FARMERS' USE OF IMPROVED RICE CULTIVATION TECHNOLOGIES IN ULIPUR UPAZILA UNDER KURIGRAM DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled **"FARMERS' USE OF IMPROVED RICE CULTIVATION TECHNOLOGIES IN ULIPUR UPAZILA UNDER KURIGRAM DISTRICT"** submitted to the department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfillment of the requirements for the degree of Master of Science (M.S.) in Agricultural Extension, embodies the result of a piece of bona fide research work carried out by **MD. TOHOMIDUR RAHMAN, Registration No. 19-10053** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:
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DEDICATED
TO
MY BELOVED
PARENTS

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The Author

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
GDP	Gross Domestic Product
DAE	Department of Agricultural Extension
et al.	All Others
USA	United States of America
FAO	Food and Agriculture Organization
HYV	High Yielding Varieties
GoB	Government of Bangladesh
MoA	Ministry of Agriculture
UAO	Upazila Agricultural Officer
MoYS	Ministry of Youth and Sports
MoP	Muriate of Potash
TSP	Triple Super Phosphate
IPM	Integrated Pest Management
BINA	Bangladesh Institute of Nuclear Agriculture
BADC	Bangladesh Agricultural Development Corporation
STW	Shallow Tube-well
DTW	Deep Tube-well
SAAO	Sub Assistant Agriculture Officer
SAU	Sher-e-Bangla Agricultural University
SPSS	Statistical Package for Social Sciences

FARMERS' USE OF IMPROVED RICE PRODUCTION TECHNOLOGIES IN ULIPUR UPAZILA UNDER KURIGRAM DISTRICT

MD. TOHOMIDUR RAHMAN

ABSTRACT

The objectives of the study were to describe the socio-economic characteristics of the rice cultivator; to determine the extent of use of improved rice cultivation technologies by farmers in the area and to explore the relationship between selected characteristics of farmers with their use of improved rice cultivation technologies. The study was undertaken purposively in Ulipur upazila under Kurigram district. Validated and well-structured interview schedule was used to collect data from 104 rice cultivator during January 10 to February 28, 2021. Descriptive statistics, Pearson's Product-Moment Correlation Co-efficient were used for analysis. Most (75%) of the farmers were under low to medium use categories of improved rice cultivation technologies. One-fifth (25%) of the farmers were under high used category of technologies. Among nine selected characteristics of the farmers six characteristics namely- education, annual income from rice cultivation, rice farming experience, extension contact and knowledge on improved rice cultivation technologies had positive significant relationship with their use of improved rice cultivation technologies but constraints faced in rice cultivation had negative significant relationship with their use of improved rice cultivation technologies. The study recommends that extension services should be strengthened with necessary inputs for use of improve rice cultivation technologies by respondents.

CHAPTER-I
INTRODUCTION

1.1 General Background of the Study

Bangladesh is a densely populated small agrarian country. Comprising 1,47,570 sq. km of area with an estimated population is about more than 169.3 million (BBS, 2021). This country is regarded as one of the most densely populated area of the world. About 61.82 percent of its population live in rural areas and 40.6 percent of the country's total labour force are engaged in Agriculture (BBS, 2021). According to the BBS report, agricultural output's prices have been found to contribute 13.10% to the GDP in which 5.96% comes from crops, 1.78% from forestry, 2.06% from livestock and 2.71% from fisheries (BBS, 2021).

Agriculture plays a vital role in the development of Bangladesh economy through cultivation, employment generation and poverty alleviation. As the population of the country is ever increasing, the farm holding size of a family is ever decreasing. According to a study of the International Food Policy Research Institute (IFPRI, 2020), 83 per cent of farmers belong to the group of marginal and small category which have land less than 1.5 acres. This situation is steadily declining although there is acute food deficiency in the country.

Rice is the people's main food and energy source. It grows in three seasons namely; Aus, Aman and Boro. Rice is grown on about 10.5 million hectares which has remained almost stable over the past three decades. About 75% of the total cropped area and over 80% of the total irrigated area is planted rice. Bangladesh would produce 19 million tons in the ongoing Boro season, which accounts for 55 per cent of the country's total rice cultivation (USAID, 2021). However, the agriculture ministry is hopeful of harvesting 20.5 million tons. Among the total rice cultivation area, 7 percent land was under Aus, 38 percent land was under Aman (BBS, 2021). Currently, the average yield of rice in

Bangladesh is around 1.8 t/ha, which is less than the world average of 2.9 t/ha and frustratingly much below the highest producing country average in China (6.5 t/ha). The average rice yields of some countries are: India 2.7 t/ha, Vietnam 4.3t/ha, South Korea 6.48 t/ha, Japan 6.41 t/ha, Indonesia 5.12 (FAO, 2019). Moreover the impact of climate change on agriculture is severe. Floods, cyclones and storm surges are likely to damage agriculture crops and infrastructures. In addition, soil erosion, drainage congestion, water logging, saltwater intrusion, and scarcity of freshwater for drinking and irrigation are likely to increase substantially (IPCC, 2014, Ahmed and Alam, 1999, MoEF, 2009, Rawlani and Sovacool, 2011).

A remarkable change in rice cultivation has been already observed in Bangladesh after introducing of HYV varieties of rice. Bangladesh Rice Research Institute (BRRI) has developed and released 106 Modern Varieties (MVS) having potential to produce 2.0 or more times yield than those of traditional varieties. Whenever an innovation is generated, effort has been made to diffuse the innovation. Bangladesh has achieved tremendous growth in rice cultivation (3.5 times higher than 1971) due to increased cropping intensity (192%); higher adoption of HYV rice in dry (99%), early wet (90%) and wet (80%) seasons, and better agronomic management and irrigation application (Kabir *et al,* 2018). Improved cultivation technologies should be spread to the farmers in a inclusive and fascinating way. So that farmers can response quickly to use those technologies. Whereas, the country is densely populated there is a least scope to increase cultivation by smooth expansion. As a result, intensive or vertical expansion by using high cost agricultural practices and input are the only way to increase food cultivation. This inputs are usually considered MV seeds, fertilizers, irrigation, pesticides, intercultural operation etc. Accordingly, efforts are being made to encourage farmers to accept and make use of the research findings. Nevertheless, the technologies are not being used by all the farmers at an equal rate. Some of them responds to an innovation quickly while other delay or sometimes don’t adopt at all. An

individual usually doesn't adopt a new technology unless he finds the benefits of it by himself. Even if he is convinced about its benefit still he may not use the same due to lack of financial capability.

Currently, Government has taken all good measures to disseminate improved technologies to the root level farmers by implementing New Agricultural Extension Policy (NAEP) to achieve desire goals and sustainable agricultural cultivation. Kurigram is the poorest district in Bangladesh with 54% poverty rate (BBS, 2021). Naturally people of this region remain behind to use of improved rice cultivation technologies in many ways e.g imbalance use of fertilizers, less agri-machineries, not use of improve rice varieties etc. Studies on individual, group and society revealed that acceptance of improved technologies is conditional upon many factors. Some of these are social, personal, economical and situational factors. A very few previous research work tried to find out the above facts. Therefore, the researcher felt necessity to conduct a research entitled "Farmers' use of improved rice cultivation technologies in Kurigram district."

1.2 Statement of the Problem

When an innovation is introduced to the farmer, it may be readily accepted, partly accepted, completely or partly rejected or sometimes it may so happen that the adoption of innovation is discontinued or totally stopped. These happenings are certainly due to a number of factors. Use of improved technologies in rice cultivation is influenced by the farmers' demographic and socio economic position. An understanding about the same will be useful to the researchers, planners and extension workers in doing research, planning and execution of extension programs for enhancing use of improved technologies. The purpose of this study therefore, was to explore the relationships between different characteristics of the farmers and their use of improved technologies and classify the user categories. This was done by seeking answer to the following questions:

1. What are the important characteristics of the rice farmers influence their use of improved rice cultivation technologies?
2. To what extent the improved rice cultivation technologies were used by the farmers?
3. Is there any relationships between selected characteristics of the farmers and their use of improved rice cultivation technologies?

1.3 Objectives of the Study

To get the answer of the above questions, the researcher under took a piece of research topic entitled "**Farmers' use of improved rice cultivation technologies in the selected areas of Ulipur upazila under Kurigram district**" .The following specific objectives were formulated for giving proper direction to the study:

1. To describe the socio-economic characteristics of the rice growers in the study area. The selected characteristics were:
    i. Age
    ii. Level of education
    iii. Household size
    iv. Rice cultivation area
    v. Annual income from rice cultivation
    vi. Rice farming experience
    vii. Extension contact
    viii. Knowledge on improved rice cultivation technologies
    ix. Constraints faced in rice cultivation
2. To determine the extent of use of improved rice cultivation technologies by farmers in the area.
3. To explore the relationship between selected characteristics of farmers with their use of improved rice cultivation technologies.

1.4 Justification of the Study

It has been revealed by different scientific studies that major it's of farmers are illiterate or less educated and most of our farmers are following conventional methods of rice 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 rice, our traditional structure of rice 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 rice 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-economic, 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 findings of the study will, in particular, be applicable to the study area at Ulipur upazila of Kurigram district. The findings may also be applicable to other locale of Bangladesh where socio-cultural, psychological and economic circumstance do not differ much than those of the study areas. The findings of the study may also be subsidiary to the field worker of extension service to enhance their action strategies of use of improved technologies on rice cultivation. To the academicians, it may help in the further conceptualization of the systems model for analyzing the effects on rice cultivation at any region of Bangladesh. In addition, the findings of this study may have other empirical evidence to all aspects of effects on rice cultivation at any region of Bangladesh which may be used to build a theory of effect in use of improved technologies.

Considering the time, money and other necessary resources available to make the study manageable and meaningful, it was necessary to consider the following limitations:

1. The study was confined in four villages of two union under Ulipur upazila of Kurigram district.
2. Only nine characteristics of the farmers were selected.
3. Population of the study includes only the heads of the farm families.
4. Only nine cultivation technologies were selected as improved technologies, i.e., improved rice varieties, soil testing, optimal seed rate, timely transplanting, improved line spacing, planting depth, balanced use of fertilizer, IPM practices and mechanical cultivation.
5. The study was confined with the rice growers during January-February of the year 2021.

1.6 Assumptions of the study

An assumption is "the supposition that an apparent fact of principle is true in the light of the available evidence" (Goode and Hatt, 1952) While undertaking the study the following assumptions were taken into account:

1. The respondents were capable of providing proper responses to the questions included in the Appendix-A.
2. Views and options furnished by farmers included in the sample were the representative views and opinion of the whole population of the study area.
3. The responses furnished by the respondents were reliable, i.e., they expressed the truth about their conviction and options.

1.7 Definition of the Related Term

The terms, which used throughout the study, are defined below for clarity of understanding

Age: It means the age of a farmer that refers to the period of time from his birth to the time of investigation.

Education: Education referred to the desirable change of human behavior, i. e. change in knowledge, skill and attitude of an individual through reading, writing and other related activities.

Household size: The total members in the family of the respondents were considered as the Family size.

Cultivation Area: The term referred to the hectare of land owned by a farmer on which he carried his farming and family business, the area being estimated in terms of full benefit to the farmers.

Annual Income from rice: It referred to the total earning by the respondent himself and the members of his family from rice cultivation in a year. It is expressed in taka.

Extension contact: It is referred the respondents becoming accessible to the influence of different information media through different extension teaching methods.

Improved technologies: The term is used to those recommended practices by some competent authority through which better yield is achieved by various management and inputs. This term could be interchangeably with improved farm practices, selected farm practices, improved technologies etc.

Improved rice variety: It refers to the variety (ies) those have the capability of high cultivation per unit area.

Soil Testing: Soil testing is a rapid chemical analysis to access available nutrient status of the soil and includes interpretation, evaluation and fertilizer recommendation based on the result of chemical analysis and other considerations.

Optimal seed rate: Optimal Seeding Rates Optimum population is a function of the cultivation of environment, the yield goal, and the planting date. A higher seeding rate is required by low tillering varieties.

Line transplanting: It referred to transplanting seedlings keeping specific distance with a help of rope.

Balanced fertilizer dose: The balanced fertilizer dose refers to the recommended doses of various chemical fertilizer for Ulipur upazila. Those are mentioned below:

Urea-217 kg/ha TSP-51 kg/ha

MP - 60 kg/ha Gypsum - 30 kg/ha

ZnS04 - 5 kg/ha

Technology: Technology is a design of instrumental action that reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome (Rogers, 1995). In other words, technology refers to the combination of knowledge, inputs and managed mental practices, which are used together with productive resources to gain a desired output (ILEIA, 1991: 3).

Integrated Pest Management (IPM):

Agricultural Board of National Council in 1971 has defined IPM as "An ecological approach to pest management where all available necessary techniques are consolidated into a unified program. So that pest populations can be managed in such a manner that economic damage is avoided and adverse effects are minimized. It includes five components, such as use of

(i) Resistant variety.

(ii) Cultural practices.

(iii) Biological practices.

(iv) Mechanical practices.

(v) Chemical practices.

Assumption: An assumption is the supposition that an apparent fact of principle is true in the light of the available evidences (Goode and Hatt, 1952).

CHAPTER 2
REVIEW OF LITERATURE

Review of the literatures relevant with this study is presented in this chapter. The present study is concerned with the use of improved rice 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 rice cultivation technologies and selected individual characteristics. This chapter is divided into three parts. The first part deals with general findings on the use of different cultivation technologies of rice or any other crops, 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

Khan (2019) conducted investigation on adoption of selected hybrid rice cultivation technologies by the farmers of Joypurhat district in Bangladesh. The study revealed that about 68.5 percent of the farmers had medium adoption compared to 9 percent having low adoption and 22.5 percent having high adoption of hybrid rice cultivation technologies.

Hossain *et al.* (2006) showed that by the year 2001–2002, the coverage of modern rice varieties reached 65% of the rice-cropped area—80% for the dry season and 51% for the wet season; thus, the Green Revolution in rice cultivation is not yet complete in Bangladesh.

The researchers at BRRI, BINA, BAU, and DU are found Labour-intensive rice farming activities in Bangladesh. A. Aman rice harvesting by the farmers. B. Straw carrying after threshing. J Intl Cooper Agric Dev, (2016) 27 working to improve rice cultivars by incorporating tolerance to drought, flood, and

salinity. Scientists at BRRI and BINA have developed numerous rice varieties with some tolerance to submergence (BRRI dhan51, BRRI dhan52, Binadhan-11, and Binadhan-12 for boro), drought (BRRI dhan55 for boro; BRRI dhan42, BRRI dhan43, and BRRI dhan48 for aus; BRRI dhan33, BRRI dhan56, and BRRI dhan57 for aman), and salinity (BRRI dhan40, BRRI dhan41, BRRI dhan47, Binadhan-8, and Binadhan-10 for boro and BRRI dhan53 and BRRI dhan54 for aman (Shelley *et. al.*, 2016)

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.

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.

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.

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.

Jahan (2017) conducted investigation on “Socio-Economic Determinants of Adoption of Sunflower Cultivation by the Farmers of Patuakhali Sadar Upazila” in Bangladesh. The study revealed that the highest proportion (69.1 percent) of the sunflower growers fell under the medium adoption category,

while 21.2 percent had high adoption and 9.7 percent had low adoption of sunflower cultivation technologies.

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 intercultural (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 cultivation technology. They observed that majority of sugarcane growers had the medium level of adoption and were partial adopters of scientific recommendations of sugarcane cultivation 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 modern sugarcane cultivation.

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.

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.

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 and use

Young farmers are expected to be more eager in adopting rice technologies on their farms than older farmers, being that they are risk bearers in decision making (Chekene and Chancellor, 2015, Singh and Varshney, 2016).

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 an age 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 and use

Education plays a very important role in promoting agricultural technologies. The education variable has a significant ($P \leq 0.093$) and positive influence on AIRV, suggesting that more educated and informed farmers seems to be positive in adoption of improved rice technology than the others. Further,

education level of the farmer not only increases his rice productivity but also improves his ability to understand and evaluate new rice technologies. The finding is consistent Ghimire *et al*. (2015) and Kumar *et al*. (2016), who found significant and positive relation between education and adoption of new rice technologies.

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 Family size and use

Jahan (2017) conducted investigation on "Socio-Economic Determinants of Adoption of Sunflower Cultivation by the Farmers of Patuakhali sadar upazila" in Bangladesh. She found that family size of the farmers had no significant contribution with their adoption of improved practices of sunflower cultivation.

Hossain (2003) revealed that family size of the farmers had a significant and positive relationship with their adoption of modern Boro rice cultivation practices.

Sardar (2002) found that the family size of the farmers had significant positive relationship with their adoption of IPM practices.

Hossain (1999) conducted a study to determine the farmers' perception of the effects of agro-chemicals on environment. He found no relationship between the farmer's family sizes with their adoption of fertilizer.

Chowdhury (1997) conducted a research study on adoption of selected BINA technologies by the farmers of Boira union in Mymensingh district. He observed that family size of the farmers had positive and significant relationship with the adoption of selected BINA technologies.

Hossain (1991) in his study in sadar thana of Jamalpur observed that family size of the farmers had no significant effect on their adoption of improved farm practices. Similar results were observed by Sobhan (1975), Hoque (1993), Bashar (1993), Hossain (1999) also found that family size of the farmers had positive significant relationship with the adoption of agro-chemical. Similar results were also observed by Pal (1995), Muttalab (1995), Sarker (1997), Chowhdury (1997), Hoque (1993) and Khan (1993).

2.2.4 Farm size and use

Abu Bakar in his study, landholding size is expected to positively influence in the AIRV. In our study, landholding size is positively contributed to participation of improved rice seed technology. Nevertheless, the variable was not significantly. This result implies that farmers' having large landholding size is more likely to AIRVs on their farms. They will be willing to utilize their land

to new agricultural technology compared to those with small landholding size (Abubakar *et al.*, 2016, Kumar *et al.*, 2016, Singh and Varshney, 2016).

The estimated coefficient for family size is positive but not significant, while the coefficient of farming experience is significantly positive, which imply that more farming experience will help the farmers in making decision to adopt agricultural technology. Similar finding is reported by Abubakar *et al*. (2016) and Adedoyin *et al*. (2016).

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.

2.2.5 Annual family income and use

The development of the rural economy, driven by the full-scale diffusion of the Green Revolution, led to an increase in agricultural wage (Fujita, 2010).

Rice is the most widely cultivated (78% areas) staple crop. Despite the country is self-sufficient in rice production, food import of this country is steadily increasing due to large deficit in other crops production (e.g., wheat, pulses and oilseeds) (FPMU, 2018).

Thus, an additional 8.22 and 14.00 million tons of food grains production may need to be increased by the years 2030 and 2050, respectively compared to the base year (2005–2006) production (27.81 million tons) for keeping pace with the population growth and shrinking land resource base (Hussain, 2011). Similarly, reported that an additional 11.8 million tons (44.6 MT) clean rice need to be increased by 2050 compare to base year (2014) production (32.8 MT) (Kabir *et al.*, 2015).

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.

2.2.6 Farming experience and use

Farming experience improves farmers' skills at production, which implies that more experienced farmers may have a low level of uncertainty about improved agricultural innovations, performance and also be able to evaluate the advantages of new agricultural technology.

Furthermore, landholding size is expected to positively influence in the AIRV. In our study, landholding size is positively contributed to participation of improved rice seed technology. Nevertheless, the variable was not significantly. This result implies that farmers' having large landholding size is more likely to AIRVs on their farms. They will be willing to utilize their land to new agricultural technology compared to those with small landholding size (Abubakar *et al.*, 2016, Kumar *et al.*, 2016, Singh and Varshney, 2016).

As the adoption of modern varieties (MV) of rice is reaching a plateau, particularly for the irrigated ecosystem, an important issue is whether the research system will be able to sustain the growth of production addresses the following questions: (i) to what extent farmers have been replacing the old MV with the new MV, and (ii) what has been the impact of the variety replacement on productivity and profitability (Mahbub *et al.*, 2006).

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 cultivation technology.

2.2.7 Extension media contact and use

Information plays a very important role in strengthening a farmer's decision and making associated with farming activities by improving his skill and knowledge about modern agricultural technologies, inputs and markets. The

result showed significant and positive association between market information and the AIRVs. Farmers need up-to-date information regarding inputs, new technology, developed and released improved varieties, prices and new agronomic practices. Further, market information has a positive influence on adoption of new seeds or technologies, and increasing crop productivity and livelihood of the farmers (Aker, 2011, Ali and Kumar, 2011).

The agriculture extension service is very important institutional factor. In this study, extension contact is used as a proxy for institutional network. It has a significant and positive relation with AIRVs. This means that farmers in more contact with extension agents are more likely to adopt the improved rice varieties. Various researchers observed that the farmers with a regular extension contact are more willing to adopt new agricultural varieties (Mirani *et al.*, 2002, Chekene and Chancellor, 2015, Ghimire *et al.*, 2015, Abubakar *et al.*, 2016).

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 an 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.

2.2.8 Knowledge and use

Bangladesh, like other rice-producing countries in South Asia, has historically relied upon traditional (landrace) rice varieties (TYV) with relatively low yields per hectare (Husain *et al.,* 2001).

A HYV, as reported by the Bangladesh Bureau of Statistics (BBS), is an inbred variety created by a public or private breeding program that has higher yields than traditionally grown varieties, while a hybrid is cross-bred to achieve hybrid yield vigor, often resulting in 15–20% higher yields than HYV (Nalley *et al.,* 2016, 2017; Shelley *et al.,* 2016).

HYV cultivation displays lower technical efficiency and much greater variability in efficiency. Also, efficiency is not independent of household endowments in that small farmers, and/or those with the least education and growing experience, are least efficient. Policies that promoted education and provided smaller farmers with greater access to public services would promote

efficiency and equity, and help reduce HYV yield variability (Najma R. Sharif and Atul A. Dar, 2007).

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 cultivation practices better than those of the farmer width lower level of agricultural knowledge. Ali (1995), Alam (1997) and Sardar (2002) found the similar findings.

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).

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 focus variable” and an explanatory variable”. A focus variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variables (Townsend, 1953). An explanatory 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 2.1.

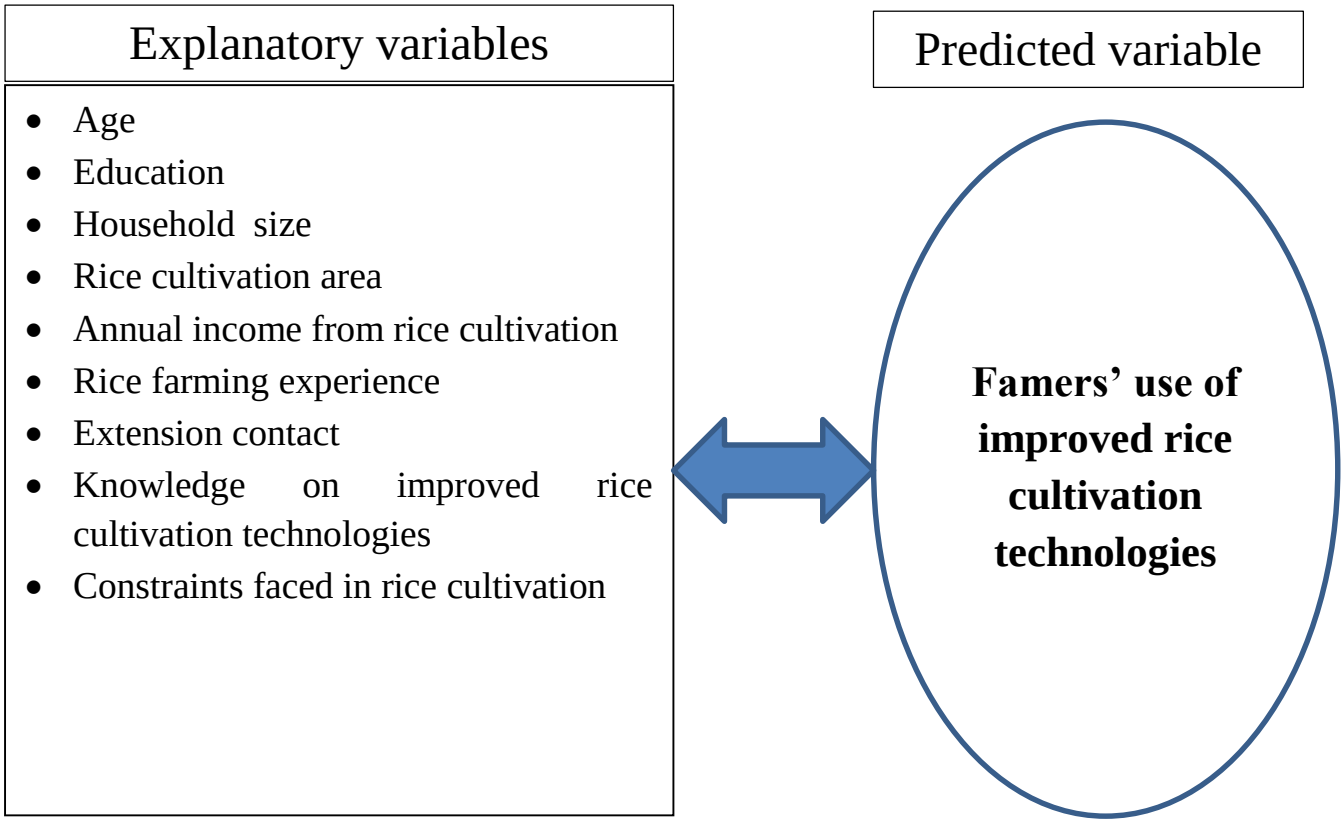

Figure 2.1. Conceptual framework of the study

CHAPTER III
METHODOLOGY

In conducting a research study, methodological issue is one of the prime considerations for yielding of valid and reliable findings. Appropriate methodology enables the researcher to collect valid and reliable information and to analyze the information properly in order to arrive at correct conclusions. However, the methods and operational procedures followed in conducting this study has been described in the subsequent sections of this chapter.

3.1 Locale of the Study

The study was conducted at Bazra and Tabakpur union of Ulipur upazila under Kurigram district. Out of 13 unions, Bazra and Tabakpur unions was purposively selected because of higher rice cultivation. Thereafter, four villages namely, Khamar bazar and Purba bazar villages from Bazra union and Shadullah and Umanondo villages from Tabakpur union under Ulipur upazila were selected randomly from 27 villages of these unions. A map of Kurigram district showing Ulipur upazila and a map of Ulipur upazila showing the study area have been shown in Fig 3.1 and 3.2, respectively.

3.2 Populations and Sampling Design

All the rice growers of the selected union were the population of the study. A list of the farmers of this Upazila was prepared with the help of Sub Assistant Agriculture Officer, Upazilla Agricultural office; Ulipur upazila under Kurigram district. The total numbers of rice growers in these four villages were around 1041. Out of them 10 percent of the total population were selected random sampling methods. Proportionate random sampling method was used in order to select the respondents. So, 104 (10% of population) rice farmers were the sample of the study.

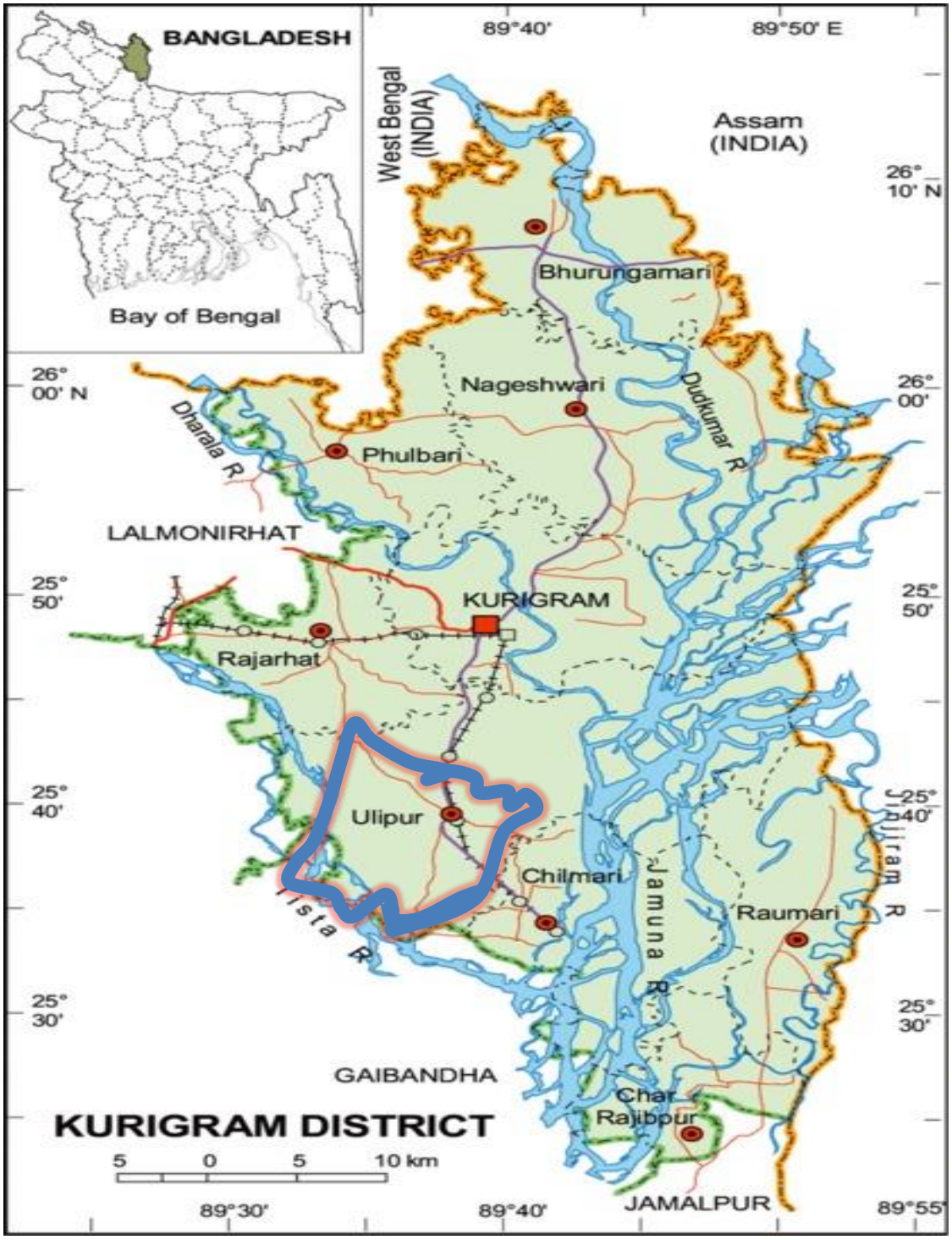

Figure 3.1: A Map of Kurigram district showing Ulipur upazila

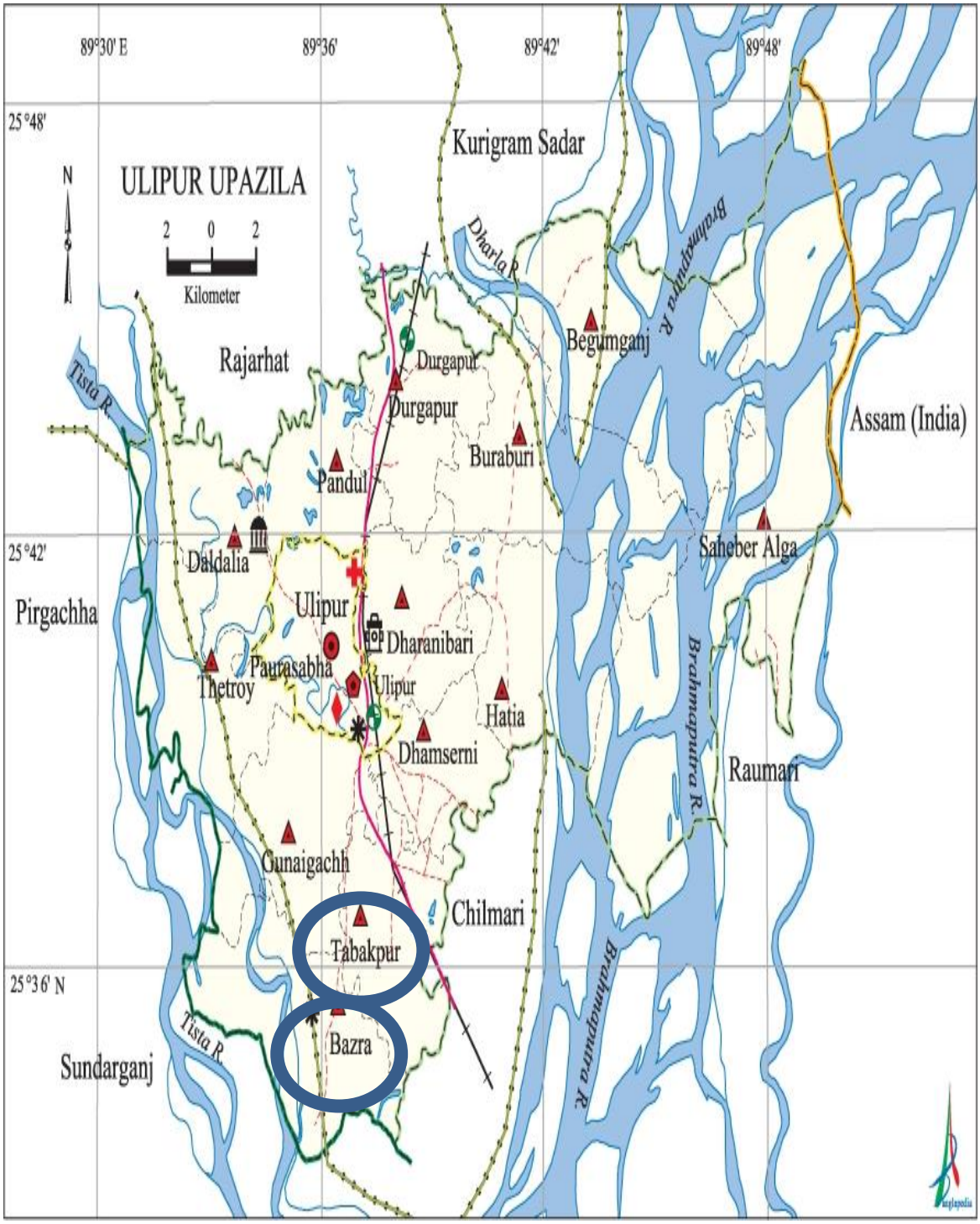

Figure 3.2: A Map of Ulipur upazila showing the Bazra and Tabakpur union.

A reserve list of 10 rice cultivars was also prepared by the same method so that the respondents of this list could be used for interview if the respondents included in the original sample were not available at the time of conduction of interview. The distribution of the population sample and number of respondents in the reserve list are given in Table 3.1.

Table 3.1 Distribution of the farmers constituting the populations, sample and reserve list in selected villages under Ulipur upazila

Name of Unions	Name of Villages	Population of rice farmers	Sample size (10%)	Reserve list
Bazra	Khamar bazar	312	31	3
	Purba bazra	241	24	2
Tabakpur	Shadullah	289	29	3
	Umanondo	199	20	2
Total		**1041**	**104**	**10**

3.3 Instrument for Data Collection

In order to collect reliable and valid Information from the rice farmers, an interview schedule was prepared carefully keeping the objectives of the study in mind. The interview schedule contained both open and closed form questions.

Appropriate schedule was also developed to operationalize the selected characteristics of the rice cultivars. The interview schedule was prepared in English version and was pre-tested with rice cultivars. This pre-test facilitated the researcher to examine the suitability of different questions and statements in general. The interview schedule has been given at Appendix-A.

3.4 Measurement of Variables

A variable is any characteristic, which can assume varying, or different values in successive individual cases (Ezekiel and Fox, 1959). An organized research usually contains at least two important variables, viz. an explanatory and a focus variable. According to the relevant research area, the researcher selected

nine characteristics of the rice cultivars as the explanatory variable and use of improved rice cultivation technologies as focus variable. It was pertinent to follow a methodological procedure for measuring the variables in order to conduct the study in accordance with the objectives already formulated. The procedures for measuring the variables are described below.

3.4.1 Measurement of explanatory variables

3.4.1.1 Age

The age of the respondents were measured in terms of years, on the basis of the responses of the respondents. Age was measured by the period of time from the birth of a respondent to the day of interviewing. A score of one (1) was assigned for each years of age. A age was placed in item no. 1 of the interview Schedule (Appendix-A).

3.4.1.2 Education

Education of a respondent is measured in term of grades (classes) passed by the respondent. One (1) score was assigned for one year of successful schooling. For example, if a respondent passed the final examination of class six, his education score was taken as 6; if a respondent had education outside the school and if the level of education was through equivalent to that of class four of the school, then his education score was taken as 4 An illiterate person was given a score zero (0). A score of 0.5was assigned for those who don't read and write but can sign his name only. Data obtained in response to item no. 2 of the interview schedule were used to determine the level of education of the respondent.

3.4.1.3 Household size

Household size was operationally measured by assigning a score of one for each member of the family who jointly live and eat together. The members included the respondent himself, his wife, children and other dependent members.

3.4.1.4 Rice cultivation area

Rice cultivation area of a respondent was measured in terms of area covered by rice cultivation by the respondent. It was expressed in hectare.

3.4.1.5 Annual income from rice cultivation

Annual income from rice cultivation of a respondent was measured in thousands taka on the basis of total yearly earning of the respondents from rice cultivation. A score of one (1) was given for each Tk.1000 to compute the annual income score of the respondents.

3.4.1.6 Extension contact

The extension contact of a respondent was measured by computing an extension contact score on the basis of his extent of contact with 7 selected sources of information. The respondents were asked to mention his response to five alternative nature of contact for each media. The score for each respondent was determined by adding his responses to all the items on the basis of his frequency of contact as never, rarely, occasionally, often and regularly with a score of 0, 1, 2, 3 and 4 respectively. Extension contact score of the respondents could range from 0 to 28, where 0 indicating no extension contact and 28 indicating very high extension contact.

3.4.1.7 Rice farming experience

It is the period that was passed by the respondent in cultivating rice. It was measured in years. In a measuring score of one (1) was assigned for each year of rice farming experience of a respondent either in his own farm or to that of his parents.

3.4.1.8 Knowledge on improved rice cultivation technologies

A scale consisting of 15 questions was used to determine the knowledge score of the respondents. The questions were selected from different dimensions of improved technologies used by the farmers after thorough consultation with the

relevant experts and review of relevant literatures as shown in Appendix A. The score allotted for each question was 2. A respondent could get 2 score against each question for correct response and 0 for wrong or no response and partial score was assigned for partially correct answer. Thus, knowledge score of the respondents could range from 0 to 30, where 0 indicated very low knowledge on improved rice cultivation technologies and 30 indicated very high knowledge on improved rice cultivation technologies. This variable appears in item number eight (8) in the interview schedule as presented in Appendix-A.

3.4.1.9 Constraints faced in rice cultivation

After thorough consultation with relevant experts, farmers and literatures, 10 problems were selected related to rice cultivation for the study. A list of 10 probable problems that farmers could face in different aspects were listed and asked to indicate the extent of their problem faced in rice cultivation. It was measured by using a four point rating scale. For each problem score of 3, 2, 1 and 0 were assigned to indicate extent of problems as high, medium, low and no problems, respectively. The problems score was computed for each respondent by adding his/her scores for all 10 problems. The possible range of problem scores thus could be 0 and 30. A total score of 30 indicated highest problems in respect of rice cultivation, while a score of 0 indicated no problems faced in rice cultivation

3.5 Measurement of predicted variable

The extent of use of improved rice cultivation technologies by the farmers was considered as focus variable in this study. This variable was measured on the basis of their use of different kinds of improved rice cultivation technologies. The scores of the respondents were computed on the basis of the respondent use of nine improved rice cultivation technologies. The 9 improved rice cultivation technologies are:

1. Improved Rice Varieties
2. Soil Testing Before Seed Sowing or Transplanting
3. Optimum Seed Rate
4. Timely Transplanting
5. Improved Line Spacing
6. Planting Depth
7. Balanced Use of Fertilizer
8. IPM
9. Mechanical Harvesting

A four-point rating scale such as high, moderate, low and no was used to measure the extent of use of improved rice cultivation technologies. 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. For each use score of 3, 2, 1 and 0 were assigned to indicate extent of use as high, moderate, low and no use, respectively.

As nine improved rice cultivation technologies were selected for the study, so the range of improved rice technologies score of a respondent could vary from 0 to 27, where, 0 indicate no use of improved rice cultivation technologies and 27 indicates highest use of improved rice cultivation technologies.

3.6 Statement of the Hypothesis

As defined by Goode and Hatt (1952) "A hypothesis is a proposition, which can be put to a 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 studying the relationship among variables, research hypotheses are formulated which state the

anticipated contributory relationship with variables. However, for statistical test it becomes necessary to formulate null hypothesis.

3.6.1 Research hypothesis

Research hypothesis states a possible relationship between the variables being studied or a difference between experimental treatments that the researcher expects to emerge. The following research hypothesis was put forward to know the relationships between each of the 9 selected characteristics of the farmers and their use of improved rice cultivation technologies. “Each of the 9 selected characteristics of the farmers will have significant relationship with their use of improved rice cultivation technologies.”

3.6.2 Null hypothesis

A null hypothesis states that “there is no relationship between selected characteristics of the farmers with their use of improved rice cultivation technologies in the selected area of Ulipur upazila under Kurigram district”. The selected characteristics were age, level of education, household size, rice cultivation area, annual income from rice cultivation, rice farming experience, extension contact, knowledge on improved rice cultivation technologies and constraints faced in rice cultivation.

3.7 Collection of Data

The researcher himself through face-to-face interview collected data personally from selected respondents. Before starting collection of data, the researcher met the respective Upazila Agriculture Officer, Agriculture Extension Officer and Sub Assistant Agriculture Officers. Interviews were usually conducted with the respondents in their homes. While starting interview with any respondent the researcher took all possible care to establish rapport with him so that he did not hesitate to furnish proper responses to the question and statement in the schedule. However, if any respondent failed to understand any question the researcher took care to explain the issue. The researcher did not face any major

problem in collecting data. Excellent co-operation and co-ordination were extended by the respondents and other concerned persons during data collection. The entire process of collecting data took place during January 10 to February 28, 2021.

3.8 Data Processing and Analysis

After completion of field survey, all the data were processed according to the objectives of the study. Local units were converted into standard unit. All the individual responses to questions of the interview schedule were transferred to master sheet to facilitate tabulation, categorization and organization. In case of qualitative data, appropriate scoring technique was followed to convert the data into quantitative form. SPSS computer package was used for data processing and analysis.

The statistical measures such as range, mean, standard deviation, and percentage were used for describing both variables. Tables were also used in presenting data for clarity of understanding. To find out the relationship between selected characteristics of the respondents and their use of improved rice cultivation technologies, Pearson's Product-Moment coefficient of correlation (r) test was used.

Five percent (0.05) level of probability was used for rejecting a null hypothesis. Co-efficient values signification at 0.05 level is indicated by one asterisk (*) and that at 0.01 level by two asterisks (**).

CHAPTER IV
RESULTS AND DISCUSSION

In this chapter the findings of the study and its interpretation are presented in four sections according to the objectives of the study. The first section deals with the selected characteristics for the rice farmers, while the second section deals with famers' use of improved rice cultivation technologies. The third section deals with the relationships between the selected characteristics of the rice farmers and their use of improved rice cultivation technologies.

4.1 Selected Characteristics of the Farmers

Nine characteristics of the farmers were selected for this research. The characteristics include: age, level of education, household size, rice cultivation area, annual income from rice cultivation, rice farming experience, extension contact, knowledge on improved rice cultivation technologies and constraints faced in rice cultivation. Some descriptive statistics of these features are given in Table 4.1. Data contained in the Table 4.1 reveal the salient features of the characteristics of the farmers in order to have an overall picture of these characteristics at a glance. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

Table 4.1 The salient features of the selected characteristics of the farmers

Categories	Measuring Unit	Range		Mean	S D
		possible	observed		
Age	Years	-	25-75	44.72	13.49
Level of education	Year of schooling	-	00-16.00	6.16	5.42
Household size	Number		2-19	5.81	2.03
Rice cultivation area	Hectare	-	.08-3.45	0.61	0.38
Annual income from rice cultivation	Years		13.50-470	80.73	63.79
Rice farming experience	Score	-	2-50	18.15	12.52
Extension contact	Score	0-28	3-24	13.95	4.14
Knowledge on improved rice cultivation technologies	Score	0-30	12-28	20.46	3.42
Constraints faced in rice cultivation	Score	0-30	10-27	19.48	3.20

4.1.1 Age

The age of the farmers ranged from 25 to 75 year, the average being 44.72 years and the standard deviation was 13.49. On the basis of their age, the farmers were classified into three categories: “young” (up to 35), “middle aged” (36- 50) and “old” (above 50). The distribution of the farmers according to their age is shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories	Farmers		Mean	SD
	Number	Percent		
Young aged (up to 35)	25	24.04	44.72	13.49
Middle-aged (36-50)	51	49.04		
Old (>50)	28	26.92		
Total	**104**	**100**		

The highest proportion (49.04 percent) of the farmers was middle aged compared to 24.04 percent of them was young aged and 26.92 percent of them old. The overwhelming majority (75.96 percent) of the farmers were middle to old aged.

4.1.2 Education

The education score of the farmers ranged from 0-16, with an average of 6.16 and standard deviation 5.42. Based on their education scores, the farmers were classified into four categories namely illiterate (0-0.5), primary education (1-5), secondary education (6-10) and above secondary (above 10). The distribution of the farmers according to their education is shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their education

Categories	Farmers		Mean	SD
	Number	Percent		
Illiterate (0-0.5)	41	39.42	6.16	5.42
Primary level (1-5)	8	7.69		
Secondary level (6-10)	32	30.77		
Above secondary level (>10)	23	22.12		
Total	**104**	**100**		

It is evident from the Table 4.3 that the highest proportion (39.42 percent) of the rice farmers were illiterate compared to 7.69 percent of them had primary level of education. About 30.77 percent of them were secondary level of education. The proportion of rice farmers above secondary level of education were 22.12 percent. Thus, the overwhelming majority (81.18 percent) of the rice farmers were educated ranging from above secondary to primary level of education. The findings thus, indicate that the current literacy rate in the study area is lower than that of the national average of 73.9 percent (BBS, 2021).

4.1.3 Household size

The household size of the farmers ranged from 2 to 19 and the mean was 5.81 with standard deviation of 2.03. According to the household size of the farmers, they were classified into three categories as “Small (up to 3)”, “Medium (4-7)” and “Large (>7)”. The distribution of the farmers according to their household size is shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their household size

Categories	Farmers		Mean	S D
	Number	Percent		
Small family (up to 3)	5	4.80	5.81	2.03
Medium family (4-7)	85	81.73		
Large family (above 7)	14	13.46		
Total	**104**	**100**		

Above three – fourth (81.73 percent) of the farmers had medium family size compared to 13.46 percent of them having large family size and only 4.80 percent of the farmers had small family size.

4.1.4 Rice cultivation area

The rice cultivation area of the farmers ranged from 0.08 to 3.45 hectares and the mean was 0.61 hectares with standard deviation of 0.38. According to the rice cultivation area of the farmers, they were classified into four categories as suggested by DAE "Marginal (up to 0.2)", "Small (0.21-1)", "Medium (1.1-3)" and "Large (>3)".The distribution of the farmers according to their rice cultivation area is shown in Table 4.5.

Table 4.5 Distribution of the farmers according to their rice cultivation area

Categories	**Farmers**		Mean	SD
	Number	Percent		
Marginal farm (up to 0.2 ha)	40	38.46	0.61	0.38
Small farm (0.21-1.0 ha)	58	55.77		
Medium farm (1.01-3.0 ha)	2	1.92		
Large farm (>3.01 ha)	4	3.85		
Total	**104**	**100**		

Above half (55.77 percent) of the rice farmers possessed small land compared to 38.46 percent of them having marginal land, only 1.92 percent had medium 55.77 and 3.85 percent of the farmers had large rice cultivation area.

4.1.5 Annual income from cultivation

Annual income from cultivation of the farmers ranged from Taka 13.50 thousand to 470 thousand, the mean being 80.73 thousand and standard deviation 63.79 thousand. On the basis of their annual income from cultivation scores, the farmers were divided into three categories: “low income” (up to 17), “medium income” (18-143) and “high income” (above 143). The distribution of the farmers according to their income from cultivation is shown in Table 4.6.

Table 4.6 Distribution of the farmers according to their annual income

Categories	Farmers		Mean	SD
	Number	Percent		
Low contact (up to 17)	2	1.92	80.73	63.79
Medium contact (18-143)	89	85.58		
High contact (above 143)	13	12.50		
Total	**104**	**100**		

The majority (85.58 percent) of the rice farmers had medium income compared to 1.92 percent of them having low income and 12.50 percent of the farmers had high income from cultivation. Thus, the vast majority (98.08 percent) of the rice farmers had medium to high income, indicating that rice cultivation is usually practiced by the farmers of comparatively lower economic standings.

4.1.6 Rice farming experience

The experience score of the rice farmers ranged from 2 to 50 with a mean of 18.15 and standard deviation of 12.52. Based on the cultivation experience scores, the rice farmers were classified into three categories: “low experience” (upto 6 years), “medium experience” (7-30 years) and “high experience” (above 30 years). The distribution of the farmers according to their rice farming experience is presented in Table 4.7.

Table 4.7 Distribution of the farmers according to their farming experience

Categories	Farmers		Mean	SD
	Number	Percent		
Low experience (up to 6)	24	23.08	18.15	12.52
Medium experience (7-30)	61	58.65		
High experience (above 30)	19	18.27		
Total	**104**	**100**		

About 58.65 percent of the rice farmers had medium experience on rice cultivation & while the rest 23.08 and 18.27 percent of them had low and medium experience in rice cultivation.

4.1.7 Extension contact

The observed extension contact scores of the rice farmers ranged from 3 to 24 against the possible range from 0 to 28, the mean and standard deviation were 13.95 and 4.14 respectively. According to this score, the rice farmers were classified into three categories: “low extension contact” (up to 9), “medium extension contact” (10-17) and “high extension contact” (above 17). The distribution of the farmers according to their extension contact is shown in Table 4.8.

Table 4.8 Distribution of the farmers according to their contact

Categories	Farmers		Mean	SD
	Number	Percent		
Low contact (up to 9)	12	11.54	13.95	4.14
Medium contact (10-17)	73	70.19		
High contact (above 17)	19	18.27		
Total	**104**	**100**		

A proportion of 70.19 percent of the rice farmers had medium extension contact compared to 18.27 percent of them having high extension contact and 11.54 percent of the rice farmers had low contact. Thus, overwhelming majority (81.73 percent) of the rice farmers had low to medium extension contact. Extension contact is a very effective and powerful source of receiving

information about various new and modem technologies. The status of no or having low and medium contacts might have significant impacts on the knowledge rice cultivation.

4.1.8 Knowledge on improved rice cultivation technologies

Rice farmers' knowledge scores could theoretically range from 0 to 30. But their observed knowledge scores ranged from 12 to 28, the mean being 20.46 and standard deviation 3.42. Based on the theoretical scores, the farmers were classified into three categories as: "low knowledge" (upto 17), "medium knowledge" (18-23), "high knowledge" (above 23). The distribution of the farmers according to their knowledge is shown in Table 4.9.

Table 4.9 Distribution of the farmers according to their knowledge

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low (up to 17)	22	21.15	20.46	3.42
Medium (18-23)	65	62.50		
High (above 23)	17	16.35		
Total	**104**	**100**		

About 62.50 percent of the farmers had medium knowledge on improved rice cultivation technologies, 16.35 percent of the farmers had high knowledge on improved rice cultivation technologies and only 21.15 percent of the farmers had low knowledge on improved rice cultivation technologies. Thus, a proportion of 78.85 percent of the farmers had medium to high knowledge on improved rice cultivation technologies.

4.1.9 Constraints faced in rice cultivation

The problem faced score of the rice farmers ranged from 10 to 27 against the possible score of 0-30 with a mean of 19.48 and standard deviation of 3.20. Based on the problem faced scores, the rice farmers were classified into three categories: "low problem" (upto 16), "medium problem" (17-22) and "high problem" (above 22). The distribution of the rice farmers according to their

problem faced is presented in Table 4.10.

Table 4.10 Distribution of the farmers according to their problem

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low (up to 16)	19	18.27	19.48	3.20
Medium (17-22)	65	62.50		
High (above 22)	20	19.23		
Total	**104**	**100**		

About 62.50 percent of the rice farmers had medium problem compared to 19.23 percent of them having high problem and 18.27 percent having low problem. Thus, the vast majority (80.77 percent) of the rice farmers had low to medium problem.

4.2 Famers' use of improved rice cultivation technologies

Scores of the use of improved rice cultivation technologies of the farmers ranged from 10 to 26 with an average of 17.17 and standard deviation 3.76. The rice farmers were classified into three categories on the basis of their use of improved rice cultivation technologies scores, such as low (up to 14), medium (15-20) and high (above 20). The findings of using rice cultivation technologies by the farmers are shown in Table 4.11.

Table 4.11 Distribution of farmers according to their use

Categories	Farmers		Mean	SD
	Number	Percent		
Low uses (up to 14)	28	26.92	17.17	3.76
Medium uses (15-20)	50	48.08		
High uses (>20)	26	25.00		
Total	**104**	**100**		

Most (75%) of the farmers were under low to medium use of improved rice cultivation technologies. One-fifth (25%) of the farmers had high used category of technologies.

The result obtained in the use of improved rice cultivation technologies can be explained as the individual characteristics of the farmers may greatly vary and the various factors might have great Table 4.11. Table showed the categories of respondents on the basis of their use of improved rice cultivation technologies. Farmers use modern 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. Maximum (48.08%) farmers of the study area had medium use (15 to 20) of improved rice cultivation technologies. Twenty five percent farmers had high use (above 20) of improved rice cultivation technologies.

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

To explore the relationships of the selected characteristics of farmers' with their use of improved rice cultivation technologies, "Pearson's Product-Moment Correlation Co-efficient 'r' has been used.

A hypothesis was rejected when the observed 'r' value was greater than the tabulated value of 'r' at 0.05 level of probability.

As mentioned earlier, the nine selected characteristics of the farmers were considered for the study. The variables were age, level of education, household size, rice cultivation area, annual income from rice cultivation, rice farming experience, extension contact, knowledge on improved rice cultivation technologies and constraints faced in rice cultivation. Farmers' use of improved rice cultivation technologies were the main focus of the study.

From this correlation test, it was found that level of education, annual income from rice cultivation, rice farming experience, extension contact and knowledge on improved rice cultivation technologies had positive significant

relationship with their use of improved rice cultivation technologies but constraints faced in rice cultivation had negative significant relationship with their use of improved rice cultivation technologies. Beside these six characteristics, rest three characteristics of the farmers (age, household size and rice cultivation area) had no significant relationship with their use of improved rice cultivation technologies.

The results of the correlation analysis between each of the selected characteristics of the farmer with their use of improved rice cultivation technologies are shown in Table 4.12. In a bid to achieve the said inter-correlations, the correlation coefficients among the variables were arranged in matrix (Appendix-B).

Table 4.12 Co-efficient of correlation showing relationship between selected characteristics of the farmers with their use of improved rice cultivation technologies

Focus variable	Explanatory Variables	Computed value "r"	Tabulated value of "r"	
			at 0.05 level	at 0.01 level
Famers' use of improved rice cultivation technologies	Age	0.184^{NS}	0.192	0.251
	Level of education	0.336**		
	Household size	0.172^{NS}		
	Rice cultivation area	0.134^{NS}		
	Annual income from rice	0.354**		
	Rice farming experience	0.268**		
	Extension contact	0.532**		
	Knowledge on improved rice cultivation technologies	0.566**		
	Constraints faced in rice cultivation	-0.271**		

^{NS}Not significant

* Significant at 0.05 level of probability

** Significant at 0.01 level of probability

4.3.1 Age and use of improved rice cultivation technologies

The computed value of "r" (0.184) was smaller than that of the tabulated value

(r=0.192) with 103 degrees of freedom at 0.05 level of probability as shown in Table 4.12. Hence, the concerned null hypothesis was accepted and it was concluded that age of the farmers had no significant relationship with their use of improved rice cultivation technologies.

4.3.2 Education and use of improved rice cultivation technologies

The computed value of "r" (0.336) was greater than the tabulated value (r=0.251) with 103 degrees of freedom at 0.01 level of probability as shown in Table 4.12 and the relationship showed a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicated that education of the farmers had significant positive relationship with their use of improved rice cultivation technologies.

4.3.3 Household size and use of improved rice cultivation technologies

The computed value of "r" (0.172) was smaller than the tabulated value (r=0.172) with 103 degrees of freedom at 0.05 level of probability as shown in Table 4.12 and the relationship showed a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicated that household size of the farmers had significant positive relationship with their use of improved rice cultivation technologies.

4.3.4 Rice cultivation area and use of improved rice cultivation technologies

The computed value of "r" (0.134) was smaller than the tabulated value (r=0.192) with 103 degrees of freedom at 0.05 level of probability as shown in the Table 4.12. Hence, the concerned null hypothesis could not be rejected. The findings indicated that rice cultivation area of the farmers had no significant relationship with their use of improved rice cultivation technologies.

4.3.5 Annual family income and use of improved rice cultivation technologies

The computed value of “r” (0.354) was greater than the tabulated value (r=0.192) with 103 degrees of freedom at 0.01 level of probability as shown in Table 4.12 with a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicated that annual family income of the farmers had significant positive relationship with their use of improved rice cultivation technologies.

4.3.6 Extension contact and use of improved rice cultivation technologies

The computed value of “r” (0.532) was greater than the tabulated value (r=0.251) with 103 degrees of freedom at 0.01 level of probability as shown in Table 4.12 with a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicated that extension contact of the farmers had a significant positive relationship with their use of improved rice cultivation technologies.

4.3.7 Rice farming experience and use of improved rice cultivation technologies

The computed value of “r” (0.268) was greater than the tabulated value (r=0.251) with 103 degrees of freedom at 0.01 level of probability as shown in the Table 4.12. Hence, the concerned null hypothesis could not be rejected. The findings indicated that rice farming experience of the farmers had no significant relationship with their use of improved rice cultivation technologies.

4.3.8 Knowledge on improved rice cultivation technologies and use of improved rice cultivation technologies

The computed value of “r” (0.566) was greater than the tabulated value (r=0.251) with 103 degrees of freedom at 0.01 level of probability as shown in the Table 4.12. Hence, the concerned null hypothesis could not be rejected. The

findings indicated that knowledge on improved rice cultivation technologies of the farmers had no significant relationship with their use of improved rice cultivation technologies.

4.3.9 Constraints faced in rice cultivation and use of improved rice cultivation technologies

The computed value of "r" (-0.271) was greater than the tabulated value (r=0.251) with 103 degrees of freedom at 0.01 level of probability as shown in Table 4.12 with a negative trend. Hence, the concerned null hypothesis was rejected. The findings indicated that problem faced of the farmers had a significant negative relationship with their use of improved rice cultivation technologies.

CHAPTER-V
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

5.1.1 Selected characteristics of the farmers

The major findings of the study are summarized below:

Age: The highest proportion (49.04 percent) of the farmers was middle aged compared to 24.04 percent of them was young aged and 26.92 percent of them old.

Education: The highest proportion (39.42 percent) of the rice farmers was illiterate compared to 7.69 percent of them was primary level of education. About 30.77 percent of them were secondary level of education. The proportion of rice farmers were above secondary level of education was 22.12 percent.

Household size: Above three – fourth (81.73 percent) of the farmers had medium family size compared to 13.46 percent of them having large family size and only 4.80 percent of the farmers had small family size.

Rice cultivation area: Above half (55.77 percent) of the rice farmers possessed small land compared to 38.46 percent of them having marginal land, only 1.92 percent had medium 55.77 and 3.85 percent of the farmers had large rice cultivation area.

Annual income from cultivation: The majority (85.58 percent) of the rice farmers had medium income compared to 1.92 percent of them having low income and 12.50 percent of the farmers had high income.

Rice farming experience: About 58.65 percent of the rice farmers had medium experience on rice cultivation & while the rest 23.08 and 18.27 percent of them had low and medium experience in rice cultivation.

Extension contact: A proportion of 70.19 percent of the rice farmers had medium extension contact compared to 18.27 percent of them having high extension contact and 11.54 percent of the rice farmers had low contact.

Knowledge on improved rice cultivation technologies: About 62.50 percent of the farmers had medium knowledge on improved rice cultivation technologies, 16.35 percent of the farmers had high knowledge on improved rice cultivation technologies and only 21.15 percent of the farmers had low knowledge on improved rice cultivation technologies.

Constraints faced in rice cultivation: About 62.50 percent of the rice farmers had medium problem compared to 19.23 percent of them having high problem and 18.27 percent having low problem.

5.1.2 Famers' use of improved rice cultivation technologies

Scores of the use of improved rice cultivation technologies of the farmers ranged from 10 to 26 with an average of 17.17 and standard deviation 3.76. Most (75%) of the farmers had low to medium use of improved rice cultivation technologies. One-fifth (25%) of the farmers had high used category of technologies.

5.1.3 Relationship between the selected characteristics of the farmers and their use of improved rice cultivation technologies

To explore the relationships between the selected characteristics of farmers' use of improved rice cultivation technologies, "Pearson's Product-Moment Correlation Co-efficient 'r' has been used. As mentioned earlier, the nine

selected characteristics of the farmers were considered for the study. The variables were age, level of education, household size, rice cultivation area, annual income from rice cultivation, rice farming experience, extension contact, knowledge on improved rice cultivation technologies and constraints faced in rice cultivation. Farmers' use of improved rice cultivation technologies were the main focus of the study.

From this correlation test, it was found that level of education, annual income from rice cultivation, rice farming experience, extension contact and knowledge on improved rice cultivation technologies had positive significant relationship with their use of improved rice cultivation technologies but constraints faced in rice cultivation had negative significant relationship with their use of improved rice cultivation technologies. Beside these six characteristics, rest three characteristics of the farmers (age, household size and rice cultivation area) had no significant relationship with their use of improved rice cultivation technologies.

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.

i. The study indicated that most of the farmers (75%) had low to medium use of improved rice cultivation technologies compared to 25% had high use of improved rice cultivation technologies. There is a further scope for increasing the extent of using improved technologies in rice cultivation.
ii. Education of the farmers had significant positive relationship with their use of improved rice cultivation technologies. It was thus proved that farmers' use of improved rice cultivation technologies is dependent with their education. In other words it may be concluded that the education was an important factor towards attitude of the farmers.

iii. Annual family income of the farmers had significant positive relationship with their use of improved rice cultivation technologies. It was thus proved that farmers' use of improved rice cultivation technologies is dependent with their annual family income.

iv. A major portion (76.92 percent) of the farmers had medium to high rice farming experience, while a positive significant relationship between rice farming experience and their use of improved rice cultivation technologies was reported. Therefore, it may be concluded that, farmers having higher rice farming experience increase the use of improved rice cultivation technologies.

v. Extension contact of the farmers had significant positive relationship with their use of improved rice cultivation technologies. It was thus proved that farmers' use of improved rice cultivation technologies is dependent with their extension contact.

vi. A great majority (62.50 percent) of the farmers had medium to high knowledge on improved rice cultivation technologies, while there had a very strong positive significant relationship between knowledge on improved rice cultivation technologies and use of improved rice cultivation technologies was reported. Therefore, it may be concluded that, low knowledge on improved rice cultivation technologies farmers adopted less rice cultivation and with the increase of knowledge on improved rice cultivation technologies of the farmers tends to increase their extent of use of improved rice cultivation technologies.

vii. Problem faced by the farmers had significant and negative relationship with their use of improved rice cultivation technologies. It may be concluded that farmers' use of improved rice cultivation technologies is dependent with their problem faced.

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:

i. It is observed that 73.08 percent of the farmers had medium to high use on various aspects of improved rice cultivation technologies. So, it is strongly recommended that adequate technical support and training facilities should be extended to improve their use of improved rice cultivation technologies.

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

iii. Annual family income of the farmers had significant positive relationships with their use of improved rice cultivation technologies. Therefore, it may be recommended that, government and NGOs should provide credit facilities as well as other parties should increase their income with farmers so that their use of improved rice cultivation technologies could increase.

iv. It is observed that 78.85 percent of the farmers had medium to high knowledge on improved rice cultivation technologies. So the concerned GOs and NGOs should take necessary steps to increase their knowledge on improved rice cultivation technologies.

v. The farmers' literacy rate was high and it related to their knowledge gain. It is therefore, recommended that farmers can take advantage of different printed materials i.e. book, booklets, leaflets, posters, newspapers, etc. so that they can get more knowledge easily and can increase positive attitude. It is, therefore, recommended that arrangement should be made by the concerned authorities to undertake more educational activities for increasing the education

level of the farmers.

vi. As stated before that generally extension contact is positive in relation to knowledge gain. The use of result demonstration and method demonstration could be more effective than mass media. It is thus, strongly recommended that a media campaign should be launched involving all teaching methods in a balanced way to increase their use of improved rice cultivation technologies.

vii. Farmers faced considerable amount of problems on their use of improved rice cultivation technologies. It is therefore, recommended that concerned authorities should give due attention to the solution of the problems as soon as possible.

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 nine characteristics of the farmers with their use of improved rice cultivation technologies have been investigated in this study viz. age, level of education, household size, annual income from rice cultivation, rice cultivation area, rice farming experience, extension contact, knowledge on improved rice cultivation technologies and constraints faced in rice cultivation. But besides these nine characteristics of the farmers, which influence the use of rice 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 rice cultivation technologies.

2. The present study was conducted in 2 unions of Ulipur upazila under Kurigram 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 constraints faced in rice cultivation of the farmers.

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

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APPENDIX-A

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University

Dhaka-1207

Interview schedule for the data collection for the research on

FARMERS' USE OF IMPROVED RICE CULTIVATION TECHNOLOGIES IN ULIPUR UPAZILA UNDER KURIGRAM DISTRICT

Sl. No. …… **Date:** ……..

Name of the respondent: ……

Mobile No: …….

Address:

Village: ……... **Union:** ……..

Upazila: …….. **District:** ……

Please answer the following question. Your provided information will be kept confidential and used only for research purposes.

1. Age:

How old are you? .....(years)

2. Level of Education:

Please mention your educational status.

a. I don't know how to read and write. ( )

b. I can sign only. ( )

c. I have studied up to class…….

3. Household Size (family members):

Please mention the number of your family members.

a. Male: b. Female: Total:

4. Rice Cultivation Area:

Please mention the area of your farm size under rice cultivation.

SL. No.	Types of Land	Area of Land	
		Local Unit	Hectare
1	Land under own cultivation (F_1)		
2	Land given to others on borga (F_2)		
3	Land taken from others on borga (F_3)		
4	Land taken from others on lease (F_4)		

5	Others (F_5)		
Total farm size = F_1+1/2(F_2+F_3)+ F_4+ F_5			

5. Annual Income from Rice Cultivation:

Please mention your annual income from rice cultivation.

SL. No.	Sources of Income	Amount (Tk) /year
01.	Boro Rice	
02.	Aman Rice	
03.	Aus Rice	
Total		

6. Rice Farming Experience:

How many years do you involve with rice cultivation for? ……. Years

7. Extension Contact:

Please mention the extent of your contact with the following sources of information.

Sl. No.	Sources of Information	Extent of contact				
		Regularly	**Often**	**Occasionally**	**Rarely**	**Never**
1	Sub-Assistant Agriculture Officer (SAAO)	2 or more times/ month( )	1-2 times/2 month ()	1-2 times/ 3 month ( )	Once / 6 month ( )	Not even once ( )
2	Upazilla Agriculture Office(UAO/AEO)	6 or more times/ year ( )	4-5 times/ year ( )	2-3 times/ year ( )	Once / year ( )	Not even Once ( )
3	NGO workers	3 times or more /month( )	1-2 times /2 month ( )	1-2 times /3 month ( )	Once / 6 month ( )	Not even once ( )
4	Mass media(Television program/Radio)	4 times or more / month( )	3 times /month ( )	2 times / month( )	Once/ month( )	Not even once ( )
5	Farm Publications (e.g. Krishi katha, poster, leaflet)	10 or more times/year ( )	6-9 times/ year ( )	3-5 times/ year ( )	1-2 times/ year ( )	Not even once ( )
6	Mobile phone/Internet/Call Centre etc.	1-2 times/ week( )	1-3 times/ month( )	1-3 times/ season( )	1-3times/ 6 month ( )	Not even once ( )
7	Other farmers /neighboring farmers/relatives	3 times or more / month( )	1-2times /2 month( )	1-2 times /3 month ( )	Once / 6 month ( )	Not even once( )

8. Knowledge on Improved Rice Cultivation Technologies:

Please answer the following questions:

SL. No.	Questions	Full Marks	Obtained Marks
01.	Have you ever heard the term 'Improved Technologies'? If yes, what does it mean?		
02.	How do you plough your land? Name the equipment used.		
03.	Name five improved varieties of rice?		
04.	Have you ever tested soil before fertilizer application?		
05.	Do you prepare any seed bed maintaining the standards like dimensions, soil height, farm yard manuring, seed soaking etc.?		
06.	What is the seed rate you normally follow during seed bed preparation?		
07.	What types fertilizers do you apply on your rice field?		
08.	Do you transplant seedlings on time?		
09.	What could be resulted if you do not transplant seedlings on time?		
10.	What is balanced fertilization for rice cultivation?		
11.	Do you maintain optimum line spacing during transplanting seedling?		
12.	How deep do you plant rice?		
13.	What types of insecticides & pesticides do you use in your rice field?		
14.	Do you adopt any of the technologies like combine harvester and modern rice milling?		
15.	What is meant by IPM in rice cultivation?		

9. Constraints Faced in Rice Cultivation:

What are the problems you face in using improved rice cultivation technologies?

Sl. No.	Problems	Extent of problems			
		High	Medium	Low	No
1	Purchasing cost is high				
2	Maintenance cost is high				
3	Poor supply chain of improved seed, fertilizer and pesticides				
4	Lack of knowledge on using agro-chemicals				
5	High cost of fuel, labor etc.				
6	Inadequate govt. assistance				
7	Lack of agricultural machineries and tools for improved cultivation				
8	Inadequate irrigation in dry season				
9	Natural calamities				
10	Inadequate help from Block Supervisors				

10. Use of Improved Rice Cultivation Technologies:

Please mention your level of satisfaction of using the following technologies:

Sl. No.	Technologies	Extent of use			
		High	**Moderate**	**Low**	**No**
1	Improved rice varieties				
2	Soil testing before seed sowing or transplanting				
3	Use of balanced fertilizer				
4	IPM				
5	Optimal seed rate				
6	Mechanical harvesting				
7	Improved line spacing				
8	Planting depth (5 cm)				
9	Timely transplanting				

Thank you for nice co-operation

Signature of the Interviewer :…….

Date :…….

APPENDIX -B

Correlation matrix showing the interrelationships among the concerned variables

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	Y
X_1	1									
X_2	-.231*	1								
X_3	.279**	-.057	1							
X_4	.133	-.065	.233*	1						
X_5	.080	.128	.208*	.036	1					
X_6	.925**	-.224*	.231*	.095	.159	1				
X_7	.008	.335**	.057	-.087	.327**	.100	1			
X_8	.185	.450**	.089	-.014	.281**	.206*	.656**	1		
X_9	-.124	-.250*	-.042	.066	-.320**	-.207*	-.271**	-.312**	1	
Y	.184	.336**	.172	.134	.354**	.268**	.532**	.566**	-.271**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

X_1=Age	X_7= Extension contact
X_2=Level of education	X_8=Knowledge on improved rice cultivation technologies
X_3=Household size	X_9=Constraints faced in rice cultivation
X_4=Rice cultivation area	Y=Famers' uses of improved rice cultivation technologies
X_5=Annual income from rice cultivation	
X_6=Rice farming experience	