index

Based on ISUI, the improved sugarcane cultivation technologies could be classified into the following categories such as

Table 16 Distribution of improved sugarcane technologies based on their ISUI

Categories	Score	Distribution of technologies	
		Number	Percentage
Highly used technologies	288-345	1, 15=2	13.33
Medium used technologies	174-287	2,3,4,5,6,8,9,10,11,12,13,14=12	80.00
Low used technologies	Upto 173	7=1	6.67

A particular technology might be proved beneficial or suitable for a farmer but he may not be in a position to accept it due to his varied mental make-up and situational factors.

Among the 15 identified improved technologies, the percentage of highest used technologies by the farmers is 13.33. The highly used technologies are "Ratoon management and recommended sugarcane varieties" which ranked I^{s1} and 2nd respectively. The percentage of medium used technologies is 80. Medium used technologies are "Early planting, use of certified seed, seed treatment with chemicals, trench method, STP method, intercropping with sugarcane, flood irrigation, use of IPM practies, earthing up, spade harvesting and detrashing of dry leaves" which ranked 3rd, 4th, 5th, 6th, 7th , 8^{,h} 9'\ 10th, 11th , 12th, 13th, 14th respectively. The percentage of low used technologies is 6.67. Paired row planting is least used technologies by the farmers which ranked 15th

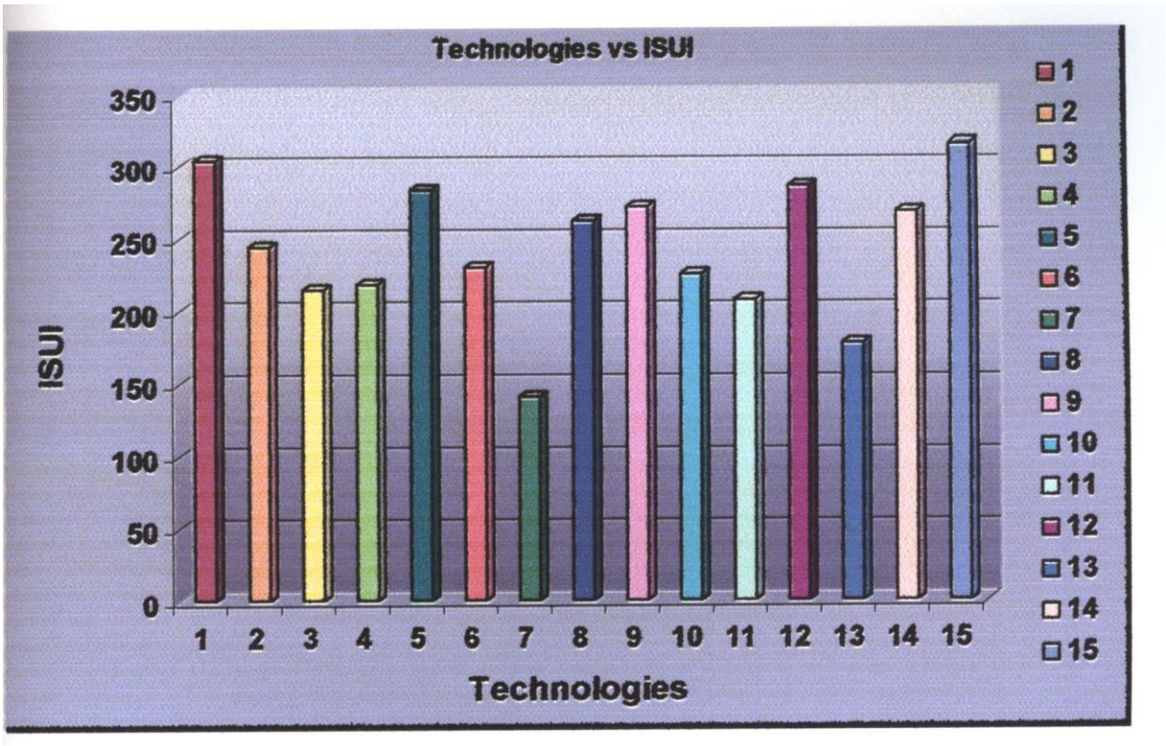

Figure 5. Bar graph showing the extent of use of improved sugarcane cultivation technologies by the farmers

1= Recommended sugarcane varieties; 2= Early planting; 3= Use of certified seed; 4= Seed treatment with chemicals; 5= Trench method; 6= STP method; 7= Paired row planting; 8= Recommended dozes of fertilizer; 9= Intercropping with sugarcane; 10= Flood irrigation; 11= Use of IPM practices; 12= Earthing up; 13= Spade harvesting; 14= Detrashing of dry leaves; 15= Ratoon management.

The highly used technologies were found more popular among the farmers, because they, in general, exert immediate and observable benefits. These technologies are not so costly, easy to adopt. Farmers had appropriate knowledge about how to apply these technologies in their field. They got adequate help from sugar mills for using these technologies By

using these technologies farmers increased yield of sugarcane. The medium uses technologies are also not so costly. These technologies are available to the farmers and they can easily adopt these technologies in their field. The farmers got observable benefits from these technologies. Low uses technologies are relatively complex, costly and these technologies are used to a less extent among the farmers.

4.2Overall use of improved sugarcane cultivation technologies

Scores of the use of improved sugarcane cultivation technologies of the farmers ranged from 24 to 44 with an average of 32.90 and standard deviation 5.279. The sugarcane farmers were classified into three categories on the basis of their use of improved sugarcane cultivation technologies scores, such as low (up to 30), medium (31 to 37) and high (above 37). The findings of using sugarcane cultivation technologies by the farmers are diagrammatically shown in Figure 6.

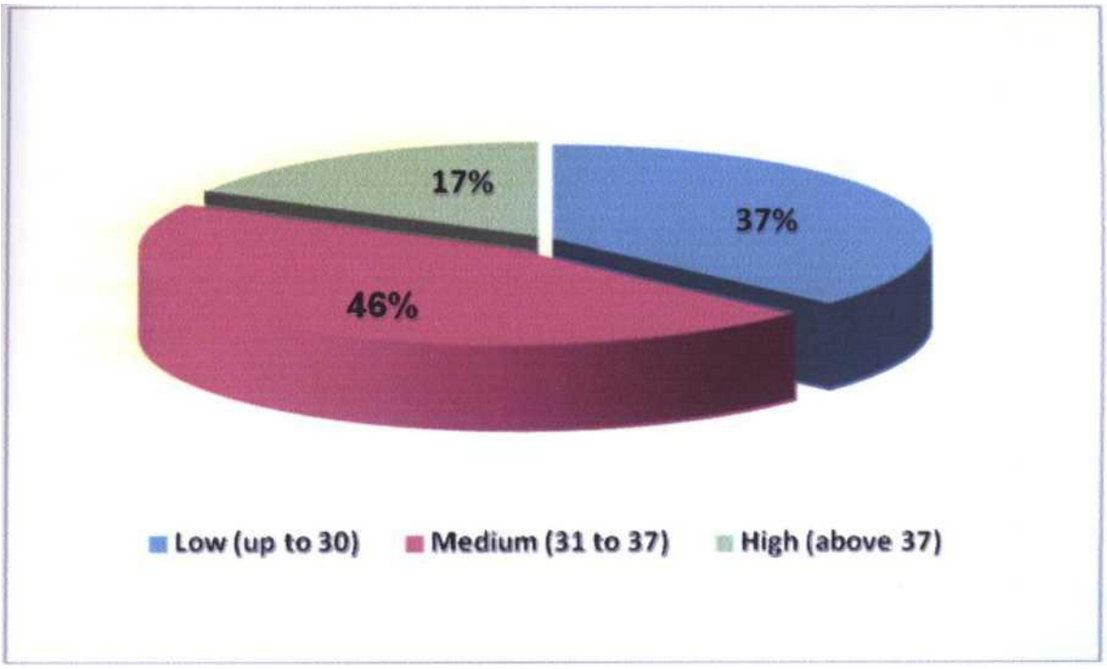

Figure 6. Pie graph showing the categories of respondents on the basis of their use of improved sugarcane cultivation technologies.

Most (83%) of the farmers were under low to medium use of improved sugarcane cultivation technologies. One-fifth (17%) farmers fell in high used category of technologies.

The result obtained in the use of technologies can be explained as the individual characteristics of the farmers may greatly vary and the various factors might have great

impact on their use of improved technologies. Farmers use modem technologies when they find those useful in their own socio-economic set-up and agro-economic settings. Fanner's individual characteristics and personal make-up play a vital role in adopting any agricultural technology in the overall technology transfer process. Thirty seven percent fanners had low use (up to 30) of improved sugarcane cultivation technologies. Reason might be that maximum of them had no education or primary education. They possessed small farm. They had low farming and training experience. Their participation with various organizations was low. Their extension media contact was low. Maximum of them got low input availability. They are laggards. Their awareness level about improved sugarcane cultivation technologies was low.

Maximum (46%) farmers of the study area had medium use (31 to 37) of improved sugarcane cultivation technologies. Because the farmers were not much rich or poor, 62% farmers had medium farm, 47% of them read up to secondary level (6-10th class). Maximum farmers had low training experience and organizational participation, 31% farmers had medium extension media contact and 41% farmers had medium innovativeness. Seventy five percent farmers had medium input availability including seed, fertilizer, insecticide, irrigation water, market and credit facilities. Major portion (51%) of the farmers had medium awareness about improved sugarcane cultivation technologies.

Seventeen percent farmers had high use (above 37) of improved sugarcane cultivation technologies. Because their education was above secondary level. Maximum of them had large farm and high farming and training experience. Their organizational participation and extension media contact was high. Maximum of them were innovators. They had availability of inputs and their awareness level about improved sugarcane cultivation technologies was high.

4.3 Relationship between the selected characteristics of the farmers and their use of improved sugarcane cultivation technologies

Coefficient of correlation was computed in order to explore the relationship between the selected characteristics of the farmers and their improved sugarcane cultivation technologies. Table 17 has been used for descriptive interpretation of the meaning of 'r'.

Table 17 The meaning of 'r' values

r	Meaning
0.00 to 0.19	A very low correlation
0.20 to 0.39	A low correlation
0.40 to 0.69	A moderate correlation
0.70 to 0.89	A high correlation
0.90 to 1.00	A very high correlation

Source: Cohen and Holliday, 1982:92-93

The relationship 'r' between the selected characteristics of the farmers and their use of improved sugarcane cultivation technologies has been presented in Table 18. However, the inter-correlationships among different independent and dependent variables have also been computed by using Pearson's Product Moment Correlation Co-efficient. The results have been presented in Appendix - C.

Table 18 Relationship between the selected characteristics of the farmers and their use of improved sugarcane cultivation technologies

Selected characteristics (Independent variables)	Computed 'r' values	Tabulated V values with d.f. 113 (N-2)	
		0.05 level	0.01 level
Age	0.04^{NS}	0.184	0.240
Education	0.369**		
Farm size	0.193*		
Annual family income	0.173^{NS}		
Farming experience	0.233*		
Training experience	0.306**		
Organizational participation	0.194*		
Extension media contact	0.463**		
Innovativeness	0.441**		
Input availability	0.204*		
Awareness about improved sugarcane cultivation technologies	0.352**		

NS = Not significant

* = Significant at 0.05 level of probability

** = Significant at 0.01 level of probability

4.3.1 Age of the farmers and their use of improved sugarcane cultivation technologies

Relationship between age of the farmers and their use of improved sugarcane cultivation technologies were examined by testing the following null hypothesis:

"There is no relationship between age of the farmers and their use of improved sugarcane cultivation technologies".

The computed value of co-efficient of correlation between concerned variables was found to be 0.04 (Table 18). This led to be the following observations regarding the relationship between these two variables.

- Relationship showed a positive value direction between the variables.
- Very low correlation exists.
- The computed value of 'r' (0.04) was smaller than the tabular value of r (±0.184) with 113 degrees freedom at 0.05 level of probability.
- Hence the relation was not statistically significant.

Based on the above findings, null hypothesis was not rejected and hence researcher concluded that age of the farmers had no significant relationship with their use of improved sugarcane cultivation technologies. Islam (2002), Rahman (2001), Podder (1999) and Chowdhury (1997) observed similar findings in their studies. The reason might be all aged group farmers are equal concern about improved sugarcane cultivation technologies.

4.3.2 Education of the farmers and their use of improved sugarcane cultivation technologies

The education of the farmers and their use of improved sugarcane cultivation technologies were examined by testing the following null hypothesis:

"There in no relationship between education of the farmers and their use of improved sugarcane cultivation technologies".

The computed value of co-efficient of correlation between concerned variables was found to be 0.369 (Table 18). This led to be the following observations regarding the relationship between these two variables.

- Relationship showed a positive direction between the variables.
- Low correlation took place.
- The computed value of 'r' (r = 0.369) was greater than the tabular value (r = ±0.240) with 113 degree of freedom at 0.01 level of probability.
- Hence the relationship was statistically significant.

The null hypothesis was therefore rejected on the basis of this finding. Thus the researcher concluded that education of the farmers had a significant positive relationship with their use of improved sugarcane cultivation technologies. Similar findings were also observed by Alam (1997), Rahman (1999) and Sardar (2002).It may be education is a contributory factors of gaining knowledge and skills and has a role in creating positive attitude in an individual towards improved technologies.

4.3.3 Farm size of the farmers and their use of improved sugarcane cultivation technologies

Farm size of the farmers and their use of improved sugarcane cultivation technologies were tested by examining the following null hypothesis:

"There is no relationship between farm size of the farmers and their use of improved sugarcane cultivation technologies".

The computed value of co-efficient of correlation between farm size and their use of improved sugarcane cultivation technologies were found to be 0.193 (Table 18). The following observations were recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- The relationship showed a tendency in positive direction between concerned variables.
- Relationship between concerned variables was very low.

- The computed value of 'r' (r = 0.193) was found to be greater than tabular value (r = ±0.184) with 113 degree of freedom at 0.05 level of probability.
- Hence the relationship was statistically significant.

On the basis of these findings, null hypothesis was rejected and hence researcher concluded that the farm size of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Hossain (2003), Alam (1997) and Islam (1996) observed similar findings in their studies. It might be due to farmers having large farms are generally economically solvent and able to gain knowledge and also to use improved technologies.

4.3.4 Annual income of the farmers and their use of improved sugarcane cultivation technologies

Annual income of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:

"There is no relationship between annual income of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned annual income of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.173 (Table 18). The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was very low.
- The computed value of 'r' (r = 0.173) was smaller than tabular value (r = ±0.184) with 113 degree of freedom at 0.05 level of probability.
- Hence the relationship was not statistically significant.

Based on the above findings, null hypothesis was not rejected and hence researcher concluded that annual income of the farmers had no significant relationship with their use of improved sugarcane cultivation technologies. It means that the annual income did not

have any influence on the use of improved sugarcane cultivation technologies. Sardar (2002) and Hoque (1993) indicated that the annual income of the farmers had no significant relationship with their adoption of IPM practices. Most of the farmers had low to medium use of improved sugarcane cultivation technologies. They are able to use improved technologies. But they do not do so. The reason might be they are not aware about the benefit of using improved technologies or they have not got proper guideline how to apply these technologies in their field from extension workers. For that they are not interested to invest money to use those technologies.

4.3.5 Farming experience of the farmers and their use of improved sugarcane cultivation technologies

Farming experience of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:

"There is no relationship between farming experience of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned farming experience of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.233 (Table 18). The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was low.
- The computed value of 'r' ($r = 0.233$) was greater than tabular value ($r = \pm 0.184$) with 113 degree of freedom at 0.05 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that farming experience of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Chowdhury (1996) also observed similar findings in his studies. It seems to be farming experience of an individual helps him to learn new knowledge and lead him to take correct decision.

4.3.6 Training experience of the farmers and their use improved sugarcane cultivation technologies

Training experience of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:

"There is no relationship between training experience of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned training experience of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.306 (Table 18).The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was low.
- The computed value of 'r' (r = 0.306) was greater than tabular value (r = ±0.240) with 113 degree of freedom at 0.01 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that training experience of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Hossain (1981), Rahman (2001), Sarder (2002) and Haque (2003) observed similar findings in their studies. The reason might be farmers having more exposure with training had better knowledge and a knowledgeable person is more aware about different aspects of improved technologies.

4.3.7 Organizational participation of the farmers and their use of improved sugarcane cultivation technologies

Organizational participation of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:

"There is no relationship between organizational participation of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned organizational participation of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.194 (Table 18). The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was very low.
- The computed value of 'r' (r = 0.194) was greater than tabular value (r = ±0.184) with 113 degree of freedom at 0.05 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that organizational participation of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Hossain (1999), Khan (1993), Sarker (1997) and Chowdhury (1997) also found the similar findings. It may be participation in organization provides opportunity for an individual to know new technologies.

4.3.8 Extension media contact of the farmers and their use improved sugarcane cultivation technologies

Relationship between extension media contact of the farmers and their use of improved sugarcane cultivation technologies were examined by testing the following null hypothesis:

"There is no relationship between extension media contact of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned extension media contact of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.463 (Table 18). The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was moderate correlation.

- The computed value of ‘r’ (r = 0.463) was greater than tabular value (r = ±0.240) with 113 degree of freedom at 0.01 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that extension media contact of the farmers had significant relationship with their use of improved sugarcane cultivation technologies . This finding is also reasonable because farmers with high extension contact used to receive more information on the improved cultivation technologies in sugarcane cultivation. The extension contact strengthened the base of their knowledge. The knowledge definitely acts as motivation towards use of improved sugarcane cultivation technologies. Sardar (2002) found that extension contact of the farmers had positively significant with their adoption of IPM practices. Karim (1973), Kher (1992), Islam (1993) and Podder (1999) also find the similar findings.

4.3.9 Innovativeness of the farmers and their use improved sugarcane cultivation technologies

Innovativeness of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:

“There is no relationship between innovativeness of the farmers and their use of improved sugarcane cultivation technologies”.

Computed value of co-efficient of correlation between the concerned innovativeness of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.441 (Table 18). The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was moderate correlation.
- The computed value of ‘r’ (r = 0.441) was greater than tabular value (r = ±0.240) with 113 degree of freedom at 0.01 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that innovativeness of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Rahman (1973) and Hussen (1999) also found the similar findings. The reason might be innovative people are always advanced to use improved technologies than other people.

4.3.10 Inputs availability of the farmers and their use improved sugarcane cultivation technologies

Input availability of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:
"There is no relationship between input availability of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned input availability of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.204 (Table 18). The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was low.
- The computed value of 'r' (r = 0.204) was greater than tabular value (r = ±0.184) with 113 degree of freedom at 0.05 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that input availability of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Butzer *et al.* (2002) also observed the similar findings. It may be for that when the farmers have more input availability facilities, they usually use improved technologies more.

4.3.11 Awareness about improved sugarcane cultivation technologies of the farmers and their use improved sugarcane cultivation technologies

Awareness about improved sugarcane cultivation technologies of the farmers and their use of improved sugarcane cultivation technologies were measured by testing the following null hypothesis:

"There is no relationship between awareness about improved sugarcane cultivation technologies of the farmers and their use of improved sugarcane cultivation technologies".

Computed value of co-efficient of correlation between the concerned organizational participation of the farmers and their use of improved sugarcane cultivation technologies were found to be 0.352 as shown in Table 18. The following observations are recorded regarding the relationship between these two variables on the basis of co-efficient of correlation.

- Relationship showed a tendency in positive direction.
- Relationship between the concerned variables was low.
- The computed value of 'r' (r = 0.352) was greater than tabular value (r = ±0.240) with 113 degree of freedom at 0.01 level of probability.
- Hence the relationship was statistically significant.

Based on the above findings, null hypothesis was rejected and hence researcher concluded that awareness about improved sugarcane cultivation technologies of the farmers had significant relationship with their use of improved sugarcane cultivation technologies. Alam (1997) and Sardar (2002) found the similar findings. The reason might be the farmers who are more aware, they generally use improved technologies more than other people.

4.4 Ranking of the problems confronted by the farmers in using improved sugarcane cultivation technologies

In order to ascertain the extent of severity of problem confronted by the farmers in using improved sugarcane cultivation technologies, Problem Confrontation Index (PCI) was

computed. The PCI of any problem could ranges from 0 to 345, where 0 indicated no problem and 345 indicated high problem. However, the Computed Problem Confrontation Index of the 15 problems ranged from 125 to 295 and has been arranged in rank order according to their problem indices which appears in Table 19.

Table 19 Ranking of the problems confronted by the farmers in using improved sugarcane cultivation technologies

SI. No.	Problems	Extent o ‘ problem					
		H	M	L	N	PCI	Rank
1	Unavailability of recommended varieties	13	28	53	22	148	11
2	Unavailability of certified seed cane	16	25	45	30	143	12
3	High demand and high cost of fertilizer	75	29	12	0	295	1
4	Scarcity of fertilizer supply in time	47	34	20	5	229	4
5	Lack of cattle power for cultivation	21	26	26	43	141	13
6	Lack of power tiller	16	26	25	47	125	15
7	Lack of loan from sugar mills and Govt.	18	26	46	25	152	9
8	Inadequate help from CDA	17	27	46	25	151	10
9	Inadequate irrigation in dry season	18	28	53	17	163	8
10	Low price of sugarcane	60	36	14	5	266	3
11	Lack of IPM knowledge	24	53	27	12	205	7
12	Lack of training in adoption of improved technologies	23	60	21	12	210	6
13	Problem in carrying sugarcane	17	27	25	47	130	14
14	Late payment of cane price	29	58	19	10	222	5
15	Lack of ‘purjee’ (permit) for supply sugarcane in time	69	30	17	0	284	2

Abbreviation: H= High, M= Medium, L= Low, sf= Not at all, PCI= Problem Confrontation Index

Based on PCI, the problems confronted by the farmers could be classified into three categories such as

Table 20 Distribution of problems based on their PCI

Categories	Score	Distribution of technologies	
		Number	Percentage
High confronted problem	260-300	3,15,10=3	20
Medium confronted problem	259-146	4, 14, 12, 11,9, 7, 8,1=8	53.33
Low confronted problem	Upto 145	2, 5, 13, 6=4	26.66

The percentage of high confronted problem is 20. “High demand and high cost of fertilizer, lack of purjee for supply sugarcane in time and high demand and high cost of fertilier” are highly confronted problem by the farmers which ranked 1st ,2nd and 3rd respectively. The percentage of medium confronted problem is 53.33. Medium confronted problems are “Scarcity of fertilizer supply in time, late payment of cane price, lack of training in adoption of improved technologies, lack of IPM knowledge, inadequate irrigation in dry season, lack of loan from sugar mills and Govt. , inadequate help from CDA and unavailability of recommended varieties” which ranked 4th, 5th, 6th, 7th, 8th, 9th, 10th and 11th respectively. The percentage of low confronted problem is 26.66. The low confronted problems are “Unavailability of certified seed cane, lack of cattle power for cultivation, problem in carrying sugarcane and lack of power tiller” and they ranked 11th, 12th, 13th, 14th and 15th respectively. “High demand and high cost of fertilizer” ranked 1st problem with PCI value of 295. It is the crucial problem of the farmers. Farmers usually cultivate traditional variety, requires low amount of the fertilizer but whenever using improved variety requires high amount of fertilizers. During sugarcane cultivation in the field, the market price of fertilizer is usually increased rapidly which has become an usual and normal event of fertilizer distribution and management programme of the country. Probably that is why farmers perceived this problem as top most one. The 2nd cited problem of the farmers was “lack of purjee (permit) for supply sugarcane in time” with the PCI of 284. Mills authority usually make programme to lift the cane within 150 days of the crushing season. But the poor and small farmers can not wait for such a longer period. Besides various interferences from different comers make the purjee (permit) distribution programme vulnerable and artificial purjee crisis is made especially to the small to middle class farmers. They do not usually get the puijee (permit) in time and suffer from considerable loss due to drying of cane in the field. The 3 rd cited problem of the farmers was “low price of sugarcane” with the PCI 266. As sugarcane is a long duration crop and usually stands in the field for 12-15 months by this time 3 short time crops can be grown in the similar field. As the price of other food and short durable vegetable crops are now higher, the price of sugarcane is comparatively low and less remunerative. As such, lower price of cane are discouraging the farmers for cultivation of sugarcane. The 4th cited problem of the farmers was “scarcity of fertilizer supply in time” with the PCI at 229. The farmers do not get fertilizer in time when they go for cultivation of sugarcane. All kind of fertilizers are not available at the time of plantation as phosphate and Murate of Potash (MP) are imported and mostly not available

in time. If phosphate is not available in time which is used by cent percent in trenches at planting time cannot be used later on. Probably due to these reasons farmers confronted problem in this respect. The 5th cited problem of the farmers was "late payment of cane price" with PCI of 222. The Sugar Mills authority are completely tied with the sugar price fixed by the Govt, and more often can not sell the produced sugar in time and also cannot pay sugarcane price to the farmers in time. As such the small and middle class farmers mostly suffer from delayed cane price payment. The 6th cited problem was "lack of training in adoption of improved technologies" with the PCI of 210. There were low facilities of training and maximum of the farmers could not know how to cultivate sugarcane through modem method. The 7th problem of the farmers was "lack of IPM knowledge" with the PCI of 205. Farmers did not understand and realize about IPM. Probably due to this reason farmers faced problem in this respect. The 8th problem of the farmers was "inadequate irrigation in dry season" with the PCI of 163. Cultivation of sugarcane requires adequate water supply especially in dry season. For scarcity of irrigation, farmers could not produce better yield. There were also not sufficient deep tube wells and available water in the river during dry season in the study area for supply of irrigation water to the field. Probably due to this reason farmers confronted problem in this respect. The 9th problem of the farmers was "lack of loan from sugar mills and Govt." with the PCI of 152. The socio-economic condition of sugarcane farmers is not good. They require incentives in using improved sugarcane technologies. In absence of loan to the small farmers from sugar mills and Govt., the farmers confronted difficulties in using such technologies. The 10th problem of the farmers was "inadequate help from CDA" with the PCI of 151. Cane Development Assistants though provide technical support or advice to the farmers but this is considered inadequate especially to the farmers having small farm size.

Actually the problems confronted under rank order 11th to 15th with the PCI of 148 to 125 respectively, these are mostly to the small farmers who are not covered under loan programme of the Sugar Mills. The farmers who cultivate below 33 decimal of land cannot be covered under loan programme due to lack of fund and also due to manpower. Besides, these are less problem confronted to the medium and large farmers.

Problem Confronted by the farmers in using improved sugarcane cultivation technologies has been diagrammatically shown in Figure 7.

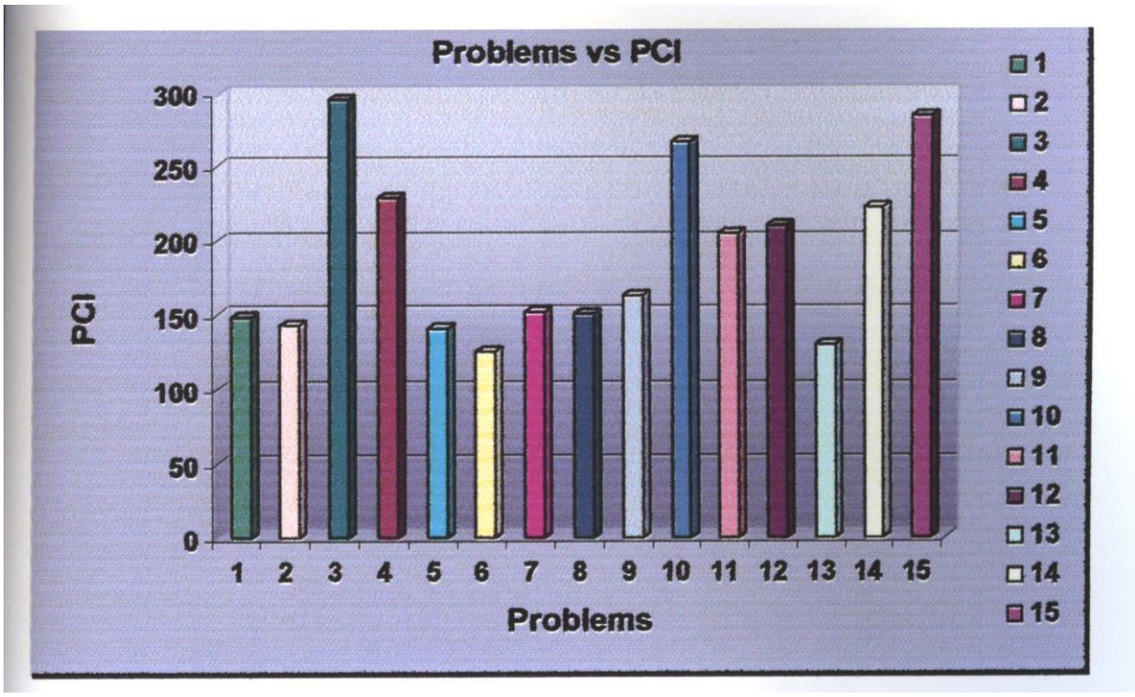

Figure 7 **Bar graph showing the extent of problems confronted by the farmers in using improved sugarcane cultivation technologies**

I = Unavailability of recommended varieties; 2 = Unavailability of certified seed cane; 3 = High demand and high cost of fertilizer; 4 = Scarcity of fertilizer supply in time; 5 = Lack of cattle power for cultivation; 6 = Lack of power tiller; 7 = Lack of loan from sugar mills and Govt.; 8 = Inadequate help from CDA; 9 = Inadequate irrigation in dry season; 10 = Low price of sugarcane;
II = Lack of IPM knowledge; 12 = Lack of training in adoption of improved technologies; 13 = Problem in carrying sugarcane; 14 = Late payment of cane price; 15 = Lack of ‘putjee' (permit) for supply sugarcane in time.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

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SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

5.1.1 Introduction

Among the cash crops sugarcane stands second, next to jute and it is the principal sugar crop in the country. During the last five years, average sugarcane cultivated land is 0.17 million hectares and average cane yield per hectare is 41.32 ton. It is the major sugar and gur producing crop of the country. Sugarcane is cultivated in almost all the districts of Bangladesh. There are two well-defined zones of sugarcane cultivation, one is a mill zone and the other is a non-mill zone. Sixteen (16) sugar mills are situated mainly in the greater districts of Rajshahi, Kushtia, Rangpur, Dinajpur, Bogra, Pabna, Faridpur, Dhaka and Mymensingh.

Sugarcane, the most important sources of sucrose, the cheapest form of energy giving food, needs less land per unit of energy produced than any other crop. Sugarcane is the basic raw material for the sugar industry, a subsidiary raw material for industrial plant, a very important source of cash income to its farmers and an important foreign exchange saver for the Government. The sugar industries are also contributing considerable amount of revenue to the national exchequer in the form of excise duty. They turnout valuable wastes like pressmud, being used as organic fertilizer, bagasses and molasses, which are partly being used as raw material in paper industry and distilleries respectively.

Sugarcane and sugar mills of the country are contributing significantly to the development of rural areas by providing the rural employment, improvement of the rural infrastructure and also saving foreign exchange and adding directly and indirectly to the national exchequer (BSFIC, 1986). More than 0.6 million farm-families are dependent on sugar industry for their subsistence. The government of Bangladesh is emphasizing the attainment of self-sufficiency in sugar and gur production by stabilizing sugarcane area and increasing yield. Bangladesh Sugar and Food Industries Corporation (BSFIC) authority have ambitions of intensive cane development schemes to expand the industry to meet the requirements of both local and foreign markets through increasing per acre yield, production of quality cane, increasing recovery percentage and so on. The actual increase in production of sugarcane will mostly depend on the activities of farmers.

Again the behavior of an individual is influenced by his various characteristics (personal, economic, social etc). An understanding of the relationship of the characteristics of the farmers with their use of improved sugarcane cultivation technologies is necessary to plan and execute program for increasing per acre yield of cane. Little research has been conducted on this aspect in the past. Such consideration prompted the researcher to undertake an investigation to study the relationships of selected characteristics of the farmers with their use of improved technologies of sugarcane cultivation.

5.1.2 Specific objectives:

The following specific objectives are formulated for giving proper direction to the study

i) To determine the extent of use of improved sugarcane cultivation technologies by the farmers

ii) To describe some selected characteristics of the farmers related to sugarcane improved technologies

The selected characteristics are-

- Age
- Education
- Farm size
- Annual family income
- Farming experience
- Agricultural training exposure
- Organizational participation
- Extension media contact
- Innovativeness
- Input availability
- Awareness about improved sugarcane cultivation technologies

iii) To explore the relationship between the extent of use of improved sugarcane cultivation technologies with the selected characteristics of the farmers

iv) To determine the problems confronted by the farmers in using improved sugarcane cultivation technologies

5.1.3 Methodology

The farmers of twelve units of Mill Gate sub-zone of Pabna Sugar Mills under Ishurdi upazila of Pabna District constituted the population of this study. The total number of sugarcane farmers of 12 units was estimated to 882 and sample of 115 (13.04 %) farmers were selected randomly from the list of population. However, a reserve list of 23 farmers was also prepared.

An interview schedule was prepared in Bengali for this purpose. The questions and statements continued in the schedule were simple, direct and easily understandable by the respondents without giving rise to any doubt and understanding in their minds. Collection of data took from 25 April to 22 May 2008. The schedule was pre-tested in actual field situations. The investigator personally conducted a door-to-door survey by herself to collect the data. Advance information was given to the respondents before going to them for interview. The collected data were then coded, compiled, tabulated and analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative data by means of suitable scoring wherever necessary.

The farmers were classified on the basis of use of modem sugarcane cultivation practices as well as on the basis of their characteristics. In developing the categories, the researcher was guided by the nature of data. The standards and criteria prevailing in the social system were also taken into consideration.

Various statistical measures such as range, mean, percentage, standard deviation were used in categorization and describing the selected personal characteristics of the respondents. For clarity of understanding tables were used for presentation of data, coefficient of correlation (r) test was used to explore the relationships between independent and dependent variables. All these analyses were done by a computer using the SPSS (Statistical Package for Social Science).

Throughout the study five percent (0.05) level of probability was used to accept or reject any null hypothesis.

5.1.4 Summary of Findings

5.1.4.1 Selected characteristics of the farmers' (Independent variables)

The major findings of the study are summarized below:

Age

Age of the farmers ranged from 19 to 75 years, the average being 43.44 years and standard deviation 14.152. Highest proportions of the farmers were under middle aged category. More than half (53%) of the sugarcane farmers were middle aged (32-56 years).

Education

Education level of the farmers were categorized as no education, primary education, and secondary education and above secondary education and corresponding percentage were 10, 18, 47 and 25 respectively. The average education level was 7.73 and standard deviation 4.096.The majority of the farmers were secondary category. One-tenth (10%) of the sugarcane farmers were illiterate and 47 % having secondary education

Farm size

Farm size of the farmers ranged from 0.02 to 11.74 hectares with the mean of 1.64 and standard deviation 1.610. The majority of the farmers were medium farm size category. Near about two-third (62%) of the farmers had medium farm compared to 34% had small farm and 4% having large farm. The majority of the farmers had either small or medium farms

Annual income

The annual income of the farmers ranged from 20.4 to 210 with an average of 72.07 and standard deviation 36.158. The majority of the farmers were low and medium income category. Highest proportion (45%) of the farmers had low annual income compared to 45% had medium annual income and 11% having high annual income. It may also be revealed that 90% of the respondents under study area had low to medium annual income

Farming experience

Farming experience of the farmers score ranged from 1 to 60, the average being 20.75 and the standard deviation 12.281. The majority of the farmers were low faming experience category. About 57% of the respondents had low farming experience compared to 36% as medium farming experience and 7 % under high farming experience. Thus almost 93% of the farmers had low to medium farming experience.

Agriculture training exposure

Training experience of the farmers ranged from 0 to 44, the average being 13.48 and the standard deviation 9.678. The majority of the farmers were low training experience category. About 45% of the respondents had low training experience compared to 40% having medium training experience and 15% had high training experience. Data also revealed that majority (85%) of the farmers were under low to medium training exposure.

Organizational participation

Organizational participation of the farmers ranged from 0 to 45 with an average of 8.89 and standard deviation 8.853. The majority of the farmers were low participation category. One-fifth (20%) of the responded farmers had no organizational participation compared to 43% low, 27% medium and 10% high organizational participation. It may also be revealed that majority (80%) of the farmers were under low to high organizational participation.

Extension media contact

The extension media contact score of the farmers ranged from 9 to 32 with an average of 19.61 and the standard deviation of 5.761. The majority of the farmers were high media contact category. Slightly more than one- fifth (21%) percent of the respondents had low extension media contact while 31% had medium extension media contact and 48% had high extension media contact. The findings of the study indicate that 79% of the respondents had medium to high extension media contact.

Innovativeness

Innovativeness scores of the farmers ranged from 13 to 34 with an average of 25.99 and standard deviation 4.597. The majority of the farmers were medium innovativeness category. About 39% of the respondents had low innovativeness compared to 41% had medium innovativeness and 20% had high innovativeness. These findings also indicate that 80% of the respondents had either low or medium innovativeness.

Input availability

Input availability scores of the farmers ranged from 7 to 28 with an average of 16.53 and standard deviation 3.416. The majority of the farmers were medium input availability category. Three-fourth (75%) of the farmers having medium input availability compared to 7% having low and 18% having high input availability. Data also revealed that majority (93%) of the farmers were medium to high input availability.

Awareness about improved sugarcane cultivation technologies

The awareness about improved sugarcane cultivation technologies of the farmers ranged from 12 to 32 with an average of 25.39 and standard deviation 4.205. The majority of the farmers were medium awareness category. More than half (51%) of the farmers fell in the medium awareness category compared to 23% low and 26% high awareness category. It may also be revealed that 77% of the respondents had either medium or high awareness about improved sugarcane cultivation technologies.

5.1.4.2 Dependent variable

Use of improved sugarcane cultivation technologies scores of the respondents ranged from 24 to 44, against the possible range 0 to 45. The average and the standard deviation were 32.90 and 5.279 respectively. The highest proportion (46%) of the farmers used medium technologies and 37% low and 17% high technologies.

5.1.4.3 Summary of hypotheses testing

The selected characteristics (independent variables) like education, farm size, farming experience, training exposure, organizational participation, extension media contact, innovativeness, input availability and awareness about improved sugarcane cultivation technologies of the farmers had significant positive correlation with their use of improved sugarcane cultivation technologies.

The rest of the independent variables e.g. age and annual family income of the farmers had no significant relationship with their use of improved sugarcane cultivation technologies.

5.1.4.4 Problems confrontation by the farmers in using improved sugarcane technologies

Problem confrontation scores of the farmers ranged from 11 to 37 with an average of 23.10 and standard deviation 5.354. The majority of the farmers were high problem confrontation category. Almost one-third (33%) of the farmers had low problem confrontation compared to 31% having medium and 36% having high problem confrontation. "High demand and high cost of fertilizer, lack of purjee for supply sugarcane in time and high demand and high cost of fertilier" are highly confronted problem by the farmers which ranked 1st ,2nd and 3rd respectively. Medium confronted problems are "Scarcity of fertilizer supply in time, late payment of cane price, lack of training in adoption of improved technologies, lack of IPM knowledge, inadequate irrigation in dry season, lack of loan from sugar mills and Govt. , inadequate help from CDA and unavailability of recommended varieties" which ranked 4th, 5th, 6th, 7th, 8th, 9th, 10th and 11th respectively. The low confronted problems are "Unavailability of certified seed cane, lack of cattle power for cultivation, problem in carrying sugarcane and lack of power tiller" and they ranked 11th, 12th, 13th, 14th and 15th respectively.

5.2 Conclusions

Findings of the study and the logical interpretations of their meaning, in light of other relevant facts, prompted the researcher to draw the following conclusions.

1. The study indicated that most of the farmers (83%) had low to medium use of improved sugarcane cultivation technologies compared to 17% (20 farmers) had high use of improved sugarcane cultivation technologies. There is a further scope for increasing the extent of using improved technologies in sugarcane cultivation.

2. Among the selected 11 characteristics all showed a positive significant relationship except age and annual family income.

3. Almost one-third (33%) of the farmers had low problem confrontation compared to 31% having medium and 36% having high problem confrontation.

5.3 Recommendations

On the basis of the findings and conclusions of the study, the following recommendations for policy implication are made:

5.3.1 Recommendations for policy implications

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

1. BSRI, DAE and BSFIC should organize more mass media campaign and conduct training programs for the sugarcane farmers on improved sugarcane cultivation technologies. Large-scale distribution of printing materials such as leaflets, booklets, folders, posters etc. on improved sugarcane cultivation technologies should be made.

2. The extension workers of BSFIC, DAE, and different NGOs should encourage the farmers to participate in different voluntary associations.

3. The extension workers of BSFIC, DAE and different NGOs should encourage the farmers to participate in different voluntary associations.

4. Extension agencies should realize the existing problems of the sugarcane cultivation and take necessary steps to minimize these problems.

5.3.2 Recommendations for further research

Short term and sporadic study being conducted in some specific location cannot provide all information for proper understanding about different activities and related matters. Future studies should be undertaken covering more dimensions in the related matters. The following recommendations are suggested in this connection:

1. The relationship of eleven characteristics of the farmers with their use of improved sugarcane cultivation technologies have been investigated in this study viz. age, education, farm size, annual income, farming experience, training exposure, organizational participation, extension media contact, innovativeness,

input availability and awareness about improved sugarcane cultivation technologies. But besides these eleven characteristics of the farmers, which influence the use of modem sugarcane cultivation technologies, there might be other factors. Therefore, further research should be conducted to explore the relationship of such other characteristics of the farmers with their use of improved sugarcane cultivation technologies.

2. The present study was conducted in 12 units of Mills Gate sub-zone of Pabna Sugar Mills under Ishurdi upazila of Pabna district. So similar attempts may be undertaken in other parts of the country to verify the study.

3. Findings of the study indicate the need for establishment of new agro-based industry in the rural areas of the country. Research is necessary to evolve effective principles and procedures for management, supervision and financing of such industries.

4. Research should be undertaken to study the effectiveness of Agricultural Extension Service and other related organizations in helping people to solve their problem confrontation in sugarcane production of the farmers.

5. Research should also be undertaken to identify the factors causing hindrance to high use of modem sugarcane cultivation technologies.

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Appendix-A

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University Dhaka-1207

An Interview Schedule for a research study entitled
Use of Improved Sugarcane Cultivation Technologies by the Farmers

ENGLISH VERSION OF THE INTERVIEW SCHEDULE

SL No....

Name of the respondent .....

Village ..... Union.....

Unit no.....Sugar Mills.....

Please answer the following questions

1. Age

What is your present Age? ..... years

2. Education

Please mention your educational qualification.

a) Can not read and write .....

b) Can sign only .....

c) Read up to class .....

3. Farm size

Please furnish information about your land ownership.

SI. No.	Nature of ownership	Area (h a)	
		Local unit	Hectare
1.	Homestead (Including pond and garden)		
2.	Own land under own cultivation		
3.	Own land given to others on borga		
4.	Land taken from others on borga		
5.	Land taken from others on lease		
6.	Others (specify)		
	Total		

4. Annual family income

Please furnish your family income from different sources in the last year.

Sources of income		Amount of Taka
Agricultural sectors	1. Crops	
	2. Livestocks	
	3. Poultry	
	4. Fisheries	
Non agricultural sectors	5. Business	
	6. Services	
	7. Labour	
	8. Others	
Total (Tk)		

5. Farming experience

How long have you been engaged in farming ?

…….years

6. Training exposure

Have you attended any agricultural training program?

Yes ..... , No.....

If your answer is 'yes' then indicate the following information.

SI. No.	**Name of training course**	**Sponsoring organization**	**Duration (Day/month/year)**
1.			
2.			
3.			
4.			
5.			

7. Organizational Participation

Please mention the nature and duration of your participation in the following organizations.

SI No.	**Name of organization**	No parti-cipation	**Nature and duration of participation**		
			Ordinary member (duration)	Executive committee members (duration)	President/ Secretary of the committee (duration)
1.	Krishak samabay samity				
2.	Mosque/ Mandir/ Girza Committee				
3.	School/College/ Madrasha committee				
4.	Youth club				
5.	Market committee				
6.	Union council				
7.	NGO				
8.	Others				

8. Extension media contact

Please indicate your extent of contact with following.

SI. No.	Nature of media	Extent of communication		
		Frequently	Occasionally	Not at all
	Personal contact			
1.	Sub Assistant Agriculture Officer (SAAO)	> 1 time/month ( )	1 time/month ( )	Not at all/month **( )**
2.	Cane Development Assistant (CDA)	> 1 time/month < >	1 time/month **( )**	Not at all/month **( )**
3.	Farm input dealer (Seed/Fertilizer/Pesticide etc.)	> 1 time/month ( )	1 time/month ( )	Not at all/month ( )
4.	Local leader	> 1 time/month (>	1 time/month ( )	Not at all/month ( )
5.	Fellow cane grower	> 1 time/week ( )	1 time/week **( )**	Not at all/week (**)**
6.	Progressive farmer	> 1 time/month (>	1 time/month ( )	Not at all/month **( )**
	Group contact			
7.	Group discussion	> 1 time/3months **( )**	1 time/3 months **( )**	Not at all/month **( )**
8.	Result demonstration	> 1 time/year **( )**	1 time/year **( )**	Not at all/year **( )**
9.	Method demonstration	> 1 time/year **( )**	1 time/year (>_	Not at all/year ( )
10.	Participation in field day/Agril. meeting	> 1 time/year ( )	1 time/year < >'	Not at all/year ( )
11.	Participation in agricultural training course	> 1 time/year ( )	1 time/year ( )	Not at all/year ( )
	Mass contact			
12.	Farm radio program	> 1 time/week ( )	1 time/week < >	Not at all/week ( )
13.	Agril. program in TV	> 1 time/week ( )	1 time/week ( )	Not at all/week ( )
14.	Farm publication (Poster, leaflet, booklet etc.)	> 1 time/year ( )	1 time/year ( )	Not at all/year ( )
15.	Agril. fair	> 1 time/year ( )	1 time/year ( )	Not at all/year ( )
16.	Agril. Related book/ magazine	> 1 time/week ( )	1 time/week ( )	Not at all/week ( )

9. Innovativeness

If you use the following technologies, please indicate duration of its use from first hearing.

SI. No.	**Name of Technologies**	**Duration of use**				
		Within 1 years after hearing	Within 2 years after hearing	Within 3 years after hearing	Within **4** years or above after hearing	**Do not use**
1.	Use of power tiller					
2.	Use of green manure					
3.	Use of organic fertilizer					
4.	Seed treatment using chemicals					
5.	Mechanical control of stem borer					
6.	Use of STP method					
7.	Use of trench method					
8.	Intercropping with sugarcane					

10. Input availability

Please give your information about following inputs.

SI. No.	**Inputs**	**Extent of inputs availability**			
		Always (3)	Easily (2)	At times (1)	Not at all (0)
1.	Availability of modem varieties				
2.	Availability of fertilizer				
3.	Availability of insecticide				
4.	Availability of irrigation water				
5.	Availability of Farm implementation				
6.	Availability of technical assistance				
7.	Availability market facility				
8.	Availability of credit facility				

11. Awareness about improved sugarcane production technologies

Please answer the following questions.

SL No.	Items	Full marks	Marks obtained
1.	Name four recommended varieties of sugarcane.	2	
2.	What are the advantages of early plantation?	2	
3.	Do you know about certified seed of sugarcane?	2	
4.	Name two fungicides used for sett treatment.	2	
5.	What are the advantages of trench method?	2	
6.	What is STP system and how it is done?	2	
7.	What are the advantages of paired row planting?	2	
8.	Mention recommended dozes of fertilizer (kg/ha) Urea : TSP : MP : Zinc :	2	
9.	Mention four intercrops most suitable for cultivation with sugarcane?	2	
10.	Mention how many times of irrigation is needed for better yield?	2	
11.	What is IPM? Do you apply it for pest control?	2	
12.	Mention the times and benefits of earthing-up for sugarcane?	2	
13.	What are the benefits of spade harvesting?	2	
14.	Do you know about the advantages of detrashing of dry leaves?	2	
15.	Is rationing cane cultivation profitable and why?	2	
Total		**30**	

12. Use of improved sugarcane cultivation technologies

Please mention how frequently you use the following improved sugarcane technologies in your field.

SI. No.	Technologies	Extent of use			
		Frequently	Occasionally	Rarely	Not at all
1.	Recommended sugarcane varieties				
2.	Early planting (Mid August-Mid Nov)				
3.	Use of certified seed (Heat treated seed source)				
4.	Seed treatment with chemicals				
5.	Trench method				
6.	STP method				
7.	Paired row planting				
8.	Recommended dozes of fertilizer				
9.	Intercropping with sugarcane				
10.	Flood irrigation				
11.	Use of IPM practices				
12.	Earthing up				
13.	Spade harvesting				
14.	Detrashing of dry leaves				
15.	Ratoon management				

13. Problem Confrontation

Please mention your problem that you confronted during sugarcane cultivation.

SL No	Problems	Extent of problem			
		High	Medium	Low	Not at all
1.	Unavailability of recommended varieties				
2.	Unavailability of certified seedcane				
3.	High demand and high cost of fertilizers				
4.	Scarcity of fertilizer supply in time				
5.	Lack of cattle power for cultivation				
6.	Lack of power tiller				
7.	Lack of loan from sugar mills and Govt.				
8.	Inadequate help from CDA				
9.	Inadequate irrigation in dry season				
10.	Low price of sugarcane				
11.	Lack of IPM knowledge				
12.	Lack of training in adoption of improved technologies				
13.	Problem in carrying sugarcane				
14.	Late payment of cane price				
15.	Lack of‘Purjee’ (permit) for supply sugarcane in time				

Thank you for your kind cooperation.

Signature of interviewer

Date .....

APPENDIX -C

Correlation matrix showing the interrelationships among the concerned variables

	x,	X_2	x_3	**X4**	x_5	X6	x_7	x_8	x_9	$X_{,0}$	$x_{,,}$	x_{12}	Y,
X,	1.000												
X_2	- 0.072	1.000											
X_3	0.153	0.188*	1.000										
X4	0.001	0.470**	0.504**	1.000									
X_5	0.739**	- 0.042	0.03	-0.019	1.000								
X_6	0.098	0.136	- 0.004	-0.037	0.234*	1.000							
X_7	0.072	0.073	-0.132	- 0.066	0.038	-0.139	1.000						
X_8	0.002	0.403**	0.178	0.270**	0.024	0.109	0.321**	1.000					
X_9	0.113	0.210*	0.161	0.144	0.126	0.095	0.234*	0.580**	1.000				
X_{10}	- 0.043	-0.05	0.141	-0.139	- 0.025	- 0.052	0.277**	0.361**	0.383**	1.000			
X11	0.039	0.129	0.191*	0.105	0.119	0.250**	0.027	0.477**	0.360**	0.362**	1.000		
X12	-0.041	0.081	0.040	0.182	-0.126	-0.288**	0.094	0.113	-0.020	-0.138	0.065	1.00	
Yi	0.04	0.369**	0.193*	0.173	0.233*	0.306**	0.194*	0.463**	0.441**	0.204*	0.352**	-0.226*	1.000

** Correlation is significant at the 0.01 level of probability.

* Correlation is significant at the 0.05 level of probability.

Xi = Age
X_2 = Education
X_3 = Farm size
X4 = Annual family income
X_5 = Farming experience
X6 = Training exposure

X7 = Organizational participation
X8 = Extension media contact
X9 = Innovativeness
X10 = Input availability
X11 = Awareness about improved sugarcane cultivation technologies
X12 = Problem Confrontation
Yi = Use of improved sugarcane cultivation technologies