ADOPTION OF SELECTED HYBRID RICE PRODUCTION TECHNOLOGIES BY THE FARMERS OF JOYPURHAT DISTRICT IN BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled **"ADOPTION OF SELECTED HYBRID RICE PRODUCTION TECHNOLOGIES BY THE FARMERS OF JOYPURHAT DISTRICT IN BANGLADESH"** 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 fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension**, embodies the result of a piece of bona fide research work carried out by **MD. OWALIULLAH KHAN, Registration No. 12-04925** 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.

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THIS THESIS IS LOVINGLY DEDICATED TO

MY PARENTS

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June,2018 **TheResearcher**

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
HYV	High Yielding Varieties
UN	United Nations
TSP	Triple Super Phosphate
RDRS	Rangpur Dinajpur Rural Service
IPM	Integrated Pest Management

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ABSTRACT

The objectives of this study were describe some selected characteristics of the farmers; to determine the extent of adoption of selected hybrid rice production technologies by the farmers and to explore the relationships between the selected characteristics of the farmers with their extent of adoption of selected hybrid rice production technologies. The study was conducted in four villages of Ahmmedabad and Udaipur union under Kalai upazila of Joypurhat district. Data were collected by using interview schedule from the randomly selected 111 respondents during 15 February to 20 March, 2019. Descriptive statistics, Pearson Product Moment correlation were used for analysis. Majority (68.5 percent) of the respondents had medium adoption while 22.5 percent had higher and 9 percent had lower adoption of hybrid rice production technologies. Among ten selected farmers' characteristics, education, farm size, annual family income, organizational participation, cosmopoliteness and knowledge on hybrid rice cultivation had significant relationship with their adoption in hybrid rice production technology. The remaining characteristics of the farmers, age, and income from hybrid rice cultivation, extension contact and attitude towards hybrid rice cultivation had no significant relationship with their adoption of hybrid rice production technology. The findings of the study indicated that farmers' adoption of hybrid rice production has not up to the marks. It is concluded that adoption of hybrid rice production technology can be increased through organizational participation, cosmpoliteness and knowledge. Government should take necessary steps to overcome thissituation.

CHAPTER I
INTRODUCTION

1.1 GeneralBackground

Bangladesh is one of the most densely populated country in the world with 160 (BBS, 2017) million people living in a land area of 147,570 sq. km. Agriculture employs nearly 45.1% (BBS, 2018) of its labor force and contributes one third of its gross national product. However, its agriculture suffers from various problems such as small, unviable and fragmented landholdings, frequent natural disasters, and limited technological progress and low productivity of resources. The principal crop and the staple food is rice, which occupies nearly 75% of its total cropped area in the country.

Rice production in Bangladesh remained nearly stagnant in 1950s at around 11 to 12 million MT rough rice, or paddy. But the population growth rate accelerated from less than one percent per year to nearly three percent during the decade causing a concern for Bangladesh‟s ability to feed its growing population. The 1985s, however experienced a rapid growth of production due to increase in cropping intensity of rice, changes from direct seeding to transplanting method of production, and introduction of modern agricultural inputs such chemical fertilizers and irrigation by power pumps, promoted by the government‟s “grow more food production programme” (Hossain, 1988). Rice production grew from 12.1 m MT in 1990-2000 to 16.9 million MT in 2000-10; an increase of 40% over a decade, almost 50% of which came from expansion of cropped area. The potential of further growth of rice production through increase in cultivated land and rice cropping intensity however was almost fully exploited by the end of1990s.

Although modern high-yielding varieties (HYV) of rice were adopted beginning in 1968, the rate of adoption remained low till 1975-76. The major sources of growth of food grain production in the 1970s were the expansion of area and the yield of wheat. The rapid diffusion of rice HYVs took place after mid-1980s with the liberalization of policies regarding the procurement and distribution of agricultural inputs, and reduction of import duties on agricultural equipment (Hossain and Akash, 1994). Rice area covered by modern varieties has now reached nearly 65% supported by an expansion of minor irrigation by tube wells and pumps that now cover nearly 48% of

the cropped area. Traditional varieties are grown only in the unfavorable ecosystems, the rain fed uplands (Aus), the deep water areas (broadcast Aman) and the saline affected coastal areas. Rice production increased from 21.4 million MT in 1990-00 to nearly 34 million MT by 2001-2015, and the rice yield increased from 2.0 t/ha to 3.2t/ha during this period.

The adoption of HYV rice technology, which enabled Bangladesh to double the yield rate during 1990-00 to 2001-2015, was not however an unmixed blessing (BBS: 2016). The increasing adoption of HYV technology led to displacement of land for non-rice crops like pulses, oilseeds and spices that resulted in the stagnation of their production. The adoption of a few profitable HYVs may have displaced many traditional varieties and contributed to an erosion of biodiversity. Again, increased cropping intensity including intensive rice mono-culture in the irrigated land, and use of improper and unbalanced doses of chemical fertilizers are reportedly depleting soil fertility causing a virtual threat to the long run sustainability of crop-based agricultural production system inBangladesh.

On the other hand, Bangladesh needs to increase rice yield further to meet the growing demand emanating from population growth. The United Nations (UN, 1998) project that even by 2020 the Bangladesh population will grow at 1.2% per year and will reach 173 million, 31% higher than the present number. Nearly 46% of the population will live in urban areas in 2020 compared to 27% now. Farmers will have to generate larger marketable surplus to feed the growing urbanpopulation.

The National Commission of Agriculture projected that to remain self-sufficient Bangladesh will need to produce 47 million MT of paddy (31.6 million MT of rice) by year 2020, implying a required rate of growth of production at 1.7% per year. An earlier Agricultural Research Strategy document prepared by the Bangladesh Agricultural Research Council projected the required paddy production by 2020 at 52 million MT (34.7 million MT of rice), which would require a production growth of 2.2% per year. As mentioned earlier, Bangladesh will have to target the yield growth at a higher rate to release some land from rice production for supporting crop diversification and meeting the growing demand for land for housing, industrialization and infrastructuredevelopment.

Rice breeders have, therefore, been trying to evolve input-efficient and pest-resistant higher yielding varieties to increase the rice yield while sustaining the natural resource base. One innovation has been the development of hybrid rice varieties for the tropics, which is expected to shift the yield potential of the rice plant by 15-20% or more with same amount of agricultural input. The technology has attracted the attention of researchers and policy makers in many Asian countries who see it as an opportunity to overcome the yield ceilings reached by many enterprising farmers in the irrigated ecosystem.

A recent study (Janaiah and Hossain, 2000) indicated that although farmers got about 16% yield advantage in the production of hybrids compared to the popularly grown inbred varieties, the yield gains were not stable. Also there was very little profit margin as six to eight percent of the yield gains were eaten up by additional seed cost and another 10% by lower price due to inferior quality of the hybrid rice grains. So for commercial farmers, there was no economic incentive for adopting hybrid rice. Farmers‟ perception during on-farm testing (1992-93 and 1993-94) also indicated that the poor grain quality of the tested rice hybrids would constrain large-scale adoption of this technology in India (Janaiah *et al*, 1993; Janaiah, 1995; Janaiah,1999).

1.2 Statement of theProblem

The success of any technology depends on its dissemination among the potential users, which ultimately is measured by its level of adoption. It is assumed that notable improvements can take place in Bangladesh agriculture, if the available technologies are accepted and adopted by the farmers. Very little is known about the adoption of selected modern rice production technologies by the farmers in the country. Generalization from studies conducted home and abroad regarding the adoption of other technologies may not be always applicable due to considerable variation in attributes of the technologies and for various other factors. For wider adoption of selected hybrid rice production technologies, it is necessary to have a clear understanding of the present status of adoption of selected hybrid rice production technologies by the farmers. It is also necessary to have an understanding of the facts that contributed to adoption of selected hybrid rice production technologies. An understandingoftherelationshipoffarmers‟adoptionbehaviorwiththeirselected

characteristics as well as the problems faced by the respondents will be helpful to the planners and extension workers.

In view of the foregoing discussion, the researcher undertook a study entitled "Adoption of Selected Rice Production Technologies by the farmers of Joypurhat district in Bangladesh." The main purpose of the study was to have an understanding on the adoption of modern agricultural technologies by the farmers and about some selected factors contributing in the adoption of selected hybrid rice production technologies. For conducting the research in a planned and appropriate way, the researcher put forwarded the following questions:

1. What are the characteristics of hybrid rice farmers?
2. What extent the selected hybrid rice production technologies have been adopted by thefarmers?
3. What are the farmers selected characteristics having relationships with the adoption of selected hybrid rice production technologies by thefarmers?
4. What are the levels of adoption for each of the selected hybrid rice production technologies by thefarmers?

1.3 SpecificObjectives

1. To describe the selected characteristics of thefarmers;
2. To determine the extent of adoption of selected hybrid rice production technologies by thefarmers;
3. To explore the relationships between the selected characteristics of the farmers with their extent of adoption of selected hybrid rice production technologies.

1.4 Justification of theStudy

Limitation of cultivable land and lack of knowledge and skill about selective hybrid rice production are the major problem for the farmers. So, to ensure adequate food supply, it is necessary to give thrust to increase food production using selectedhybrid rice production technologies. Agricultural intensification, to minimize food shortage and maximize self-sufficiency in food production is possible only when adoption of

selected hybrid rice production technologies and their application skills create positive impact on the behavior of ultimate users.

Several research institutes have developed quite a good number of modern agricultural technologies but the farmers have so far adopted a few of them. Technical, biological, environmental and socio-economic barriers are the main hindrances of technology transfer and adoption of selected hybrid rice production technologies. Selected hybrid rice production technologies must be simple, demand driven, locally available, economically feasible and socially acceptable to bring desirable changes in attitude of the farmers for theiradoption.

It is obviously true that farmers are the key elements of adoption of selected modern rice production technologies. At present, there is a lack of adequate understanding as to how the characteristics of the farmers influence their adoption of modern rice production technologies. These facts indicate the need for an investigation to ascertain the relationships of the characteristics of the farmers with their adoption of selected hybrid rice production technologies. Findings of this study, therefore, would be helpful to the planners and extension personnel in planning and execution of programs for enhancing the rice productionyield.

1.5. Assumptions of the study

An assumption is the supposition that an apparent fact or principles is true in light of the available evidence (Goode and Hatt, 1952). An assumption is taken as a fact or belief to be true without proof. In this study, the researcher had the following assumptions in mind while carrying out this study:

1. The farmers included in the sample were competent to furnish proper responses to the items included in the interviewschedule.

2. The researcher who also acted as the interviewer was well adjusted to the socio-cultural environment of the study area. The researcher collected data with utmost care and can be treated as reliable.

3. The responses furnished by the respondents were reliable and they truly expressed their opinion on adoption of selected hybrid rice production technologies and their selectedcharacteristics.

4. The sample size was representative of the whole hybrid rice cultivars families of the studyarea.

5. The findings of the study would be useful for planning and execution of the programmers in connection with diffusion of selected rice production technologies.

6. The measures of the adoption of selected hybrid rice production technologies by the farmers are normally and independently distributed with their respective means and standarddeviation.

7. The adoption of selected hybrid rice production technologies by the farmers was linearly related with their selectedcharacteristics.

1.6. Scope of thestudy

The findings of the study will particularly be applicable to Kalai upazila under Joypurhat district. However, the findings may also be generally applicable to other areas of the district where the social ecosystem is not differing much with those of the study area. Thus, the findings are expected to be useful to the planners for preparation of programmes for rapid adoption of selected hybrid rice production technologies by the farmers. The findings may also be helpful to the extension workers of different national building departments / organizations to improve their technique and strategy of action for effective working method with the people to generate rural employment and to improve rural economy. Finally, there is a great scope for investigation on farmers' adoption of selected hybrid rice production technologies, because little study was conducted on this so far in greater Joypurhat district.

1.7. Limitations of the study

The present study was undertaken with a view to have an understanding on the level of adoption of the selected hybrid rice production technologies by the farmer of Kalai Upazila under Joypurhat district. In order to manage the handle the research program proposal, it became necessary to impose some limitations on certain aspects of the study. Considering time, money and other necessary resources available to the researcher, the following limitations had been observed throughout thestudy:

1. The study was confined to villages of Kalai upazila under Joypurhatdistrict.
2. Only seven (5) hybrid rice production technologies were selected to examine the extent of adoption among the rice growers of hybrid rice farmers of Kalai upazila.
3. Only the hybrid rice farmers who cultivated hybrid rice crop were selected for thisstudy.
4. There are many attributers or characteristics of the growers that always vary but only ten (10) were selected for investigation in this study as stated in the objectives. This was done to complete the study within limited resources and time.
5. The researcher relied on the data furnished by the farmers from their memory duringinterview.
6. Population for the present study was kept confined within the heads of farm families in the study area, because they were the decision makers in their respective rice productiontechnologies.

1.8 Statement ofHypothesis

As defined by Goode and Hatt (1952), "A hypothesis is a proposition which can be put to a test to determine its validity. It was seemed to be 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". A hypothesis simply means a mere assumption or some supposition to be proved or disproved. But for a researcher, hypothesis is a formal question that he intends to resolve. According to Kerlinger (1973), "A hypothesis is a conjectural statement of the relation between two or more variables. Hypothesis is always in declarative sentence form, and they relate either generally or specifically variables to variables". Hypothesis may be broadly divided into two categories, namely, research hypothesis and null hypothesis. In studying relationships between variables, an investigator first formulates research hypothesis which states anticipated relationships between the variables. However, for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no relationship between concernedvariables.

The null hypothesis was developed in this study to explore the relationships between dependent and independent variables. There are ten independent variables and a single depended variable. The null hypotheses were formulated to explore the relationships

between each of the characteristics of farmers and their adoption of selected hybrid rice production technologies. Ten null hypotheses were developed in the following manner:

"There was no relationship between the farmers selected characteristics with their adoption of selected hybrid rice production technologies**"**. The characteristics were: age, education, farm size, annual family income, income from rice production, organizational participation, Cosmo politeness, extension contact, knowledge on hybrid rice production and attitude towards hybrid rice production.

1.9 Definition of Terms

A researcher needs to know the meaning and contents of every term that he uses. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted asfollows:

Age

Age of a respondent defined as the span of his/her life and is operationally measured by the number of years from his/her birth to the time of interviewing.

Education

Education referred to the development of desirable knowledge, skill, attitudes, etc. of an individual through the experiences of reading, writing, observation and related matters.

Farm size

Farm size referred to the total area on which a farmer‟s family carries on farming operations, the area being estimated in terms of full benefit to the farmer‟s family.

Annual family income

Annual income referred to the total annual earnings of all the family members of a respondent from agriculture, livestock and fisheries and other accessible sources (business, service, daily working etc.).

Organizational participation

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

Cosmopoliteness

Cosmopoliteness referred to the degree to which an individual was oriented external to his own social system.

Extension contact

It referred to an individual‟s (farmer) exposure to or contact with different communication media, source and personalities being used for dissemination of new technologies.

Knowledge on hybrid rice production technologies

Literally knowledge means knowing or what one knows about a subject, fact, person etc. Knowledge on hybrid rice production referred to the understanding of the hybrid rice related about the different aspects of scientific agriculture such as improved seed, fertilizer, plant protection, irrigation, etc.

Adoption

Adoption is a process whereby a person assumes the parenting of another, usually a child, from that person's biological or legal parent or parents. A legal adoption permanently transfers all rights and responsibilities, along with filiation, from the biological parent or parents.

CHAPTER II
REVIEW OF LITERATURE

The researcher made and elaborated search of available literature for this research. But no study could be found to be specially undertaken in this direction. Therefore, attempt has been made in the present chapter to review some interlinked literature on this aspect from home and aboard. The interlinked reviews conveniently presented on the major objectives of the study as far as possible. This chapter is divided into three major sections. The first section deals with review of relevant literature regarding adoption of hybrid rice production technologies by the farmers. The second section deals with past research findings relating to the relationship of farmers‟ adoption behavior with their selected characteristics. The conceptual framework of the study is presented in the thirdsection.

2.1 Review of relevant literature

Hussen (2001) conducted investigation on adoption of modem sugarcane production practices by the farmers of Daweangonj Upazila in Jamalpur district. The study revealed that about ninety one percent (91 percent) of the farmers had medium adoption compared to 7 percent having low adoption and only 2 percent having high adoption of modem sugarcane production practices.

Rahman (2001) conducted an investigation on knowledge attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymenshingh district. The study revealed that the majority (75 percent) of the farmers had medium adoption while 18 percent and 7 percent had high and low adoption in Aalok-6201 hybrid rice production respectively.

Zegeye *et al*. (2002) studied the determinants of adoption of improved maize technologies in major maize growing region of Ethiopia. He found that the rate of adoption of improved maize varieties and chemical fertilizer, factors affecting the adoption of improved maize varieties and the determinant factors affecting adoption of chemical fertilizers are alsohighlighted.

Gebre (2002) conducted a study on Maize technology adoption in Ethiopia. This study presents the results of the Sasakawa-Global 2000 Agriculture program in Ethiopia and its influence on agricultural research and maize production in the region. The Sasakawa-Global 2000 is an international non-government organization initiated in 1986 because of the 1984-85 famine in Ethiopia, with the aim of empowering Africa to produce its own food through the adoption of improved agriculturaltechnologies.

Alexznder and Goodhue (2002) conducted the study on pricing of innovations. They evaluate the producer‟s returns to planting patented seed innovation, using acalibrated optimization model of a south-central maize producer‟s adoption decision in Iowa, USA. Their results suggest that patented seed innovations do not increase the market power of biotechnology firm in the relevant market for productionsystem.

Swinkels *et al*. (2002) studied assessing the adoption potential of hedgerow intercropping for improving soil fertility, in western Kenya. They conduct that the average cost of hedgerow intercropping was 10.5% (SD = 5.5) when based on returns to land and 17.5% (SD = 6.5) based on returns to labour. Fifth planted additional hedges and only 14% did so to improve soil fertility. It thus appears that the potential for its adoption as a soil fertility practices. Hedgerow intercropping appears to have greater adopter potential if its aim is to provide feed for an intensive dairy operation or for curbing soilerosion.

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. The study revealed that 69 percent of the farmers had medium adoption while 13 percent had low adoption and 18 percent had high adoption of modem agricultural 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 high adoption.

Rahman (1999) conducted an investigation on adoption of balanced fertilizer by the

farmers of Ishargonj upazila in Mymensingh district. The study revealed that the majority (71 percent) of the respondents had medium adoption compared to 29 percent having below optimumlevel.

Chowdhury (1997) conducted an investigation on adoption of selected BINA technologies by the farmers of Boura union in Mymensingh district. The study revealed that the majority (53 percent) of the respondents had no adoption of BINA technologies and 42 percent were adopted BINA technologies.

Sarker (1997) studied the extent of adoption of improved potato production 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 productionpractices.

Akanda (1995) studied the adoption of recommended dose of fertilizer and found that 36.64 percent respondents used recommended dose of urea 6.93 percent used recommended dose of MP, 11.88 percent used T.S.P and only 2 respondents used gypsum in their potato production.

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

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

Nikhade *et al.* (1993) observed on adoption of improved practices of soybean production that cent percent adopted improved varieties. More than 82 percent had adoption of package practices like line sowing, spacing and intercultural operations.

Partial adoption was observed in majority of the soybean growers (74.6 percent) with regard to recommended seed rate.

Hossain (1991) 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.

Bembridge and Williams (1990) studied the personal, sociological, socio-psychological and communication characteristics that influence the adoption of maize practice in Farmer Support Programme in South Africa. The study revealed less than 50 percent of the farmers who adopted practices were implementing them according to recommendations and many did not have a clear concept that the practices were interrelated.

Kariuka (1990) studied the economic impact of the adoption of hybrid maize in Swaziland. The study revealed the sensitivity of hybrid maize adoption to different farming systems and the limited usefulness of a partial analysis in evaluating the impact of innovations. A macro level cost-benefit analysis was used in an ex-post appraisal if impact of maize research, complemented by an ex-ante projection of the potential benefits and costs of its component maize breeding programme. Moderate increase in production cost would not affect the area of land devoted to maize, farm families are unlikely to produce beyond subsistence requirements without a considerable increase in output prices.

Rai Grover and Gangwar (1989) conducted a study on identifying factors responsible for acreage substitution and low yield of maize. This study showed a general downward trend in area and productivity of maize in Haryana, India. It argued that maize acreage in given year was influenced by size of irrigated area, lag year maize acreage and lag year relative income.

Razzaque (1977) studied on the extent of adoption of HYV rice in three villages of Bangladesh 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 low adoption.

Sobhan (1975) studied on the extent of adoption of ten winter vegetables namely tomato, radish, lettuce and potato in Boilar union of Mymensingh district. Over all winter vegetable adoption scores of the farmers could range from 0 to 140. Over all adoption scores indicated that 27 percent of the farmers did not adopted winter vegetables production while 28 percent had low adoption and 55 percent high adoption.

Mohammad (1974) studied the extent of 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 measure; 28 percent had high level of adoption; 32 percent had medium level of adoption and 25 percent had low level of adoption.

2.2 Review of the Studies Concerning the Relationship between Farmers' Characteristics and theirAdoption

2.2.1 Age andadoption

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He found that age of the farmers was not related to their adoption of modem agricultural technologies. Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a significant negative relationship between age and adoption of integrated homestead farming Technologies. Sardar (2002) conducted a study on adoption of IPM 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 IPM practices. Rahman (2001) observed that there was no significant relationship between age and adoption of Aalok-6201 hybrid rice production practices.Podder(1999)andHossain(1999)arefoundsimilarresultsintheir

respective studies. Hussen (2001) conducted a study, which concluded that age of the sugarcane growers had a significant negative relationship with their adoption of modem sugarcane production practices. Rahman (1999) also found similar result in this study. Chowdhury (1997) observed that the age of the farmers had no significant relationship with their adoption of selected BINA technologies. Sarkar 1997) observed that there was no significant relationship between age of the farmers and their adoption of improved potato production practices. Similar finding were observed by Singh (1989) and Kher (1992) in their respective studies. Hamid (1995) conducted a study on adoption of recommended sugarcane production practices by the farmers. He found that age had a significant negative relationship with the adoption of recommended sugarcane productionpractices.

However, researchers can‟t come to a unified decision on farmers‟ age and adoption of hybrid rice production technology relationship, which requires further research.

2.2.2 Education and adoption

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He found that education of the farmers had a positive significant relationship with their adoption of modem agricultural technologies. Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that education of the farmers had a positive significant relationship with their adoption of IPMpractices.

Aurangozeb (2002) conducted a study on adoption of integrated farming technologies by the rural women in RDRS. He found that there was a positive relationship between education and their adoption on integrated farming technologies. Hussen (2001) conducted a study on farmers' knowledge and adoption of modem sugarcane production practices. He found that education of the growers had a positive significant relationship with their adoption of modem sugarcane production practices. Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regardingAaIok-6201hybridriceinsadarupazilainMymensinghdistrict.Hefound

that academic qualification of the farmers had a significant positive relationship with their adoption regarding Aalok-6201 hybrid rice. Chowdhury (1997) found a positive significant relationship between the education of the farmers and their adoption of selected BINA technologies. Similar results were found by Barkatullah (1985), Ali *et al.* (1986), Hoque (1993), Bashar (1993) Khan (1993), Pal (1995) and Sarkar (1997) in their respective studies. Kaur (1988) found that education influenced the opinion of the women about adoption of vegetable gardening animal husbandry etc. Krishna (1969) conducted a research study on the adoption of hybrid maize in Karimnagar, India. He found significant negative relationship between the education of the respondents and their adoption of hybridmaize.

Under above circumstance we hypothesized that there is positive relation between education and adoption.

2.2.3 Farm size andadoption

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He observed that farm size of the farmers had a positive significant relationship with their adoption of modem agricultural technologies. Technologies by the farmers under PETRRA project of RDRS. He found that farm size of the farmers had a positive significant relationship with their adoption of IPM practices. Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there had no relationship between homestead area and their adoption of integrated homestead farming technologies. 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. Rahman (2001) conducted an investigation on knowledge, attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymenshigh district. He observed that there was a significant positive relationship between farm size of the farmers and their adoption of Aalok-6201 hybrid rice. Hussen (2001) conducted an investigation on adoption of modem sugarcane production practices by the farmers‟ of Dewangonj upazila in Jamalpur district. He observedthattherewasasignificantpositiverelationshipbetweenfarmsizeofthe

farmers and their adoption of modem sugarcane production practices. Chowdhury (1997) conducted a research on adoption of selected BINA technologies by the farmers. He indicated that farm size of the farmers had a strongly positive significant relationship with their adoption of selected BINA technologies. Rahman (1986), Okoro *et al.* (1992), Khan (1993). Hoque (1993) and Sarkar(1997) observed similar results in their respectivestudies.

However, researchers can‟t come to a unified decision on farmers‟ farm size and adoption of hybrid rice production technology relationship, which requires further research.

2.2.4 Annual income and adoption

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that the annual income of the farmers had no relationship with their adoption of IPM practices. Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a positive significant relationship between annual income of the respondents and their adoption of integrated homestead farming Technologies. Rahman (2001) conducted an investigation on knowledge; attitude and adoption of Alok-6201 hybrid rice fry the farmers of sadar upaziia in Mymensingh district. He observed that there was a significant positive relationship between annual income of the farmers and their adoption of Alok-6201 hybrid rice. Hussen (2001) conducted an investigation on adoption of modem sugarcane production 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 production practices. Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He observed that the annual income of the farmers had no relationship with their adoption of modem agricultural technologies. Chowdhury (1997) found a significant and positive relationship between annual income and adoption of selected BINA technologies. Rahman (1986), Okoro *et al.* (1992), Islam (1993), Khan (1993),Sarker

(1997) observed similar result in their respective studies. Tolawar and Hirevenkaragouder (1989) studied on factors of adoption of poultry management practices. They revealed that the farmers having high income tend to own bigger size of poultry unit and possess more knowledge of improved practices leading to higher level of adoption.

However, researchers can‟t come to a unified decision on farmers‟ annual income and adoption of hybrid rice production technology relationship, which requires further research.

2.2.5 Income from rice production andadoption

There was no available review of literature about income from rice production and adoption.

2.2.6 Organizational participation andadoption

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He observed that organizational participation of the farmers had no significant relationship with their adoption of IPM practices. Rahman (2001) conducted a study on knowledge attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that organizational participation of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice. Mostafa (1999) conducted a study on adoption of recommended mango production practices by the mango growers of Nawabganj Sadar thana. He found that organizational participation of mango growers had a significant positive relationship with their adoption of recommended mango production practices. Sarker (1997) conducted a study on correlates of selected characteristics of potato growers with their adoption of improved potato production practices in five village of Comilla district. He observed that organizational participation of the potato growers had no relationship with their adoption of improved potato production practices. Kher (1992) carried out a research study on the adoption of improved wheat production practices by the farmers in selected village Rajouri block, India. He observed that there was no significant relationship between the farmers' social participation and their adoption of improved wheat productionpractices.

However, researchers can‟t come to a unified decision on farmers‟ organizational participation and adoption of hybrid rice production technology relationship, which requires further research.

2.2.7 Cosmopoliteness andadoption

Rahman (2001) conducted an investigation on knowledge, attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymenshigh district. He observed that there was a significant positive relationship between cosmopoliteness of the farmers and their adoption of Aalok-6201 hybrid rice. Hussen (2001) conducted an investigation on adoption of modem sugarcane production practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a significant positive relationship between cosmopoliteness of the farmers and their adoption of modem sugarcane production practices Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that cosmopoliteness of the respondents had a significant positive relationship with their adoption of integrated homestead farming technologies. Hossain (1999) found a positive significant relationship between cosmopoliteness of the farmers and their adoption of fertilizer. Pal (1995), Haque (1993), Khan (1993), Islam (1986) and Halim (1985) observed similar results. Chowdhury (1997) found that there was no significant relationship between the farmers' cosmopoliteness and their adoption of selected BINA technologies. Similar results were observed by Hossain (1991) and Islam (1986) in their respectivestudies.

However, researchers can‟t come to a unified decision on farmers‟ cosmopoliteness and adoption of hybrid rice production technology relationship, which requires further research.

2.2.8 Agricultural extension contact andadoption

Islam (2002) conducted a study on adoption of modem agricultural technologies by the farmers of Sandwip. He found that extension contact of the farmers had no significant relationship with their adoption of modem agricultural technologies. Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a positive significantrelationshipbetweencontactwithextensionmediaoftherespondentsand

their adoption of integrated homestead farming technologies. Slade *et al*. (1988) studied that adoption rates among farmers receiving one or more VEW visits per month were generally higher than those farmers who were not visited by VEW‟S contact farmers were better adopter of some technologies that non-contact farmers Osunloogun *et al*. (1996) studied adoption of improved Agricultural practices by co-operative farmers in Nigeria. The findings of the study indicated a positive relationship between extension contact and adoption improved practices. Bezbora (1980) studied adoption of improved agricultural technology by the farmers of Assam. The study indicated a positive relationship between extension contact and adoption of improved production practices. 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 contact of the farmers and their adoption of Aalok-6201 hybrid rice. Sardar (2002) conducted a study on adoption of IPM 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. Hussen (2001) conducted an investigation on adoption of modem sugarcane production practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a positive significant relationship between extension contact of the farmers and their adoption of modem sugarcane production practices. Sarker (1997) observed a positive and significant relationship between extension contact and adoption of improved potato production practices. Kashem *et al.* (1990).Kher (1992), Pal (1995), Islam (1993), Haque (1984) also found the similar results in their respectivestudies.

Nahar (1996) found that there was a significant positive relationship in agricultural knowledge on farm women in homestead farming and their level of contact with information sources. Heong (1990) observed that the lack of adoption of IPM technologies in rice was frequently attributed to lack of sufficient extension.

However, researchers can‟t come to a unified decision on farmers‟ agricultural extension contact and adoption of hybrid rice production technology relationship, which requires further research.

2.2.9 Knowledge and adoption

Sarkar (1997) found that potato production knowledge of potato growers had a positive and significant relationship with their adoption of improved potato production practices. Ali *et at.* (1986), Muttaleb (1995) and Rahman (1995) observed similar results in their respective studies. Reddy *et al*. (1987) found significant association between knowledge and use of improved package of practices in paddy production by participant and non- participantfarmers.

Under above circumstance we come to hypothesized that there is a positive relation between knowledge and adoption.

2.2.10 Attitude andadoption

There was no available review of literature about attitude towards hybrid rice production and adoption.

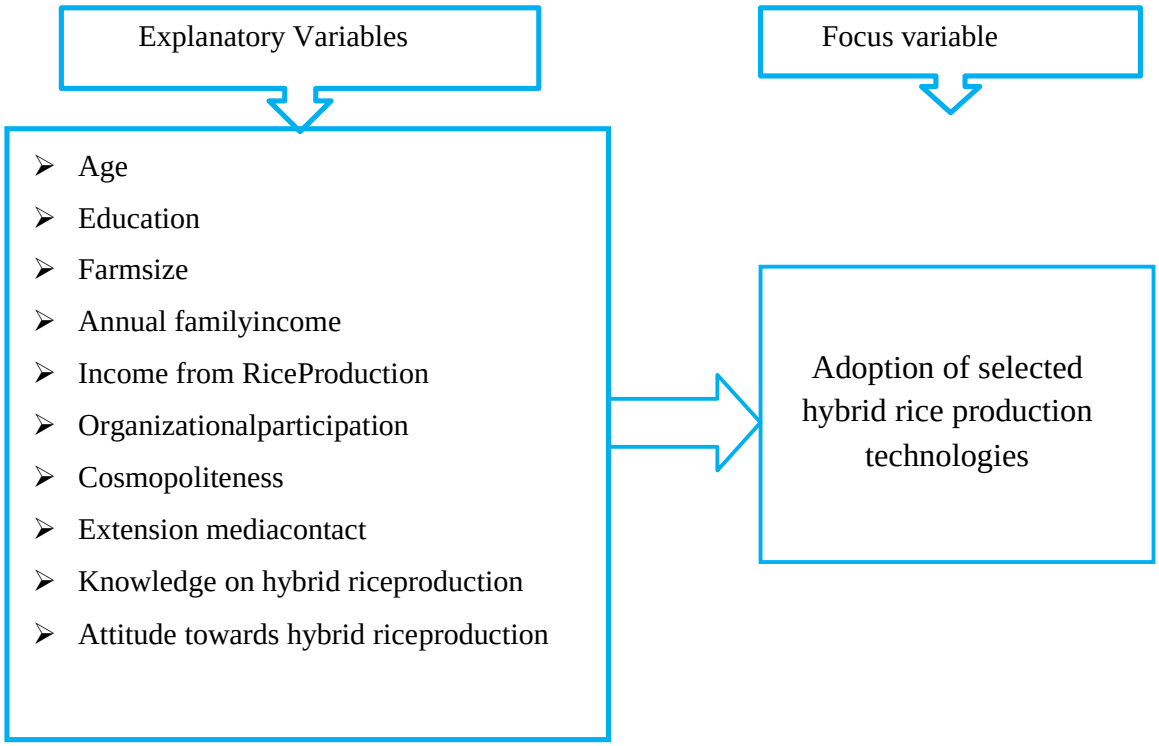
2.2.11 Research gap of thestudy

Very few researches on adoption selected hybrid rice production technologiesby the farmers have so been conducted. Some researchers have found positive significant relationship between the selected charecteristics and adoption of hybrid rice production technologies. Some other found no significant relationship and very few have found negative significant relationship. No research work has so far been carried out to explore the relationship between each of the attitude of the farmers with their adoption of hybrid rice production technologies. So, the researcher carried out the present study to explore the relationship between each of selected charecteristics of farmers with adoption of hybrid rice productiontechnologies.

2.3 The Conceptual Framework of theStudy

This study is concerned with the adoption of selected rice production technologies by the farmers of Joypurhat districts in Bangladesh. Thus the adoption was the main focus of the study and 10 selected characteristics of the farmers‟ were considered as those might have relationship with adoption. It is not possible to deal with all the factors in a single study. Therefore, it was necessary to limit the factors, which included age, education, farm size, annual family income, income fromrice

production, organizational participation, cosmopoliteness, extension contact, knowledge on hybrid rice production and attitude towards hybrid rice production. The conceptual framework of the study has been presented in Fig. 2.1.



2.1: The Conceptual Framework of the Study

CHAPTER III

METHODOLOGY

Methodology enables the researcher to collect valid information. It is impossible to conduct research work smoothly without proper methodology and it is very difficult to address the objectives with a scientific manner. It requires a very careful consideration on the part of the researcher to collect valid and reliable data and to analyze the same for meaningful conclusion. A sequential description of the methodology was followed in conducting this research work has been presented in this chapter.

3.1 Locale of the study

ThestudywasconductedinKalaiUpazilaunderJoypurhatdistrict.Kalaiupazilahas 5 unions and out of 5 unions Ahmedabad and Udaypur unions were selected purposively as the locale of the study. Out of 71 villages, four villages of two unions wereselectedrandomlyaslocaleofthestudy.KalaiUpazila(Joypurhatdistrict)area 166.30 sq km, located in between 24°59' and 25°11' north latitudes and in between 89°08' and 89°17' east longitudes. It is bounded by panchbibi and gobindaganj upazilas on the north, khetlal and shibganj (bogura) upazilas on the south, Shibganj and Gobindaganj upazilas on the east, Khetlal and joypurhat sadar upazilas on the west. A map of Kalai upazila is presented in Figure 3.1 and3.2.

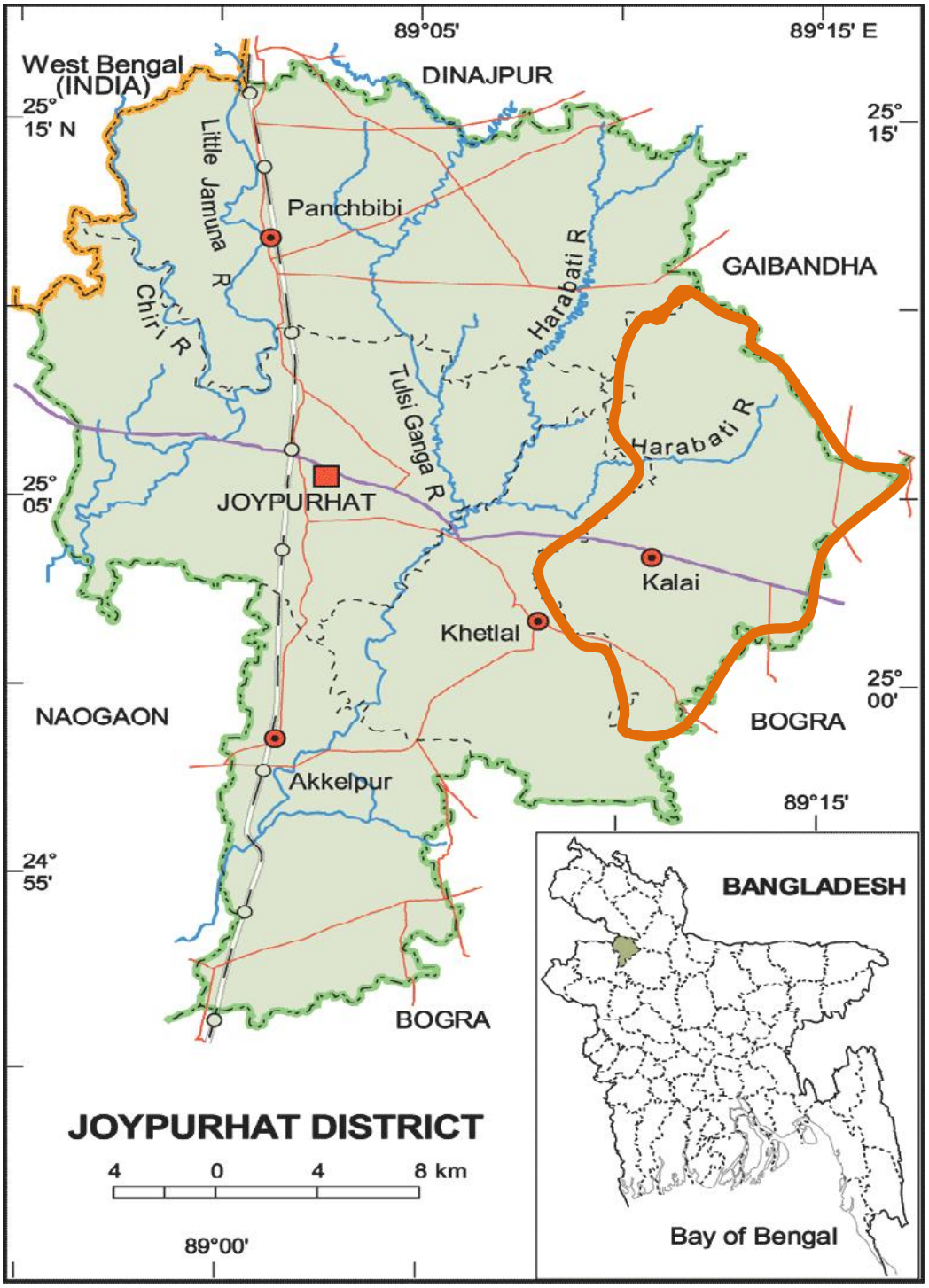


Figure 3.1: A map of Joypurhat district showing Kalai upazila

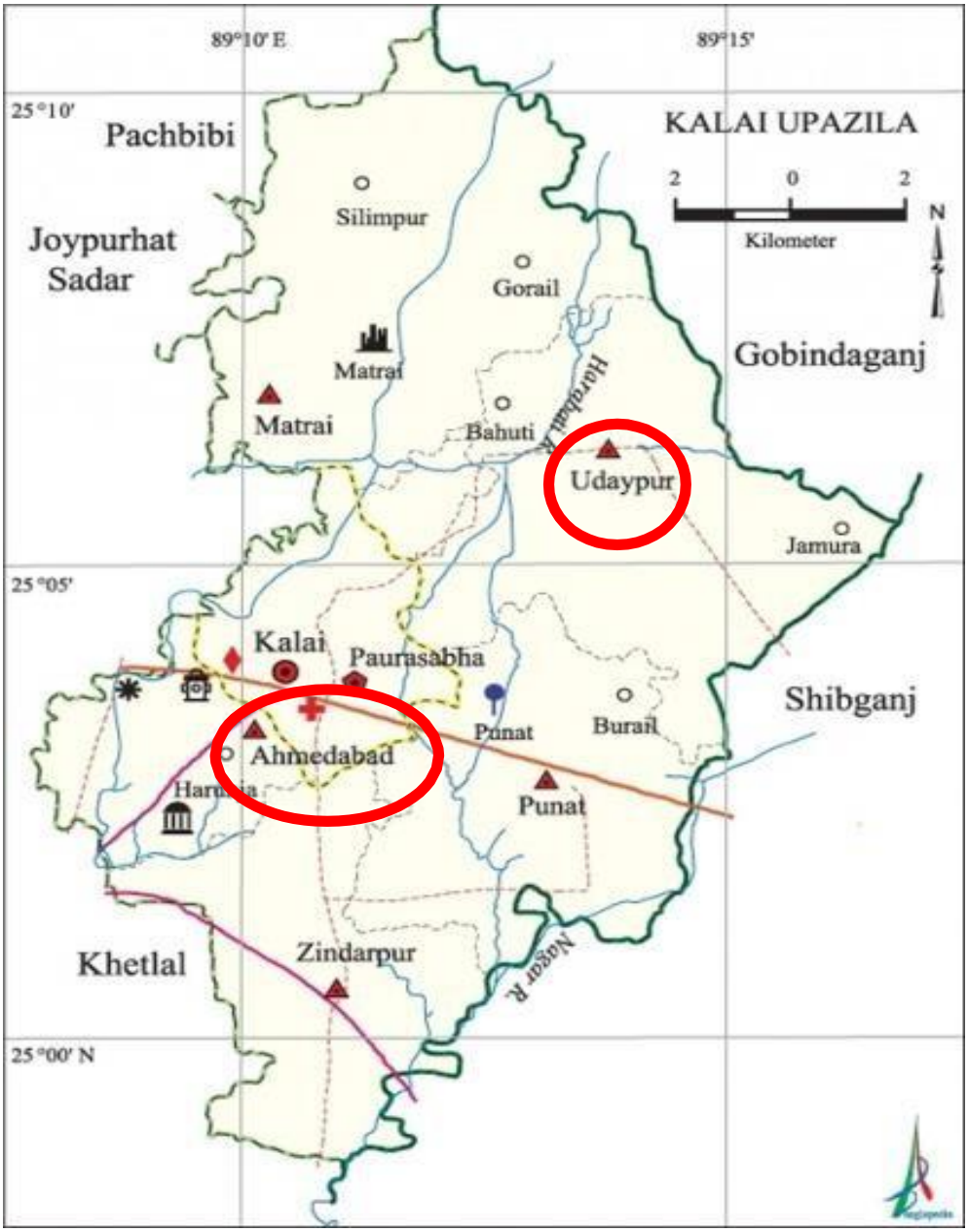


Figure 3.1: A map of Kalai upazila showing the study area

3.2 Distribution of the Population, Sample size and Reservelist

The total hybrid rice production farmers were 222, among of those respondents comprised of 111 (50% of total population) farmers was the sample of the study. The number of farmers considered as reserve list was 11. The distribution of the population sample and number of respondent in the reserve list (10%) are given in Table3.1.

Table 3.1 Distribution of the farmers according to population and sample size and reservelist

Name of unions	Name of villages	Population of hybrid rice farmers	Sample size (50%)	Number of farmers included in the reserve list (10%)
Ahmedabad	Hatior	58	29	3
	Jhamutpur	60	30	3
Udaypur	Aklapara	54	27	3
	Nimerpara	50	25	2
Total		**222**	**111**	**11**

3.3 Measurement ofVariables

The variable is a characteristic, which can assume varying or different values in successive individual cases. A research work usually contains at least two important variables viz. independent and dependent variables. An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). In the scientific research, the selection and measurement of variable constitute a significant task. Following this conception, the researcher reviewed literature to widen this understanding about the natures and scopes of the variables relevant to this research. At last she had selected 10 independent variables and one dependent variable. The independent variables were: age, education, farm size, annual family income, income from hybrid rice production, organizational participation, cosmopoliteness, extension media contact, knowledge on hybrid rice production and attitude towards hybrid rice production. The dependent variable of this study was the “adoption of selected hybrid riceproduction

technologies". The methods and procedures in measuring the variables of this study are presentedbelow:

3.4 Measurement of IndependentVariables

The 10 characteristics of the rice farmers mentioned above constitute the independent variables of this study. The following procedures were followed for measuring the independent variables.

3.4.1 Age

Age of respondent farmers was measured by the period of time from their birth to the time of conducting interview and it was measured in terms of complete years on the basis of their response. A score of one (1) was assigned for each year age. This variable appears in item number one (1) in the interview schedule as presented in Appendix- A.

3.4.2 Education

Education was measured by assigning score against each successful year of schooling by a respondent. One score was given for passing each level in an educational institution. For example, if a respondent passed the final examination of class five or equivalent examination, his/her education score has given five (5). Each respondent of can‟t read & write has given a score of zero (0). A person not knowing reading or writing but being able to sign only has given a score of 0.5. If a farmer did not go to school but took non-formal education, his educational status was determined as the equivalent to a formal school student. This variable appears in item number two (2) in the interview schedule as presented in Appendix- A.

3.4.3 Farmsize

Farm size of a respondent referred to the total area of land on which his family carried out the farming operation, the area being in terms of full benefit to the family. The term refers to the cultivated area either owned by the respondent or cultivated on share-cropping, lease or taking from other including homestead area. It was measured in hectares for each respondent using the following formula:

FS = F1+F2+1/2(F3+F4) +F5

Where, FS = Farm size,

F1 = Homestead land (including pond and orchard),

F2 = Land under own production,

F3 = Land given to others as borga,

F4 = Land taken from others as borga,

F5= Land taken from others on lease,

The data was first recorded in terms of local measurement unit i.e. decimal and then converted into hectare. The total area, thus, obtained is considered as his farm size score (assigning a score of one for each hectare of land). This variable appears in item number three (3) in the interview schedule as presented in Appendix -A.

3.4.4 Annual familyincome

Annual family income of a respondent referred to the total earning by her/him and other members of her/his family from agriculture, livestock, poultry, fisheries, and other sources (service, business, daily wages by working, etc.) during a year. It was expressed in Taka. In measuring this variable, total earning of an individual respondent was converted into score. A score of one (01) was given for every one(01) thousand („000ˇ)taka.

3.4.5 Income from hybrid riceproduction

Income from hybrid rice production of the respondents was measured in thousands taka on the basis of total annual income from hybrid rice production. It was expressed in Taka. In measuring this variable, total earning of an individual respondent was converted into score. A score of one (01) was given for every one (01) thousand („000ˇ) taka. This variable appears in item number 5 in the interview schedule as presented in Appendix-A.

3.4.6 Organizationalparticipation

Social organizational participation of respondent was measured on the basis of the nature of their participation in 8 selected organizations. Final score was computed by

adding all the scores of selected organizations.

Following scores were assigned for nature of participation:

Natureof participation	**Scores assigned**
Noparticipation	0
Participation asordinarymember	1
Participation asexecutivemember	2
Participation as executivecommitteeofficer	3

The social organizational participation score could range from 0 to 24 where „0‟ indicated no participation and „24‟ indicated very high social organizational participation. This variable appears in item number six (6) in the interview schedule as presented in Appendix-A.

3.4.7 Cosmopoliteness

Cosmopoliteness of a respondent was measured in terms of his nature of visits to the six (6) different places external to his own social system. The cosmopoliteness of a respondent was measured by computing cosmopoliteness score on the basis of his/her visits with six selected cosmopoliteness. Respondents mentioned the nature on his/her visits by putting a tick mark against any one of 5 responses, not at all, rarely, occasionally, frequently, and regularly. The score for each respondent was determined by his/her response to all the items on the basis of his/her frequency of visits with a score of 0, 1, 2, 3 and 4 respectively. The cosmopoliteness score of the respondents could range from 0 to 24, where, 0 indicates low cosmopoliteness and 24 indicates high cosmopoliteness towards negative effects of climate change on agriculture. This variable appears in item number 7 in the interview schedule as presented in Appendix-A.

3.4.8 Agricultural extensioncontact

Agricultural extension contact of a respondent was measured by respondent‟s extent of contact with communication channels used by extension services. The degrees of contact was „regularly‟, „frequently‟, „occasionally‟, „rarely‟, „not at all‟ against suitable scores are assigned as 4, 3, 2, 1 and 0 respectively.

Degree of contact	Score
Regularly	4
Frequently	3
Occasionally	2
Rarely	1
Not at all	0

If the number of communication channels are ten (10), then an individual respondent can obtain highest score 40 and minimum score 0 (zero).

3.4.9 Knowledge on hybrid rice production technologies

Knowledge on hybrid rice production of the farmers referred to the knowledge gained by the respondent in hybrid rice production activities. A scale consisting of 12 questions was used to determine the hybrid rice production knowledge score of the respondents. The questions were selected from different dimensions of hybrid rice cultivars 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, hybrid riceproduction knowledge score of the respondents could range from 0 to 24, where 0 indicated very low knowledge on hybrid rice production and 24 indicated very high knowledge on hybrid rice production. This variable appears in item number six (10) in the interview schedule as presented inAppendix-A.

3.4.10 Attitude towards hybrid rice productiontechnologies

Attitude towards hybrid rice production was measured by developing an attitude scale through Puttaswamy (1977) given scale that developed a scale to measure the attitude of village extension workers towards training and visit system in Indian context. Here five-point Likert method of summated ratings was used to find out the attitude towards Hybrid riceproduction.

Ten statements expressing attitude towards hybrid rice production were constructed. Out of these ten statements 6 were positive and 4 were negative. Scoring was done by assigning 5, 4, 3, 2 and 1 scores to the five alternative responses as "strongly agreed","agreed","undecided","disagreed",and"stronglydisagreed",respectively

and in case of negative statements scoring was reversed respectively. However, attitude towards hybrid rice production of a farmer was obtained by summing up his/her scores for all the ten statements in item no. 10 in the interview schedule. Attitude score, thus, obtained for a respondent could range from 1 to50, where 1 indicated lowest level of attitude and 50, indicated highest level of attitude.

3.5 Measurement of dependentvariable

Adoption of selected hybrid rice production technologies was the dependent variable of this study. It was measured on the basis of the extent of adoption of 5 selected hybrid rice production technologies by the farmers for three year. Adoption of multiple technologies is measured by the proportion ofsummation

of mean area coverage (l) out of mean potential area (L) by the number of practices for particular time period; it is expresses in percentage resulting mean (X) area coverage. The formula calculating the adoption stands as G. L. Ray(1998);

Suppose a farmer is using 5 hybrid rice production technologies with its cluster of technologies for the subsequent years 2016, 2017 and 2018.

a) Use of modern high yieldingvariety
b) Gutiurea
c) Organicfertilizer
d) Linetransplanting
e) Integrated pest management(IPM)

Calculation of the adoption of above mentioned technologies. In this case adoption can be measured in the followingways:

Area of production	Year of the adoption			∑ l/L	X adoption
	2016	2017	2018		
Allocated area for production (l)	2	2	3	1.75	.58
Potential area (L)	4	4	4		
Proportion of area coverage (l/L)	0.5	0.5	0.75		

Total adoption score of a respondent was found by adding one‟s adoption scores on seven aspects of adoption and then dividing by number of aspects. The adoption was expressed in percentage. Hence the adoption of a hybrid rice grower could range from 0 to 100, where „0‟ indicate no adoption and „100‟ indicate highest adoption.

3.6 Instrument for collection of data

In order to collect reliable and valid information from the respondents, an interview schedule was prepared for collection of data from respondents keeping the objectives of the study in mind. The question and statements contained in the schedule were simple, direct and easily understandable by the farmers. Simple and direct question, different scales, closed and open form statements and questions were included in the interview schedule to obtain necessary information. The draft interview schedule was prepared in accordance with the objective of the study. The interview schedule was pre-tested with 10 respondents of the farmers in the study area during 05 January to 06 February,2019.

The draft interview schedule was pretested in actual field situation before finalizing it for collection of data. The pre-test was helpful to identify inappropriate questions and statements in the draft schedule. Necessary addition, alternation and adjustments were made in the schedule on the basis of the experience of the pretest. The interview schedule was then printed in its final form. An English version of the interview schedule has been shown in Appendix-A.

3.7 Datacollection

Data were collected personally by the researcher himself through personnel interview schedule from the sampled farm families of the selected villages. Before starting the collection of data; the researcher met the respective Upazila Agriculture Officer (UAO), Additional Agriculture Extension Officer (AAEO) and the concerned Sub-Assistant Agriculture Office (SAAO). The researcher also discussed the objectives of the study with the respondents and above mentioned officers and requested them to provide actual information. A rapport was established with the rural people so that they feel easy to answer the questions. The researcher took all possible care to establish rapport with the respondents so that they would not feel any indecision while starting the interview. Very good cooperation was obtained from the field extension workers and the local leaders. No serious difficulty was faced by the researcher during the collection of data. The interviews were made individually in the places of respondents. Questions were asked in direct manner so that the respondents could easily understand the questions. Whenever a respondent faced difficulty in understanding any questions, care was taken to explain the same clearly with a view to enabling him to answer itproperly.

Before going to the respondents‟ home for interviewing they were informed verbally to ensure their availability at home as per schedule date and time. In the case of failure to collect information from the respondents due to their other business, a revisit was made with prior to appointments. Data were collected during 15 February, 2019 to 20 March, 2019.

3.8 Compilation of data

After completion of field survey, data recorded in the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were given numerically coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. All the collected data were checked and cross-checked before transplanting to the master sheets. To facilitate tabulation, the collected data were properly coded and transferred

from interview schedule to a master sheet. Tabulation and cross tabulation was done on the basis of categorization developed by the researcher.

3.9 Categorization ofdata

For describing the various independent and dependent variables the respondents were classified into various categories. In developing categories, the researcher was guided by the nature of data and general consideration prevailing on the social system. The procedures have been discussed while describing the variable in the sub-sequent sections of next chapter.

3.10 Statisticalanalysis

Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. Statistical measures as a number, range, mean, standard deviation were used in describing the variables whenever applicable. Pearson Product Moment correlation of coefficient test was used to determine the relationship and among the categories of farmers with regard to their adoption to hybrid rice production technologies based on selected characteristics. Throughout, in this study 0.01 and 0.05level of probability were used as the basis of rejection or accepting a null hypothesis.

CHAPTER IV
RESULTS AND DISCUSSION

In this chapter the findings of this study have been discussed in relation to the present findings and also to those found in other studies. The study investigated the adoption of selected hybrid rice production technology by the farmers of joypurhat district in Bangladesh. In accordance with the objectives of the study, presentation of the findings has been made in three sections. The first sections deals about selected characteristics of the farmers. The second section deals about adoption of hybrid rice production and the third section deals with relationship between selected characteristics of the farmers and their adoption of hybrid rice production.

4.1 Selected characteristics of the farmers

Ten characteristics of the farmers were selected for this research. The characteristics include: age, education, farm size, annual family income, income from hybrid rice production, organizational participation, cosmopoliteness, extension media contact, knowledge on hybrid rice production and attitude towards hybrid rice production. 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

Selected Characteristics	Measuring Unit	Range		Mean	SD
		possible	observed		
Age	Year	-	25-72	48.82	11.93
Education	Year of schooling	-	00-16	5.0631	4.99
Farm size	Hectare	-	.20-4.34	1.04	.98
Annual family income	(„000‟ tk)	-	34-456	114.31	101.73
Income from rice production	(„000‟ tk)	-	21-267	50.98	46.34
Organizational participation	Score	0-24	9-23	14.10	3.44
Cosmopoliteness	Score	0-24	9-19	13.23	2.38
Extension media contact	Score	0-40	11-35	21.97	5.11
Knowledge on Hybrid Rice Production	Score	0-24	10-20	14.50	1.90
Attitude towards Hybrid rice production	Score	1-50	21-45	32.94	6.44

4.1.1 Age

Age of the farmers ranged from 25 to 72 years, the average being 48.82 years and the standard deviation, 11.93. All the variables were categorized on the basis of their possible scores except age was categorized based on the classification provided by the Ministry of Youth and Sports, Government of the People‟s Republic of Bangladesh.The distribution of the Hybrid rice farmers according to their age is shown in Table4.2.

Table 4.2 Distribution of the farmers according to theirage

Categories (Year)	Farmers		Mean	SD
	Number	Percent		
Young aged (up to 35)	17	15.3	48.82	11.93
Middle-aged (36-50)	45	40.6		
Old (>50)	49	44.1		
Total	**111**	**100**		

Table 4.2 showed that the highest proportion 44.1 percent of the hybrid rice farmers fell in the "old aged" category, while 15.3 percent of them fell in the "young aged" category and 40.6 percent in the "middle aged" category. The findings indicate that a large proportion (84.7) of the farmers were middle to oldaged.

4.1.2 Education

The education scores of the farmers ranged from 0 to 16. The average was 5.06 and the standard deviation was 4.99. On the basis of their educational scores, the hybrid rice growers were classified into four categories, namely "illiterate (0-0.5), primary (1-5), secondary (6-10) and above secondary (above 10).This distribution was supported by Hoque (2016) and Masud, (2007) and shown in the Table4.3.

Table 4.3 Distribution of the farmers according to their education

Categories (Year of schooling)	Farmers		Mean	SD
	Number	Percent		
Illiterate (0-0.5)	41	36.9	5.06	4.99
Primary level (1-5)	28	25.3		
Secondary level (6-10)	26	23.4		
Above secondary level (>10)	16	14.4		
Total	**111**	**100**		

Similar result was observed by Nasreen *et al.* (2013) where highest numbers of respondents were completed up to primary education level. Table 4.3 indicated that themajority(36.9percent)ofthehybridricefarmershadilliterateeducation

compared to 23.3 percent of them having secondary. About 25.3 percent of the farmers were primary level education, while 14.4 percent had above secondary level of education. About 70% of the respondents were literate which is consistent with nationalaverage.

4.1.3 Farmsize

The farm size of the respondents varied from 0.20 to 4.34 hectares. The average farm size was 1.04 hectare with a standard deviation of 0.98. The respondents were classified into three categories based on their farm size as followed by DAE,(DAE, 1995): "marginal farm" (up to 0.2 ha), "small farm" (0.21 – 1.0 ha), "medium farm" (1.0 -3.0) and large (above 3.0 ha). The distribution of the farmers according to their farm size is shown in Table 4.6.

Table 4.4 Distribution of the farmers according to their farm size

Categories (Hectare)	Farmers		Mean	SD
	Number	Percent		
Marginal farm (up to 0.2 ha)	1	.9	1.04	.98
Small farm (0.21-1.0 ha)	76	68.5		
Medium farm (1.01-3.0 ha)	23	20.7		
Large farm (>3.0 ha)	11	9.9		
Total	**111**	**100**		

Table 4.4 indicated that more than half (68.5 percent) of the farmers possessed small farms compared to above 20.7 percent of them having medium farms and 0.9 percent marginal farms and 9.9 % of the farmers having large farm. Thus, the overwhelming majority 89.2 percent of the farmers were the owners of small to medium farms. Majority of the farmers were under small farmer‟s category which is consistent with national scenario.

4.1.4 Annual familyincome

Annual income score of the respondents ranged from 34 to 456 (in thousands) with an average of 114.31 and standard deviation 101.73. On the basis of the observed scores, the respondents were classified into three categories (Mean ±0.5SD) as shown in Table4.5.

Table 4.5 Distribution of the farmers according to their annual income

Categories	Farmers		Mean	SD
	Number	Percent		
Low income (up to 64)	38	34.2	114.31	101.73
Medium income (65-164)	52	46.8		
High income (above 164)	21	18.9		
Total	**111**	**100**		

Data presented in Table 4.5 indicate that the highest proportion (46.8 percent) of the respondent to medium annual income, while (34.2 percent) had low annual income and (18.9 percent) had high annual income. As a result, the most (81 percent) of the respondents in the study area were low to medium annual incomeearners.

4.1.5 Income from riceproduction

Income from rice production score of the respondents ranged from 21 to 267 (in thousands) with an average of 50.98 and standard deviation 46.34. On the basis of the observed scores, the respondents were classified into three categories (Mean ± 0.5SD) as shown in Table4.6.

Table 4.6 Distribution of the farmers according to their income from rice production

Categories	Farmers		Mean	SD
	Number	Percent		
Low income (up to 27)	32	28.8	50.98	46.34
Medium income (28-73)	62	55.9		
High income (above 73)	17	15.3		
Total	**111**	**100**		

Data presented in Table 4.6 indicate that the highest proportion (55.9 percent) of the respondent to medium income from rice production, while (28.8 percent) had low income and (15.3 percent) had high income. As a result, the most (84.7 percent) of the respondents in the study area were low to medium income from rice production.

4.1.6 Organizationalparticipation

The observed organizational participation score of the respondents ranged from 9 to 23. The mean score was 14.10 with the standard deviation 3.44. On the basis of organizational participation scores, the respondents were classified into three categories(Mean ±SD) namely, low organizational participation, medium organizational participation and high organizational participation, as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their organizational participation

Categories (Score)	Farmers		Mean	SD
	Number	Percent		
Low (up to 11)	23	20.6	14.10	3.44
Medium (12-17)	75	67.7		
High (above 17)	13	11.7		
Total	111	100		

Data contained in the Table 4.7 revealed that the majority (67.7%) of the farmers had medium organizational participation as compared to (20.6%) and (11.7%) having low and high organizational participation respectively.

4.1.7 Cosmopoliteness

The score of cosmopoliteness of the farmers ranged from 9-19 with a mean and standard deviation of 13.23 and 2.38. On the basis of cosmopoliteness, the respondentswereclassifiedintothreecategories(Mean±SD)namely,„low‟, „medium‟ and „high‟. The scale used for computing the Cosmopoliteness score is presented in the Table 4.8

Table 4.8 Distribution of the farmers according to their cosmopoliteness

Categories (Score)	Farmers		Mean	SD
	Number	Percent		
Low (up to 11)	29	26.1	13.23	2.38
Medium (12-15)	63	56.8		
High (>15)	19	17.1		
Total	**111**	**100**		

Similar result was observed Afroz (2013) where highest respondents were medium cosmopoliteness. Data contained in the Table 4.8 shows that the highest proportion (56.8%) of the respondents had medium cosmopoliteness while (26.1%) and (17.1%) of them had low and high cosmopoliteness categories. The majority of the farmers (82.9%) have low to medium cosmopoliteness. Cosmopoliteness of the farmers increases their knowledge about climate change on agriculture.

4.1.8 Agricultural extensioncontact

Agricultural extension contact scores of the farmers ranged from 11 to 35 with an average of 21.97 and standard deviation of 5.11. On the basis of their media contact, the respondents were classified into three categories (Mean ±SD)namely, low contact, medium contact and high contact. The scale used for computing the media contact score of a respondent is given Table 4.9.

Table 4.9 Distribution of the farmers according to their extension media contact

Categories (Score)	Farmers		Mean	SD
	Number	Percent		
Low (up to 16)	18	16.2	21.97	5.11
Medium (17-26)	77	69.4		
High (above 26)	16	14.4		
Total	**111**	**100**		

Data contained in the Table 4.9 indicated that the highest proportion (69.4%) of the respondents had medium extension media contact as compared to (16.2%) and (14.4%) having low and high extension media contact respectively. The majority (85.6%) of the respondents had low to medium extension contact in hybrid rice production.

4.1.9 Knowledge on hybrid rice productiontechnologies

Knowledge on hybrid rice production ranged from 10 to 20. The average was 14.50 with a standard deviation of 1.90. On the basis of their knowledge, the farmers were classified into the following three categories (Mean ±SD): "low knowledge" (up to13),"mediumknowledge"(14-15)and"highknowledge"(above15).Table4.10

contains the distribution of the hybrid rice farmers according to their knowledge.

Table 4.10 Distribution of farmers according to their knowledge on hybrid rice production technologies

Categories (Score)	**Farmers**		Mean	SD
	Number	Percent		
Low knowledge (up to 13)	29	26.1	14.50	1.90
Medium knowledge (14-15)	48	43.3		
High knowledge (>15)	34	30.6		
Total	**111**	**100**		

Table 4.10 showed that the majority of the 43.3 percent of the hybrid rice farmers had "medium knowledge" compared to more different than 30.6 percent of them having "high knowledge". The proportion of "low knowledge" was 26.1 percent. Thus 73.9 percent of the farmers had medium to high knowledge.

4.1.10 Attitude towards hybrid rice productiontechnologies

Attitude towards hybrid rice production score of the respondents ranged from 10 to 50. The mean score was 32.94 with the standard deviation 6.44. On the basis of attitude, the respondents were classified into three categories (Mean ±SD) namely, low, medium and high attitude, as shown in Table 4.11.

Table 4.11 Distribution of the farmers according to their attitude towards hybrid rice production technologies

Categories (Score)	**Farmers**		**Mean**	**SD**
	Number	**Percent**		
Low favourable attitude (up to 26)	21	18.9	32.94	6.44
Medium favourable attitude (27-38)	64	57.7		
High favourable attitude (above 38)	26	23.4		
Total	**111**	**100**		

Data contained in the Table 4.11 revealed that the majority (57.7%) of the farmers had medium attitude as compared to (18.9%) and (23.4%) having low and high attitude respectively. The majority (82.1%) of the respondents had medium to high attitude towards hybrid rice production.

4.2 Adoption of hybrid rice productiontechnologies

Adoption of hybrid rice production score of the respondents was found to be varying from 34 to 69.79 with an average of 53.86 and standard deviation of 9.15. Based on their score, the farmers were classified into three categories (Mean ±SD) as shown in Table4.12.

Table 4.12 Distribution of the farmers according to their adoption of hybrid rice production technologies

Categories (Score)	Farmers		Mean	SD
	Number	Percent		
Low adoption (up to 44)	10	9	53.86	9.15
Medium adoption (45-62)	76	68.5		
High adoption (above 62)	25	22.5		
Total	**111**	**100**		

The Table 4.12 indicate that the majority (68.5%) of the farmers had medium adoption on rice production that comprised by 22.5 percent and 9 percent farmers have high adoption and low adoption on hybrid rice production. The majority (91%) of the respondents had medium to high adoption on hybrid riceproduction.

4.3 Relationship between selected characteristics of the respondents and their adoption of hybrid rice productiontechnologies

To explore the relationships between the selected characteristics of farmers with their adoption in hybrid rice production technologies, Pearson Product Moment correlation was run to find out the relation between the selected characteristics of the respondents and their adoption in hybrid rice production technologies. From this correlation test, it was found that education, farm size, annual family income, organizational participation, cosmopoliteness and knowledge on hybrid rice productionhad

significant relationship with their adoption in hybrid rice production. Beside these six characteristics, rest four characteristics of the farmers (age, income from hybrid rice production, extension contact and attitude towards hybrid rice production) had no significant relationship with their adoption. Inter correlation among all the variables may be seen in Appendix-B.

The summary of the results of the Co-efficient of Correlation indicating the relationship between each of the selected characteristics of the farmers and their adoption of hybrid rice production are shown in Table 4.13.

Table 4.13 Co-efficient of correlation showing relationship between selected characteristics of the rice cultivars and adoption of hybrid rice production technologies

Focus variable	Explanatory variables	Computed value "r"	Tabulated value of "r"	
			at 0.05 level	at 0.01 level
Adoption of hybrid rice production technologies	Age	0.170^{NS}	0.185	0.241
	Education	0.544**		
	Farm size	0.239*		
	Annual family income	0.485**		
	Income from rice production	0.185^{NS}		
	Organizational participation	0.473**		
	Cosmopoliteness	0.318**		
	Extension contact	0.145^{NS}		
	Knowledge on hybrid rice production	0.609**		
	Attitude towards hybrid rice production	0.035^{NS}		

^{NS}Not significant

*Significant at 0.05 level of probability

**Significant at 0.01 level ofprobability

4.3.1 Relationship between adoption of hybrid rice production technologiesand theireducation

Relationship between education and adoption of hybrid rice production was determined by Pearson"s product moment correlation-coefficient.

The coefficient of correlation between education and adoption of hybrid rice production technologies was presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.544. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- ✓ The relationship showed a positive trend between the concernedvariables.
- ✓ The observed value of "r" (0.544) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 109 degrees of freedom at 0.01 level ofprobability.
- ✓ The null hypothesis was rejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.01 level ofprobability.

Based on the above findings, it was concluded that education of the famers had significant positive relationship with the adoption of hybrid rice production technologies. It means that higher is the education, higher is the adoption. They could understand the benefits of hybrid rice production in respects of its food value; protein, vitamin and minerals. So, reasonably education had significant relationship with adoption of hybrid rice production technologies.

4.3.2 Relationship between adoption of hybrid rice production technologies and their farmsize

The computed value of „r" (.239) was greater than the tabulated value (r=0.185) with 109 degrees of freedom at 0.05 level of probability as shown in Table 4.13 with a positive trend. Hence, the concerned null hypothesis was rejected. The findings indicated that farm size of the farmers had a significant positive relationship with their adoption of hybrid rice production technologies.

- ✓ The relationship showed a positive trend between the concernedvariables.
- ✓ The observed value of "r" (0.239) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 109 degrees of freedom at 0.05 level ofprobability.
- ✓ The null hypothesis could not berejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.05 level ofprobability.

Based on the findings, it could be concluded that farmers" having big farm size need to work hard to manage their farm efficiently. As a result they might perceive higher adoption of hybrid rice production technologies in managing theirfarm.

4.3.3 Relationship between adoption of hybrid rice production technologies and their annual familyincome

Relationship between annual family income and adoption of f hybrid rice production technologies was determined by Pearson‟s product moment correlation coefficient.

The coefficient of correlation between annual family income and adoption of adoption of hybrid rice production technologies was presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.485. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study underconsideration.

- The relationship showed a positive trend between the concernedvariables.
- The observed value of "r" (0.485) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 109 degrees of freedom at 0.01 level ofprobability.
- The null hypothesis could not berejected.
- The relationship between the concerned variables was statistically significant at 0.01 level of probability.

Based on the above findings, it was concluded that annual family income of the famers had significant relationships with the adoption of adoption of hybrid rice productiontechnologies.

4.3.4 Relationships between adoption of hybrid rice production technologies and their organizationalparticipation

Relationship between adoption of hybrid rice production technologies and their organizational participation was determined by Pearson‟s product moment correlation coefficient.

The coefficient of correlation between adoption of hybrid rice production technologies and their organizational participation was presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.473. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study underconsideration.

- ✓ The relationship showed a positive trend between the concernedvariables.
- ✓ The observed value of "r" (0.473) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 109 degrees of freedom at 0.01 level ofprobability.
- ✓ The null hypothesis wasrejected.
- ✓ The relationship between the concerned variables was statistically highly significant at 0.01 level ofprobability.

Based on the above findings, it was concluded that organizational participation had highly significant positive relationships with the adoption of hybrid rice production technologies. So, it could be said that higher is the organizational participation, higher is the adoption of hybrid rice production. Organizational participation helps the farmers to take the right decision. It guides the farmers to take action for that which is best for them.

4.3.5 Relationship between adoption of hybrid rice production technologiesand theircosmopoliteness

Relationship between cosmopoliteness and adoption of hybrid rice production technologies was determined by Pearson"s product moment correlation coefficient.

The coefficient of correlation between cosmopoliteness and adoption of hybrid rice production technologies was presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.318. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- ✓ The relationship showed a positive trend between the concernedvariables.
- ✓ The observed value of "r" (0.318) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 109 degrees of freedom at 0.01 level ofprobability.
- ✓ The null hypothesis wasrejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.01 level ofprobability.

Based on the above findings, it was concluded that cosmopoliteness of the famers had

significant positive relationships with the adoption of hybrid rice production technologies. Therefore, it could be said that higher is the cosmopoliteness, higher is the adoption of hybrid rice production technologies. Cosmopoliteness makes the farmers dynamic, innovative and conscious about agricultural aspects. Because he learns many things through visit different areas and people. So, it helps the famers to adopt hybrid rice production technologies.

4.3.6 Relationship between knowledge on hybrid rice production and adoption of hybrid rice productiontechnologies

Relationship between knowledge on hybrid rice production and adoption of hybrid rice production technologies was determined by Pearson‟s product moment correlation-coefficient.

The coefficient of correlation between cosmopoliteness and adoption of hybrid rice production technologies was presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.609. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- ✓ The relationship showed a positive trend between the concernedvariables.
- ✓ The observed value of "r" (0.609) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 109 degrees of freedom at 0.01 level ofprobability.
- ✓ The null hypothesis wasrejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.01 level ofprobability.

The findings indicated that knowledge on hybrid rice production of the farmers had a significant positive relationship with their adoption of hybrid rice production technologies.

Based on the above findings, it can be summarized that a farmers had more knowledge increased the capabilities to reduce problems of hybrid rice production of the farmers in Joypurhat district. Knowledge makes individuals to become rational and conscious about related field. It enhances the abilities of the farmers at short time than other to reduce constraints. So, knowledge has significant positive relationship with their adoption of hybrid rice productiontechnologies.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter deals with the summary of findings, conclusions and recommendations of thisstudy.

5.1 Summary ofFindings

5.1.1 Characteristics of the farmers

Age

The old aged farmers comprised the highest proportion (44.1 percent) followed by middle aged category (40.6 percent) and the lowest proportion were made by the young aged category (15.3 percent).

Education

Farmers under illiterate education category constituted the highest proportion (36.9 percent) compared to 21.43 percent primary category and 23.4 percent secondary level. On the other hand the lowest (14.4 percent) belonged to above secondary level category.

Farm size

The small land holder constitute the highest proportion (68.5 percent) of the farmers followed by 20.7 percent with medium land holder and remaining 9.9 percent with large land holder. Only .9% of the farmers had marginal farm size.

Annual family income

The farmers having medium annual family income constitute thehighest proportion (46.8percent) followed by low income (34.2 percent) and high annual family income (18.9 percent).

Income from rice production

The farmers having medium income from rice production constitute the proportion (55.9 percent) followed by low income from rice production (28.8 percent) and high income from rice production (15.3 percent).

Organizational participation

The farmers having medium organizational participation constitute the highest proportion (67.7 percent) followed by low organizational participation (20.6 percent) and high organizational participation (11.7 percent).

Cosmopoliteness

The highest proportion (56.8 percent) of the farmers had medium cosmopoliteness as compared to 26.1 percent of low cosmopoliteness and 17.1 percent had high cosmopoliteness.

Extension media contact

The farmers having medium extension media contact category constituted the highest proportion (69.4 percent) followed by low contact (16.2 percent) and high contact category (14.4 percent).

Knowledge on hybrid rice production

The highest proportion (43.3 percent) of the respondents had medium knowledge on hybrid rice production, while 30.6percent and 26.1 percent of the respondents had high and low knowledge on hybrid rice productionrespectively.

Attitude towards hybrid rice production

The farmers having medium attitude towards hybrid rice production constituted the highest proportion (57.7 percent) followed by high attitude towards hybrid rice production (23.4 percent) and low attitude towards hybrid rice production(18.9 percent).

5.1.2 Adoption of hybrid rice production technologies

The highest proportion (68.5 percent) of the respondents had medium adoption of hybrid rice production, while 22.5 percent had high adoption and the rest 9percent had low adoption of hybrid rice production.

5.1.3 Relationship between adoption of hybrid rice production technologies and their selectedcharacteristics

Education, farm size, annual family income, organizational participation, cosmopoliteness and knowledge on hybrid rice production had significant positive relationships with the adoption of hybrid rice production technologies. Age, income

from hybrid rice production, extension contact and attitude towards hybrid rice production had non-significant positive relationships with the adoption of hybrid rice production technologies.

5.2 Conclusions

Conclusions drawn on the basis of the findings of this study and their logical interpretation in the light of the other relevant factors are furnished below:

1. In the study area farmers have been adopting hybrid rice production technologies in various extents. There were 68.5% medium adopters, 22.5% high adopters and 9% low adopters. Therefore, it may be concluded that all the farmers of the study area were adopters in variety ofdegrees.
2. Majorities (36.9 percent) of the farmers were illiterate. This result has achieved because of there was fewer different NGOs‟ activities and lower educational institutes in the study area. There existed a positively significant relationship between farmers' education and their adoption of hybrid rice production. Therefore, it may be concluded that, high educated farmers adopted more hybrid rice productiontechnologies.
3. A great majority (88.3 percent) of the farmers had low to medium organizational participation, while there had a very strong positive significant relationship between organizational participation and adoption of hybrid rice production technologies. Therefore, it may be concluded that, low organizational participation farmers adopted less rice production and with the increase of organizational participation of the farmers tends to increase their extent of adoption of technologies.
4. A major portion (82.9 percent) of the farmers had low to medium cosmopoliteness, while there had a positive significant relationship between cosmopoliteness and their adoption of hybrid rice production technologies. Therefore, it may be concluded that, farmers having higher cosmopoliteness were adopted more hybrid rice productiontechnologies.
5. A great majority (73.9 percent) of the farmers had medium to high knowledge about hybrid rice production, while there had a very strong positive significant relationship between knowledge on hybrid rice production of the farmers and their adoptionofhybridriceproductiontechnologies.Therefore,itmaybeconcluded

that, farmers had higher knowledge on hybrid rice production technologies were adopted more rice production in the study area.

6. The majority (81 percent) of the farmers had low to medium annual family income, while there had a very strong positive significant relationship between annual family income and their adoption of hybrid rice production technologies. Therefore, it may be concluded that, with the increase in annual family income of the farmers tends to increase their rate of adoption.
7. A great majority (89.2 percent) of the farmers had small to medium farm size, and there was a positive significant relationship between farmers' farm size and their adoption of hybrid rice production technologies. Therefore, it may be concluded that, with the increase in farm size of the farmers tends to increase their extent of adoption oftechnologies.

5.3 Recommendations

5.3.1 Recommendations for policy implications

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

1. A majority (91 percent) of the farmers had medium to high adoption of hybrid rice production technologies. All the sample farmers were more or less involved in hybrid rice production. But their extent of adoption was not satisfactory. Therefore, it may be recommended that necessary steps should be taken to increase the adoption of hybrid rice production technologies in the studyarea.

2. Education of the farmers had significant positive relationship with their adoption of hybrid rice production technologies. Therefore, it may be recommended that, adult education should be provided to the farmers so that they could increase their educational level which might be helpful to increase their adoption of hybrid rice productiontechnologies.

3. Cosmopoliteness of the farmers had significant positive relationships with their adoption of hybrid rice production technologies. Therefore, it may be recommended that, extension service providers as well as other parties should increase their contact with farmers so that their attitude towards hybridrice

production and knowledge about rice production of farmers could increase. Because attitude towards hybrid rice production technologies and knowledge about hybrid rice production are pre-conditions for adoption of rice production technologies. So, government should take necessary steps to improve the above characteristics of thefarmers.

4. Knowledge on hybrid rice production had significant positive relationship with their adoption of rice production technologies. Therefore, it may be recommended that, there should be conducted more organization works for educating and training the farmers which will be supportive to adoption of hybrid rice production technologies.

5. Organizational participation had significant positive relationship with their adoption of hybrid rice production technologies. Therefore, it may be recommended that, GOs and different NGOs should constructed more organization that would make the farmers more conscious to adopt rice production technologies.

6. Annual family income of the farmers had significant positive relationships with their adoption of hybrid rice production technology. 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, adoption of selected hybrid rice production technologies couldincrease.

7. Farm size of the farmers had significant positive relationships with their adoption of hybrid production technologies. Therefore, it may be recommended that, farmers who have more farm they can adopt more hybrid rice production technologies.

5.3.2 Recommendation for furtherstudy

This study investigated adoption of hybrid rice production technologies by the farmers of Kalai Upazila under Joypurhat district. As a small and limited research has been conducted in the present study cannot provide much information related to this aspect. Further studies should be undertaken to cover more information in the relevant matters. So the following suggestions were put forward for furtherresearch:

1. It is difficult to determine the extent of adoption by the farmers on hybrid rice production. Measurement of adoption of the farmers is not free from questions. More reliable measurement of concerned variables is necessary for furtherstudy.
2. The present study was conducted only in two villages of Kalai Upazila under Joypurhat district. Findings of the study need further verification through similar research in other parts of thecountry.
3. The study investigated the relationship of ten characteristics of the farmers with their adoption of hybrid rice production technologies. So it is recommended that further study would be conducted with other dependent and independentvariables.
4. Research should be undertaken on the effectiveness of agricultural extension services and other related organizations in helping farmers for adoption of technologies.

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Appendix-A

English Version of the Interview Schedule

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka-1207

Interview schedule for data collection for the research on

"Adoption of Selected Hybrid Rice Production Technologies by the Farmers of Joypurhat District in Bangladesh"

Serial no.

Name of the respond…….

Village:…… Union:……

Upazila:…….. District:……

Please answer the following questions

1. **Age**

   How oldareyou?..... years

2. **Level of education**

   (Please mention your level of education)

   a) Cannot read andwrite_____

   b) Can sign only_____

   c) I have studied up toclass _____

3. Farmsize

(Please mention the area of your land according to use)

Sl. no.	Types of land use	**Land Area**	
		Local Unit	**Hectare**
F1	Homestead land (including pond and orchard)		
F2	Land under own production		
F3	Land given to others as borga		
F4	Land taken from others as borga		
F5	Land taken from others as lease		
Total = F1+F2+1/2(F3+F4)+F5			

4. Annual familyincome

(Please mention the amount of annual income from the following sources)

a) Agriculturalsources

SL. No.	**Source of income**	**Total production (kg/unit)**	**Price per kg/unit (Tk.)**	**Total price (Tk.)**
1	Jute			
2	Maize			
3	Potato			
4	Tobacco			
5	Pulse crop			
6	Oil crop			
7	Spice crop			

8	Vegetables			
9	Fruits			
10	Cow, goat, ram, bafellow			
11	Fish resources			
12	Poultry			
Total				

b) Non- agriculturalsources

SL. No.	Source of income	Income/month	Income/year	Total income (Tk.)
1	Service			
2	Business			
3	Day labor			
4	Other family members			
Total				

5. Income from riceproduction

What is your annual income from rice production during last year?

.....TK

6. Organizationalparticipation

Please mention the nature and duration of your participation.

Sl. No.	Name of Organizations	Nature of Participation			
		Not involved (0)	Ordinary member (1)	Executive member(2)	Executive officer(3)
1	Farmers‟ cooperatives				
2	School committee				
3	Religious committee				
4	Bazar committee				
5	Agricultural club (IPM, Krishi club)				
6	Village club				
7	Union parishad				
8	Upazila parishad				

7. Cosmopoliteness

(Please mention the extent of your visit the following place)

SL. No.	Places of visit	Extent of Visits				
		Regularly (4)	Frequently (3)	Occasionally (2)	Rarely (1)	Not atall (0)
1	Visit of market near your own village	10 or more times/month ()	5-9 times / month()	2-4 times /month ( )	Once / month ( )	Not even once ( )

2	Visit of relatives/ Friends	6 or more time /month ( )	4-5 times / month ( )	2-3 times / month ( )	Once/month ( )	Not even once ()
3	Visit to upazila sadar	6 or more time / month ( )	4-5 times / month( )	2-3times / month ( )	Once / month( )	Not even once ()
4	Visit to other upazila sadar	4 or more time / month()	2-3 times / 2 month ( )	1-2 times/ 3month( )	Once / 6 month( )	Not even once ()
5	Visit to upazila agricultural officer	1 or more time / month ( )	2-3 times / 4 month ( )	1-2 times/ 6 month( )	Once/ 6 month( )	Not even once ()
6	Visit to upazila/district agricultural fair	1 or more time / year ( )	1-2 times / 3 year ()	2-3 times/ 6 year ( )	Once / 6 year( )	Not even once ()

8. Agricultural Extension contact

(Please mention the extent of your extension contact)

SL. No.	**Contact with the persons**	**Extent of contact**				
		Regularly (4)	**Frequently (3)**	**Occasionally (2)**	**Rarely (1)**	**Not at all (0)**
1	Contact with AEO	>5 times/ year	4-5 times/year	2-3 times/year	1 times/year	0 time/ year
2	Contact with SAAO	>7 times/ year	5-7 times/ Year	3-4 times/ year	1-2 times/ year	0 time/ year
3	Contact with seed dealers	>9 times/ year	7-9 times/ Year	4-6 times/ year	1-3 times/ year	0 time/ year
4	Participation in agricultural training	>9 times/ year	7-9 times/ Year	4-6 times/ year	1-3 times/ year	0 time/ year
5	Contact with NGO workers	>9 times/ year	7-9 times/ Year	4-6 times/ year	1-3 times/ year	0 time/ year
6	Attend agricultural group meeting	Once in a month	Once/ 2 month	Once/ 3 month	Once/ 4 month	0 time/ 6 month
7	Listening krishi radio programs	Daily	Weekly	Fortnightly	Once/ month	0 time/ 6 month
8.	Watching agril. Related programs on	Daily	Weekly	Fortnightly	Once/ month	0 time/ 6 month

	TV					
9.	Read agril. Related ,magazine, leaflet, booklet, etc.	>7 times/ year	5-7 times/ year	3-4 times/ year	1-2 times/ year	0 time/ year
10.	Conducted result demonstration	>9 times/ year	7-9 times/ Year	4-6 times/ year	1-3 times/ year	0 time/ year

9. Knowledge on hybrid rice productiontechnologies

Please answer the following questions

SL. No.	**Questions**	**Assigned score**	**Obtained marks**
1	Name of two varieties of hybrid rice that you cultivated	2	
2	Mention seed rate of hybrid rice production per bigha	2	
3	Mention two major insects of hybrid rice	2	
4	What is the proper sowing time of hybrid rice seed?	2	
5	What type of soil is suitable for hybrid rice production?	2	
6	Name two major diseases of hybrid rice	2	
7	Mention two harmful weeds of hybrid rice	2	
8	Mention at least one insecticide, one fungicide and one herbicide of hybrid rice	2	
9	Mention the rate of farmyard manure per bigha is needed in hybrid rice production?	2	
10	Mention fertilizer doses in hybrid rice production(Urea, TSP and MP)	2	
11	Mention the intercultural operations in hybrid rice production	2	
12	Describe line sowing method and crop rotation in hybrid rice production	2	
Total		**24**	

10. Attitude towards hybrid rice productiontechnologies

Indicate the degree of agreement against the following statements

SL. No.	Statement	Nature of opinion				
		Strongly agree (5)	**Agree (4)**	**Undecided (3)**	**Disagree (2)**	**Strongly disagree (1)**
1	Hybrid variety of rice production is profitable than local variety					
2	Hybrid rice production is profitable than other crops					
3	Hybrid rice production requires large amount of chemical fertilizers					
4	Most of the pest can be controlled by clean production during pest infestation					
5	Line sowing does not provide any extra benefit					
6	Hybrid rice production depends on deep tube-well					
7	Hybrid rice production is more laborious					
8	Adoption of hybrid rice production is slowly					
9	Improved hybrid seed gives higher yield					
10	Hybrid rice production has no adverse effect on environment					

11. Adoption of selected hybrid rice production technologies

Please give your information about the use of following hybrid rice production technologies

	Technologies	Potential Area (L)	Allocated Area (l)	Years of the adoption		
				2016	2017	2018
1	Use of modem high yielding varieties					
2	Guti urea					
3	Organic fertilizer					
4	Line transplanting					
5	Integrated Pest Management (IPM)					

Thank you for your kind co-operation.

……..

Dated Signature of theinterviewer

Appendix-B

Correlations matrix between dependent and independent variables

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Y
X1	1										
X2	.194*	1									
X3	.219*	.583**	1								
X4	.289**	.671**	.661**	1							
X5	.189*	.392**	.533**	.438**	1						
X6	.263**	.513**	.511**	.530**	.427**	1					
X7	-.119	.412**	-.016	.209*	-.024	.036	1				
X8	.045	.499**	.521**	.449**	.271**	.303**	.076	1			
X9	.126	.649**	.414**	.431**	.259**	.445**	.287**	.272**	1		
X10	-.078	-.040	-.032	-.108	-.202*	-.048	-.154	.083	.023	1	
Y	.170	.544**	.239*	.485**	.185	.473**	.318**	.145	.609**	.035	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= Cosmopoliteness
X_2= Education	X_8= Extension Media contact
X_3= Farm size	X_9= Knowledge on hybrid rice production
X_4= Annual family income	X_{10}= Attitude towards hybrid rice production
X_5= Income from rice production	Y=Adoption of hybrid rice production technology
X_6= Organizational participation	

s