

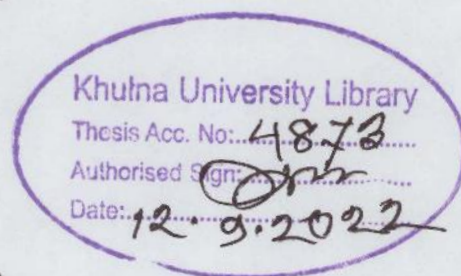
**ADOPTION BEHAVIOR OF FARMERS REGARDING HYBRID RICE CULTIVATION
IN KHULNA REGION**

A Thesis

By

Md. Abu Sayed

Student Id. MS-200820



**A Thesis (Course No. AERD-6104) Submitted to the Agrotechnology Discipline in Partial
Fulfillment of the Requirements for the Degree of**

MASTER OF SCIENCE

IN

AGRICULTURAL EXTENSION AND RURAL DEVELOPMENT

**AGROTECHNOLOGY DISCIPLINE
LIFE SCIENCE SCHOOL
KHULNA UNIVERSITY
KHULNA-9208**

MARCH 2022

**KHULNA UNIVERSITY
LIFE SCIENCE SCHOOL**

AGROTECHNOLOGY DISCIPLINE

The undersigned certify that they have read and recommended to the Agrotechnology Discipline
for Acceptance a M.Sc. Thesis Entitled

**ADOPTION BEHAVIOR OF FARMERS REGARDING HYBRID RICE CULTIVATION
IN KHULNA REGION**

By

Md. Abu Sayed

Student Id. MS-200820

Approved as to Style and Contents

By



Professor Dr. Mohammad Bashir Ahmed

(Supervisor)

Professor Dr. Md. Matiul Islam

(Co-supervisor)

Professor Dr. Sarder Safiqul Islam
(Chairman, Examination Committee
and
Head, Agrotechnology Discipline)

MARCH 2022

Dedicated
To
My Beloved Parents

ABSTRACT

Development of hybrid rice varieties is a breakthrough for rice production. In the recent years, hybrid rice varieties are gaining popularity among the farmers and occupying largest portion of production. It has an outstanding contribution to the food security of Bangladesh. The study was carried out with the aim to determine adoption behavior of farmers regarding hybrid rice cultivation and also to explore the relationship between selected characteristics of the farmers with their extent of adoption of hybrid rice varieties. Data were collected from randomly selected 80 respondents of four villages which are Khalsi, Sajiara, Golna and Hajidanga under Dumuria upazila of Khulna district through personal interview method by the researcher himself using an interview schedule during 12th January to 25th January, 2022. Farmers' adoption behavior in terms of extent of adoption of hybrid rice varieties was the dependent variable and the fifteen selected characteristics of the respondents were considered as the independent variables of the study. A computed adoption quotient was used to measure farmers' extent of adoption of hybrid rice varieties of the study area. Pearson's co-efficient of correlation (r) was used to explore the relationship between the concerned variables. Besides, simple statistics like mean, standard deviation, range, and percentile were used throughout the study. Majority (57.5%) of the respondents belonged to medium adoption category while 38.75% and 3.75% of the respondents belonged to low and high adoption categories of hybrid rice varieties respectively. Among fifteen independent variables level of education, experience in hybrid rice cultivation, extension media contact, organizational participation, cosmopolitanism, training exposure, knowledge and attitude towards hybrid rice of the respondents showed significant positive relationship with their extent of adoption while age, farming experience, experience in rice cultivation and innovativeness showed negative significant relationship with their extent of adoption of hybrid rice. The findings of the study indicated that farmer's adoption of hybrid rice production has not up to the mark. It is concluded that adoption of hybrid rice production can be increased through increase of education, organizational participation, cosmopolitanism, exposure to communication media and training. Government should take necessary steps to overcome this situation.

Key words: Farmer's adoption behavior, hybrid, rice.



ACKNOWLEDGEMENTS

The author would like to express with utmost humble gratitude and endless praises to Almighty Allah, who enabled the author to complete the study and writing up the thesis successfully.

The author have much pleasure to express his heartfelt respect, deep sense of gratitude, immense indebtedness and deep appreciation to honorable teacher and supervisor Dr. Mohammad Bashir Ahmed, Professor, Agrotechnology Discipline, Khulna University, Khulna, for his kind help for preparation of the thesis including worthy guidance, valuable suggestions, constructive criticism, encouragement and continuous supervision throughout the study work and preparation of the thesis.

The author also expresses heartiest gratefulness and thanks to thesis co-supervisor Dr. Md. Matiul Islam, Professor, Agrotechnology Discipline, Khulna University, Khulna, for his special cooperation.

The author explicit his heartiest thankfulness and indebtedness to all the respondents of the study area who co-operated the author by giving valuable information during collection of data.

The author likes to express his boundless gratitude to his parents and other members of his family whose sacrifices, inspiration, and continuous blessings opened the gate and paved the way for higher studies.

Special thanks are extended to the authority of Khulna University Central Library, Seminar Library of Agrotechnology Discipline, Khulna University, Khulna, from where the author found valuable information to complete the study.

March 2022

The Author

CONTENTS

CHAPTER	TITLE	PAGE NO.
	ABSTRACT	I
	ACKNOWLEDGEMENT	II
	CONTENTS	III-VII
	LIST OF TABLES	VIII- IX
	LIST OF FIGURES	X
I	INTRODUCTION	1-7
	1.1 Background of the study	1
	1.2 Statements of the problem	3
	1.3 Objectives of the study	4
	1.4 Justification of the study	4
	1.5 Assumptions of the study	5
	1.6 Scope of the study	5
	1.7 Limitation of the study	6
	1.8 Definition of the key terms	6
II	REVIEW OF LITERATURE	8-24
	2.1 Concept of adoption	8
	2.2 Review of literature on general context of adoption	8
	2.3 Studies regarding relationship between selected characteristics of the farmers and their adoption	10
	2.3.1 Age and adoption	10
	2.3.2 Educational qualification and adoption	11
	2.3.3 Farming experience and adoption	12
	2.3.4 Experience in rice cultivation and adoption	13
	2.3.5 Experience in hybrid rice cultivation and adoption	13
	2.3.6 Family size and adoption	14
	2.3.7 Farm size and adoption	15

CHAPTER	TITLE	PAGE NO.
	2.3.8 Annual income and adoption	16
	2.3.9 Extension media contact and adoption	17
	2.3.10 Organizational participation and adoption	18
	2.3.11 Cosmopolitanism and adoption	19
	2.3.12 Training exposure and adoption	20
	2.3.13 Innovativeness and adoption	21
	2.3.14 Knowledge about technology and adoption	21
	2.3.15 Attitude towards technology and adoption	22
	2.4 The Conceptual Framework of the Study	24
III	METHODOLOGY	25-38
	3.1 Design of the study	25
	3.2 Locale of the study	25
	3.3 Population and sampling	25
	3.4 Instrument for data collection	28
	3.5 Collection of data	28
	3.6 Compilation of data	29
	3.7 Statistical analysis	29
	3.8 Selection and measurement of variables	29
	3.8.1 Selection of variables	29
	3.8.2 Measurement of variables	30
	3.8.2.1 Measurement of the adoption behavior in terms of extent of adoption of hybrid rice (Dependent variable)	30
	3.8.2.1.1 Variety-wise extent of adoption and ranking of hybrid rice varieties	30
	3.8.2.2 Measurement of the selected characteristics (Independent variables)	31
	3.8.2.2.1 Age	31
	3.8.2.2.2 Level of education	31
	3.8.2.2.3 Family size	32
	3.8.2.2.4 Farming experience	32

CHAPTER	TITLE	PAGE NO.
	3.8.2.2.5 Experience in rice cultivation	32
	3.8.2.2.6 Experience in hybrid rice cultivation	33
	3.8.2.2.7 Farm size	33
	3.8.2.2.8. Annual income	34
	3.8.2.2.9 Extension media contact	35
	3.8.2.2.10 Organizational participation	35
	3.8.2.2.11 Cosmopolitanism	36
	3.8.2.2.12 Training exposure	36
	3.8.2.2.13 Innovativeness	37
	3.8.2.2.14 The knowledge level of the respondents about hybrid rice	37
	3.8.2.2.15 Attitude of the respondents towards hybrid rice	38
IV	RESULTS AND DISCUSSION	39-65
	4.1 Adoption behavior of farmers regarding hybrid rice cultivation	39
	4.1.1 Identification of hybrid rice as cultivated by the farmers of the study area	39
	4.1.2 Extent of adoption of hybrid rice varieties of the respondents	39
	4.1.3 Variety-wise extent of adoption of hybrid rice	41
	4.2 Selected characteristics of the respondents	43
	4.2.1 Age	43
	4.2.2 Level of education	44
	4.2.3 Family size	44
	4.2.4 Farming experience	45
	4.2.5 Experience in rice cultivation	46
	4.2.6 Experience in hybrid rice cultivation	46
	4.2.7 Farm size	47
	4.2.8 Annual income	48
	4.2.9 Extension media contact	49
	4.2.10 Organizational participation	49
	4.2.11 Cosmopolitanism	50

CHAPTER	TITLE	PAGE NO.
	4.2.12 Training exposure	51
	4.2.13 Innovativeness	51
	4.2.14 Knowledge	53
	4.2.15 Attitude towards hybrid rice	54
	4.3 Relationship between the selected characteristics of the respondents and their extent of adoption of hybrid rice	55
	4.3.1 Age and extent of adoption of hybrid rice	57
	4.3.2 Level of education and extent of adoption of hybrid rice	57
	4.3.3 Family size and extent of adoption of hybrid rice	58
	4.3.4 Farming experience and extent of adoption of hybrid rice	58
	4.3.5 Experience in rice cultivation and extent of adoption of hybrid rice	59
	4.3.6 Experience in hybrid rice cultivation and extent of adoption of hybrid rice	60
	4.3.7 Farm size and extent of adoption of hybrid rice	60
	4.3.8 Annual income and extent of adoption of hybrid rice	61
	4.3.9 Extension media contact and extent of adoption of hybrid rice	61
	4.3.10 Organizational participation and extent of adoption of hybrid rice	62
	4.3.11 Cosmopolitanism and extent of adoption of hybrid rice	63
	4.3.12 Training exposure and extent of adoption of hybrid rice	63
	4.3.13 Innovativeness and extent of adoption of hybrid rice	64
	4.3.14 Knowledge and extent of adoption of hybrid rice	64
	4.3.15 Attitude and extent of adoption of hybrid rice	65
V	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	66-70
	5. 1 Summary	66
	5.1.1 Major findings	67
	5.1.1.1 Adoption behavior of farmers regarding hybrid rice cultivation	67

CHAPTER	TITLE	PAGE NO.
	5.1.1.2 Relationship between the characteristics of the respondents and their extent of adoption of hybrid rice	67
	5.1.1.3 Selected characteristics of the respondents	68
	5.2 Conclusions	69
	5.3 Recommendations	69
	5.3.1 Recommendations for policy implication	69
	5.3.2 Recommendations for further study	70
	REFERENCES	71-79
	APPENDIX A	80-87

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
3.1	Categories of respondents according to their extent of adoption	30
3.2	Categories of the respondents according to their age	31
3.3	Categories of respondents according to their level of education	31
3.4	Categories of respondents according to their family size	32
3.5	Categories of the respondents based on farming experience	32
3.6	Categories of the respondents based on experience in rice cultivation	33
3.7	Categories of the respondents based on hybrid rice cultivation experience	33
3.8	Categories of respondents according to farm size	34
3.9	Categories of respondents according to their annual income	35
3.10	Categories of respondents according to their extension media contact	35
3.11	Categories of the respondents based on organizational participation	36
3.12	Categories of respondents according to their cosmopolitanism	36
3.13	Categories of respondents according to their training exposure	37
3.14	Categories of the respondents based on innovativeness	37
3.15	Categories of the respondents based on knowledge about hybrid rice	38
3.16	Categories of respondents according to attitude towards hybrid rice	38
4.1	Distribution of farmers according to their extent of adoption of hybrid rice	39
4.2	Extent of adoption Index and Rank order of hybrid rice varieties	41
4.3	Distribution of respondents according to their age	43
4.4	Distribution of farmers according to their level of education	44
4.5	Distribution of farmers according to their family size	45
4.6	Distribution of the farmers according to their farming experience	45

TABLE NO.	TITLE	PAGE NO.
4.7	Distribution of the farmers according to their rice cultivation experience	46
4.8	Distribution of the farmers according to their experience in hybrid rice cultivation	47
4.9	Distribution of respondents according to farm size	47
4.10	Distribution of farmers according to their annual income	48
4.11	Distribution of farmers according to their extension media contact	49
4.12	Distribution of the farmers according to their organizational participation	49
4.13	Distribution of farmers according to their cosmopolitanism	50
4.14	Distribution of respondents according to training exposure	51
4.15	Distribution of respondents according to their innovativeness	52
4.16	Distribution of farmers according to knowledge about hybrid rice	53
4.17	Distribution of farmers according to their attitude towards hybrid rice	54
4.18	Relationship between the selected characteristics of the farmers and their extent of adaption of Hybrid Rice	56

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
2.1	Conceptual framework of the study	24
3.1	A map of Khulna district	26
3.2	A map of Dumuria upazila showing the study union	27
4.1	Extent of adoption of hybrid rice by the farmers	40
4.2	Variety-wise extent of adoption of hybrid rice by farmer	42
4.3	Adopter categories based on innovativeness	53

CHAPTER I

INTRODUCTION

1.1 Back ground of the Study

Rice (*Oryza sativa* L.) is one of the most important cereal crops in the world. It is also the staple food for the people of Bangladesh which occupies nearly 75% of the total cropped area (Khan, 2018). Bangladesh has primarily an agrarian economy with a high population density where food security remains a major concern, about 76% of the people live in rural areas, and 47.5% of the total manpower is involved in agriculture (Shelley et al., 2016). Rice contributes 76 percent of the calories and 66 percent of the protein intake (BNNC, 2000). The contribution of agricultural sector to the Gross Domestic Product (GDP) is 13.47% (BBS, 2021). Water stagnation, salinization, frequent natural disasters erosion and human settlements lead to the loss of rice fields in an alarming speed in many countries (Adhikary et al., 2019). However, demand for rice in low-income countries like Bangladesh continues to increase because of increasing the population. There is a pressing need, however, to further improve rice production to meet the demands of the growing population, which increases at the rate of 1.32 percent per annum (Awal and Siddique, 2011). To meet this challenge, it's necessary to find rice varieties with higher yield potential. Among the various options available to increase the rice yields potential, hybrid rice is the most feasible and readily adoptable one (Nirmala and Suhasini, 2013).

Hybrid rice is the first generation (F_1) crop grown from the cross of two distantly-related rice varieties. Hybrid rice exploits the phenomenon called hybrid vigor or heterosis where the hybrid rice plant is more superior to any trait of its parents. Due to hybrid vigor, hybrid rice can produce 15-30% yield advantage over the conventional rice that farmers grow (PANAP, 2007). Chinese scientists Yuan Long bred the world's first hybrid rice in 1974. Hybrid rice has particularly good potential to improve the food security of poor countries where arable land is scarce, populations are expanding and labor is cheap. More countries in Asia are shifting to hybrid rice cultivation as scientists continue to introduce new varieties to meet the growing demand for food security parallel to the ever-increasing population in the region. (Mondol, 2009).

In order to feed the growing population, hybrid rice research in Bangladesh was initiated in 1993 at the Bangladesh Rice Research Institute (BRRI) (Rashid et al., 2011) and got momentum in 1996 with the technical support of International Rice Research Institute (IRRI). Since the hybrid rice research system in Bangladesh had not yet developed appropriate hybrids for the country, the government encouraged private sector companies to import hybrid rice seeds (Hossain, 2003). In 1998-99 widespread floods led to shortfalls in domestic seed supply, leading the National Seed Board (NSB) to allow the import of four hybrid rice varieties from China and India. In 2001, the government of Bangladesh released their first governmentally developed national hybrid, a variety called BRRI hybrid dhan-1 (Julfiquar, 2002), which yielded nearly 1.2 ton/ha (20%) higher than highest yielding inbred (BRRI dhan29) in selected districts (BRRI, 2004). Meanwhile, the Department of Agriculture Extension (DAE), the mainstream extension agency of the country, is focusing on dissemination of hybrid rice among farmers. Consequently, farmers are quickly adopting hybrid rice. On average, farmers brought 37.84% of their potential rice farming area for cultivation of hybrid rice over the period of 2001-2011 in the sample areas (Shah et al., 2014). The adoption of HYV rice enabled Bangladesh to double the yield rate during 1990-00 to 2001-2015 (BBS, 2016).

Conventional varieties of rice in Bangladesh are comparatively produce lower-yield and it seems to be impossible to change this yield through the reachable resources under the prevailing situation. At this stage, hybrid varieties of rice may be a breakthrough, which can overcome perpetual yield stagnancy. To feed ever increasing millions of population of Bangladesh, there is no option but go for hybrid rice. So, the development and introduction of hybrid rice varieties should get topmost priority (Awal et al., 2007). "When an agricultural program introduces a new agricultural innovation, the program must be able to evaluate whether the innovation has been adopted. It is important need to identify the factors that influence adoption". Hybrid rice is no exception (Masangano and Miles, 2004). Although there were some confusion and information gap about hybrid rice in the initial years, the technology is gaining popularity among the farming community and gradually replacing HYV rice varieties in many areas.

Khulna district is located in the south western region of Bangladesh and it is familiar for rice cultivation but this area is severely saline affected. For this reason, only T. aman is cultivated in this area (Jodder et al., 2016). So, it is a great opportunity to adopt hybrid rice in Khulna since hybrid rice is widely adopted varieties in saline condition.

There has been tremendous change in adoption of hybrid rice variety in Bangladesh. Farmers are eagerly adopted hybrid rice varieties because of its higher production (Shiyam et al., 2014), low pest and disease infestation, high tolerance against salinity and drought compared to traditional variety (El-Namaky and Demont, 2013). After the release of hybrid varieties in the year of 1999, due to the lack of information flow and experience with the new varieties, adoption was limited and slow. In order to prepare programs and courses of action for wider adoption of hybrid rice, it is important to know the current status of hybrid rice in Bangladesh in terms of area they brought under cultivation. Therefore, it is important to undertake a study analyzing the farmer's adoption behavior in cultivating hybrid rice in Bangladesh for the improvement of present situation. In this study, an effort had been made to measure extent of adoption with identifying the existing popular hybrid rice varieties and to measure the influence of selected characteristics of the farmers on extent of adoption of hybrid rice varieties in the study area.

1.2 Statement of the Problem

The success of any technology depends on its dissemination among the potential users which ultimately is measured by the level of adoption of that technology. It is assumed that notable improvements can take place in Bangladesh agriculture, if the available technologies are accepted by the growers. Among various technologies, use of improved seeds, use of balanced fertilizer, IPM (Integrated Pest Management) practices and irrigation are quite suitable for our sustainable agriculture. Very little is known about the adoption of hybrid rice by the rice growers in the country. In view of the foregoing discussion the researcher undertook a study entitled "Adoption Behavior of Farmers Regarding Hybrid Rice Cultivation in Khulna region". The purpose of the study was to have an understanding of the adoption behavior of hybrid rice growers and associated factors of adoption in the locality. For conducting the research in a planned and appropriate manner, the researcher put forwarded the following questions:

1. To what extent the hybrid rice varieties have been adopted by the rice growers?
2. What are the hybrid rice varieties used by the respondents?
3. What are the characteristics of hybrid rice growers in the study area?
4. What are the relationship between selected characteristics of hybrid rice growers and their extent of hybrid rice adoption?

1.3 Objectives of the Study

The study was conducted to fulfill the following objectives:

- i. To identify the hybrid rice varieties with their extent of adoption;
- ii. To determine adoption behavior of the farmers regarding hybrid rice cultivation;
- iii. To analyze the selected characteristics of the farmers; and
- iv. To explore relationship of the selected characteristics of the farmers and their extent of adoption of hybrid rice.

1.4 Justification of the Study

In Bangladesh, the deficit of food grain is a chronic problem for the cause of increasing population. So, to ensure adequate food supply, it is necessary to give thrust to increase food production using hybrid rice varieties. Agricultural intensification, to minimize food shortage and maximize self-sufficiency in food production is possible only when adoption of hybrid rice production 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 hybrid rice. Hybrid rice production must be simple, demand driven, locally available, economically feasible and socially acceptable to bring desirable changes in attitude of the farmers for their adoption. It is obviously true that farmers are the key elements of adoption of hybrid rice production. At present, there is a lack of adequate understanding that how the characteristics of the farmers influence their adoption of hybrid rice production. These facts indicate the need for an investigation to ascertain the relationships of the characteristics of the farmers with their adoption of hybrid rice production. Findings of this study, therefore, would be helpful to the planners and extension personnel in planning and execution of programs for enhancing the rice production.



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 researcher who also acted as the interviewer was well adjusted to the social environment of the study area. The researcher collected data with utmost care and can be treated as reliable.
2. The respondents included in the sample were competent to furnish proper responses to the items included in the interview schedule.
3. The adoption of hybrid rice varieties by the rice growers was linearly related with their selected characteristics.
4. The responses furnished by the respondents were reliable and they truly expressed their opinion on adoption of hybrid rice and their selected characteristics.
5. The sample size was representative of the whole hybrid rice cultivars of the study area.
6. The measures of the adoption of hybrid rice by the farmers are normally and independently distributed with their respective means and standard deviation.

1.6 Scope of the Study

The findings of the study will particularly be applicable to Dumuria upazila under Khulna 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 programs for rapid adoption of hybrid rice by the farmers. The results found from this study will play an important role for scheduling and implementation of the program of extension services of the Department of Agricultural Extension (DAE) and other related development agencies. Finally, there is a great scope for investigation on farmer's adoption of hybrid rice, because little study was conducted on this so far in greater Khulna region.

1.7 Limitation of the Study

The study might help to identify existing hybrid rice varieties as well as selected characteristics of the farmers which are influencing the extent of adoption of hybrid rice varieties.

There were some limitations of the study which have been described below:

- ✓ The study was confined to Dumuria upazila under Khulna district.
- ✓ The study focused on farmer's extent of adoption of hybrid rice varieties.
- ✓ There are many characteristics of the farmers which are always vary but only fifteen were selected for investigation in this study as stated in the objectives.
- ✓ The resource unavailability and time constraints limited the coverage of investigation.
- ✓ For information, the researcher was depended on the data that were furnished by the respondents from their memory during the interview as well as the data of secondary sources.

1.8 Definition of the Key Terms

For clarity of understanding, certain terms frequently used throughout the study are defined and interpreted as follows:

Adoption behavior: Adoption behavior referred to as a person's extent of adoption of an innovation.

Adoption: Adoption is the implementation of a decision to continue the use of an innovation. According to Rogers (1995) "Adoption is a decision to make full use of an innovation as the best course of action and practices if the phenomenon is known as adoption".

Age: It may be defined as the stretch of them between birth and the time of interview. It was measured in terms of actual years.

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

Attitude towards hybrid rice: The term attitude towards hybrid rice varieties of an individual was used to refer to his feelings, belief and action tendencies towards the various aspects of hybrid rice production. i.e. knowledge + beliefs + action = attitude.

Cosmopolitaness: It refers to the orientation or exposure or involvement of individual respondents external to one's own social system.

Farming experience: It refers to the livestock rearing, crop production and aquaculture experience in years.

Extension media contact: It refers to use different mass media such as TV, radio, contact with the peer group, DAE officers and other extension agents.

Family Size: Family size of the respondents is defined as the number of individuals in the family including herself, her husband, children, brother, sisters and ant other permanent dependents members that live and eat together.

Farm size: It referred to the cultivated area either owned by a farmer or obtained from others as borga and lease system.

Hybrid: The first filial generation offspring produced by crossing between two or more genetically dissimilar homogygous parents is called a hybrid. The other name of hybrid is F_1 , (first filial generation).

Innovativeness: Innovativeness is the degree to which an individual adopts new farming practices relatively earlier than others within a locality area.

Knowledge: Literally, knowledge means knowing on what ones know about a subject, facts, persons etc. Here agricultural knowledge was the extent of basic understanding of the respondent in different aspects of agricultural subject matters. It includes the basic understanding of the use of different agricultural activities i.e. crops, livestock, fisheries etc.

Level of education: Level of education of an individual farmer was defined as the formal education received up to a certain level from an educational institute (e.g. school, college and university) at the time of interview.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review literature related to the present study. The researcher made an elaborate search of available literature for the above purpose. But there is hardly any study dealing with the relationship of the characteristics of farmers and their adoption of hybrid rice varieties. The researcher attempted to search the literature on a number of studies have been conducted on the adoption behavior of farmers regarding hybrid rice cultivation. Therefore, the findings of such studies related to the extent of adoption of hybrid rice growers and other partial studies have been reviewed in this chapter. This chapter is divided into three sections; the first section deals with past research findings relating to extent of adoption of innovation, the second section deals with past research findings relating to the relationships of farmers' adoption of innovation with their selected characteristics and the third section deals with the conceptual framework of the study.

2.1 Concept of adoption

Adoption is decision to use and continuation of the innovation for a certain period of time. Adoption is a decision to make full use of innovation as the best course of action available (Rogers, 1995). When an individual takes up a new idea as the best course of action and practices it, the phenomenon is known as adoption.

2.2 Review of literature on General Context of Adoption

Ahmed (2006) studied on the extent of adoption of selected wheat varieties by the farmers. The study revealed that the majority (55%) of the respondents had medium adoption of selected wheat varieties.

Azam (2006) studied on the adoption of wheat cultivation by the farmers of two selected villages of Basail upazila in Tangail district. The finding revealed that about three-fourth (71.2 percent) of the growers had medium adoption, 13.6 percent had low and 15.2 percent had high adoption of wheat cultivation.

Hossen (2013) stated that most (82.9 percent) of the growers had low adoption while 15.4 percent had medium adoption and 1.7 percent had high adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district.

Kabir (2006) conducted a study on adoption of selected T. aman production technologies by the farmers. Highest proportion (43%) of the farmers had medium adoption while 37% had high adoption and 20% had low adoption of selected T. Aman production technologies.

Nira (2006) studied on the adoption of roof gardening at mirpur-10 area under Dhaka city. The findings revealed that majority (62%) of the respondents possessed no adoption compared to 15% and 23% had low and medium adoption of roof gardening respectively.

Ghimire and Kafle (2014) conducted a study on Integrated Pest Management Practice and its Adoption by the farmers in Nepal. The study revealed that about 53 percent of farmers were satisfied with the practice.

Hossain (2004) studied Adoption of Selected Modern Boro Rice Cultivation Technologies by the Farmers of Homna Upazila in Comilla District. He found that, the three-fifth (60 percent) of farmers fell under the medium adoption category, while 21 percent had high adoption and 19 percent had low adoption.

Swinkels et al. (2002) studied assessing the adoption potential of hedgerow intercropping for improving soil fertility, in western Kenya. They conducted 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 labor. Fifth planted additional hedges and only 14% did so to improve soil fertility. It thus appeared that the potential for its adoption as a soil fertility practices. Hedgerow intercropping appeared to have greater adopter potential if its aim was to provide feed for an intensive dairy operation or for curbing soil erosion.

Haider et al. (2001) observed that the highest proportion (37 percent) of the farmers fell in low adopter category compared to 32.5 percent falling in optimum adopter 23.5 percent above optimum adopter and only 7 percent had non-adopter on Nitrogenous fertilizer. In respect of extent of phosphoric fertilizer majority (68 percent) of the farmers had non adopter category compared to 23 percent having above optimum adopter, 5 percent optimum adopter and only 4 percent had below optimum adopter of phosphoric (P) fertilizer. In respect of extent of potassic fertilizer three quarters categories compared to 10 percent falling bellow optimum adopter, 8 percent optimum adopter and only 3 percent above optimum adopter of potassic (K) fertilizer.

Podder and Kashem (2000) studied on Use of Extension media contact Media by the farmers in the Adoption of Mehersagar banana. They concluded that about half (47 percent) of the

growers had medium adoption compare to 14 percent low adoption and 39 percent high adoption of Mehersagar banana.

Rashid (2006) studied on the adoption of maize production technologies by the farmers. Findings indicated that the majority (69 percent) of the growers had medium adoption of modern maize cultivation technologies while 30 percent had low adoption and only 1 percent had high adoption.

2.3 Studies regarding relationship between selected characteristics of the farmers and their adoption

Literature dealing with the relationships of characteristics of farmers with their adoption of innovation has been presented in this section.

2.3.1 Age and adoption

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Alok-6201 hybrid rice in sadar upazila of Mymensingh district. He observed that there was no significant relationship between age and adoption of Aalok-6201 hybrid rice.

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

Hussen (2001) conducted a study, which concluded that age of the sugarcane growers had a significant negative relationship with their adoption of modern sugarcane production practices.

Ahmed (2006) found in his study that age of the respondents showed negative significant relationship with their adoption of selected wheat varieties.

Sadekuzzaman (2007) conducted a study on adoption of intercropping in sugarcane by the farmers. He determined in his study that age of the farmers had significant relationship on their adoption of intercropping in sugarcane.

Chowdhury et al. (2016) found in his study that age of the respondents had no significant relationship with their adoption of BRRI dhan47 in Satkhira.

Hossen (2013) observed that age of the farmers had no significant relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district.

Mahmud (2006) conducted a study on adoption of modern wheat cultivation technologies revealed that age of the farmers had no significant correlation with adoption.

Hoque (2005) reported that age of rice growers and the adoption of rice varieties were not correlated in his experiment to determine the relationship of farmer's characteristics with their adoption of modern Boro rice cultivation practices.

Ali (2006) conducted a study on adoption of organic manure for boro rice production at sadar upazila in Gazipur district and observed that significant positive relationship between the age and their adoption of organic manure.

Hossain (2006) revealed that age of the farmers had an insignificant and positive relationship with their adoption of selected HYV rice cultivation practices.

2.3.2 Educational qualification and adoption

Hossain (2006) concluded that education of the farmers had a significant and positive relationship with their adoption of modern Boro rice and selected of HYV rice cultivation practices.

A study on adoption of modern boro rice cultivation practices was conducted by Hossain (2003). He concluded that education of the farmers had a significant and positive relationship with their adoption of modern boro rice cultivation practices.

Ahmed (2006) found in his study that education of the respondents had no significant relationship with their adoption of selected wheat varieties.

There was positive relationship between education and adoption of integrated homestead farming technologies observed by Aurangozeb (2002). He concluded that educated women were more interested in adoption of integrated homestead farming technologies than the illiterate women.

Khan (2002) found in his study that farmer's education had significant relationship with their adoption of Binashail rice variety.

Hossen (2013) observed that education of the farmers had significant positive relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in sadar upazilla of Mymensingh district. He found that academic qualification of the farmers had a significant and positive relationship with their adoption regarding Aalok 6291 hybrid rice.

A study on adoption of modern agricultural technologies by the farmers of Sandip was reported by Islam (2002). He concluded in his study that education of the farmers had a positive significant relationship with their adoption of modern agricultural technologies.

Haque (2005) revealed that education of the farmers had a significant and positive relationship with their adoption of modern rice varieties.

Islam (2007) conducted a study at Dhamrai upazila under Dhaka district in Bangladesh that showed a significant relationship of education on adoption of BRRI dhan29 production technologies.

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a significant contribution of education on adoption of modern technologies by the rice cultivators.

2.3.3 Farming experience and adoption

Patel (2007) reported that farming experience of rice growers had positive and significant correlation with their extent of adoption.

Bhosale (2010) indicated that farming experience of the paddy growers had positive and highly significant relationship with their extent of adoption of recommended paddy cultivation practices.

Hossain et al. (2006) concluded that the farming experiences of the farmers had positive significant relationship with their adoption of selected HYV rice.

Haque (2003) concluded that farming experiences of the farmers had significant positive relationship with their adoption of modern maize cultivation technologies.

Ghose (2001) completed her study on adoption of improved cultivation practices by the sugarcane growers of non-mill zone area in Shibgang upazila and found insignificant positive relationship with farming experiences of growers and their adoption of improved practices.

Rabbi (2006) observed that there was a negative insignificant relationship between the farming experiences of farmers and their adoption of maize cultivation under sadar upazila of Thakurgoun district.

Sonia (2009) conducted a study on adoption of vegetable cultivation in Patuakhali district and found insignificant relationship with farming experiences.

Khalje et al. (2008) reported that there was positive and significant correlation between farming experience of paddy growers and extent of adoption of recommended paddy cultivation 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 farming experiences of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

2.3.4 Experience in rice cultivation and adoption

Ali (2006) conducted a study on adoption of organic manure for boro rice production at sadar upazila in Gazipur district and observed that significant positive relationship between the rice farming experiences and their adoption of organic manure.

2.3.5 Experience in hybrid rice cultivation and adoption

No researcher did not explore any relationship regarding these variables.

2.3.6 Family size and adoption

Hossain (2009) observed in a study that family size of the farmers had no significant relationship with their use of IPM practices.

Talukder (2006) found that the family size of the farmers had no significant and negative relationship with their adoption of selected rice production practices.

Hossain (2006) concluded that family size of the farmers had significant relationship with their adoption of HYV rice.

Mia (2005) showed a study on adoption of integrated pest management practices in Rice field by the vegetable growers of Magura district. He found that family size of the vegetable growers had positive significant relationship with their adoption of IPM practices.

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

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

Azam (2006) studied on the adoption of wheat cultivation by the farmers of two selected villages of Basail upazila in Tangail district. He found in his study that family size had no significant relationship on their adoption of wheat cultivation by the farmers.

Haque (2003) conducted a study on farmer's adoption of modern maize cultivation technologies. He observed that family size of the respondents had negatively insignificant relationship with their extent of farmer's adoption of modern maize cultivation technologies.

Islam (2005) conducted a study on adoption of pashupusti in cattle rearing at farmer's level. He observed that family size of the respondents had insignificant relationship with their extent of adoption of pashupusti in cattle rearing at farmer's level.

Sadekuzzaman (2007) conducted a study on adoption of intercropping in sugarcane by the farmers. He determined in his study that family size of the farmers had no significant relationship on their adoption of intercropping in sugarcane.

2.3.7 Farm size and adoption

Ahmed (2006) found in his study that farm size of the respondents had no significant relationship with their adoption of selected HYV wheat varieties.

Aurangozeb (2002) observed that there was no relationship between homestead area and adoption of integrated homestead farming technologies.

A study on farmer's adoption of modern maize cultivation technologies was conducted by Haque (2003). He observed in his study that farm size of the respondents had insignificant relationship with their extent of farmer's adoption of modern maize cultivation technologies.

A study on adoption of modern boro rice cultivation practices was conducted by Hossain (2003). Farm size of the farmers had a significant and positive relationship with their adoption of modern boro rice cultivation practices exposed in his study.

Hossen (2013) concluded that farm size of the farmers had significant positive relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district.

A study on adoption of modern agricultural technologies by the farmers of Sandwip was conducted by Islam (2002). He found that farm size of the farmers had a positive significant relationship with their adoption.

The farm size of the farmers had significant positive relationship with their adoption of IPM practices revealed by Sardar (2002).

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 farm size of the farmers and their adoption of Aalok-6201 hybrid rice.

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

Sadekuzzaman (2007) observed a study on adoption of intercropping in sugarcane by the farmers. In his study he determined that farm size of the farmers had significant positive relationship on their adoption of intercropping in sugarcane.

2.3.8 Annual income and adoption

Miajy (2005) found that the annual income of the farmers had no significant relationship with their adoption of hybrid varieties of maize.

Reza (2007) found that the annual income of the farmers had significant relationship with their adoption of modern maize cultivation technologies.

Annual family income of the respondents had no significant relationship with their adoption of selected wheat varieties concluded by Ahmed (2006).

Mahmud (2006) found that the annual income of the farmers had no significant correlation with their adoption of modern wheat cultivation technologies.

Haque (2005) conducted a study to determine the relationship of farmers' characteristics with their adoption of modern rice varieties in Sadar upazila of Mymensingh district. He reported that annual income of the rice growers had significant and positive relation with the adoption of modern rice varieties.

A study on farmer's adoption of modern maize cultivation technologies was conducted by Haque (2003). He observed that annual income of the respondents had insignificant relationship with their extent of farmer's adoption of modern maize cultivation technologies.

Annual income of the farmers had a significant relationship with their adoption of modern boro rice cultivation practices was clarified by Hossain (2003) in his study.

Hossen (2013) concluded that family income of the farmers had significant positive relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district.

Islam (2002) reported a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that annual income of the farmers had a positive significant relationship with their adoption of modern agricultural technologies.

A study on adoption of intercropping in sugarcane by the farmers was carried out by Sadekuzzaman (2007). In his study he determined that family income of the farmers had significant positive relationship on their adoption of intercropping in sugarcane.

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 significant relationship with their adoption of IPM practices.

Islam (2007) conducted a research on adoption of BRRI dhan29 production technologies by the farmers. He found that annual income had a positive and significant relationship with the adoption of BRRI dhan29 production technologies.

2.3.9 Extension media contact and adoption

Rahman (2001) found that extension media contact of the farmers had a significant and positive relationship with their adoption regarding Aalok-6201 hybrid rice.

Haque (2005) conducted a study to determine the relationship of farmers' characteristics with their adoption of modern rice varieties in Sadar thana of Mymensingh district. He reported that extension media contact of the rice growers had significant and positive relation with the adoption of modern rice varieties.

Hossain (2006) conducted an experiment on the adoption of selected HYV rice by the farmers in some selected areas of Bangladesh and concluded that the extension media contact of the farmers had positive significant relationship with their adoption of selected HYV rice.

Talukdar (2006) concluded that the extension media contact of the farmers had positive significant relationship with their adoption of selected rice production practices by the farmers of Char-land of Gonioti River.

Extension media contact of the farmers had no relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district. This statement was concluded by Hossen (2013) in his study.

Begum (2001) observed significant positive relationship between the extension media contact and adoption of cauliflower production technology in homestead area by the rural housewives in Savar upazila of Dhaka district.

Ghose (2001) completed her study on adoption of improved cultivation practices by the sugarcane growers of non-mill zone area in Shibgang upazila and found an insignificant negative relationship with extension media contact of growers and their adoption of improved practices.

Rabbi (2006) observed that there was a positive significant relationship between the extension media contact of farmers and their adoption of maize cultivation under sadar upazila of Thakurgoun district.

Haque (2003) carried out an investigation on adoption of modern maize cultivation technologies of the farmers and concluded that extension media contact of the farmers had significant positive relationship with their adoption of modern maize cultivation technologies.

Ahmed (2006) found in his study that extension media contact of the respondents had significant positive relationship with their adoption of selected wheat varieties.

2.3.10 Organizational participation and adoption

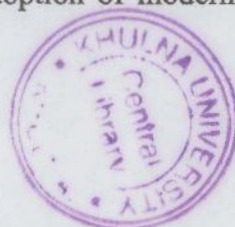
Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a non-significant contribution of organizational participation on adoption of modern technologies by the rice cultivators.

Islam (2007) conducted a study at Dhamrai upazila under Dhaka district in Bangladesh that showed a significant relationship of organizational participation on adoption of BRRI dhan49 production technologies.

A study on adoption of modern boro rice cultivation was conducted by Hossain (2003). In his study he concluded that organizational participation of the farmers had no significant relationship with their adoption of modern boro rice cultivation.

Organizational participation of the farmers had no significant relationship with their adoption of HYV rice as reported by Hossain (2006) in his study.

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



Masud (2006) found a positively significant relationship between organizational participation of the farmers and their adoption of HYV rice varieties by the farmers of Sonaimuri (Begumganj) Upazila under Noakhali district.

A study on knowledge attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in sadar upazila of Mymensingh district was carried out by Rahman (2001). He concluded that organizational participation of the farmers had significant and positive relationship with their adoption of Aalok-6201 hybrid rice.

A study on adoption of intercropping in sugarcane by the farmers was observed by Sadekuzzaman (2007). In his study he determined that organizational participation of the farmers had significant positive relationship on their adoption of intercropping in sugarcane.

Sardar (2002) concluded 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.

Hossain (2000) found insignificant relationship between organizational participation of the farmers and their knowledge on Binadhan-6.

2.3.11 Cosmopolitanism and adoption

Cosmopolitanism of the respondents had significant positive relationship with their adoption of selected wheat varieties was concluded by Ahmed (2006).

A study on farmer's adoption of modern maize cultivation technologies was observed by Haque (2003). He concluded that cosmopolitanism of the respondents had insignificant relationship with their extent of farmer's adoption of modern maize cultivation technologies.

Cosmopolitanism of the farmers had significant and positive relationship with their adoption of modern boro rice cultivation practices revealed by Hossain (2003) in his study.

Rahaman (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 cosmopolitanism of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Cosmopolitanism of the farmers had significant positive relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district. This statement was concluded by Hossen (2013).

A study on adoption of modern agricultural technologies by the farmers of Sandwip was conducted by Islam (2002). He reported that cosmopolitanism of the farmers had significant positive relationship with their adoption of modern agricultural technologies.

Sardar (2002) concluded that the cosmopolitanism had positively significant relationship with their adoption of IPM practices.

2.3.12 Training exposure and adoption

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a significant contribution of training exposure on adoption of modern technologies by the rice cultivators.

Training received of the respondents had significant positive relationship with their adoption of selected wheat varieties founded by Ahmed (2006) in his study.

A study on farmer's knowledge and adoption of ecological agricultural practices under the supervision of Proshika was conducted by Islam (2002). He concluded that agricultural training exposure of the farmers had no significant relationship with their adoption of ecological agricultural practices.

Sadekuzzaman (2007) concluded a study on adoption of intercropping in sugarcane by the farmers. In his study he determined that training exposure of the farmers had significant relationship on their adoption of intercropping in sugarcane.

Begum (2001) observed an insignificant positive relationship between the training received and adoption of cauliflower production technology in homestead area by the rural housewives in Savar upazila of Dhaka district.

Islam (2005) conducted a study on adoption of Pashu Pusti (cattle feed) concentration in the cattle rearing at farmers level and observed that there was a negative significant relationship between the farmer's training orientation and their adoption of Pashu Pusti (cattle feed) concentration cattle rearing.

Sonia (2009) conducted a study on adoption of vegetable cultivation in Patuakhali district and found insignificant positive relationship with training experiences.

2.3.13 Innovativeness and adoption

Mazumder (2006) found that the innovativeness of the farmers had highly significant relationship with their adoption of improved practice in litchi cultivation.

Kabir (2006) studied on adoption of selected T. Aman production technologies by the farmers and found positive and highly significant relationship between innovativeness of the farmers and adoption of T. Arnan production technologies.

A study on adoption of integrated homestead farming technologies by the rural women in RDRS conducted by Aurangozeb (2002). In his study he found that there was a significant relationship between innovativeness and adoption of integrated homestead farming technologies.

Hossen (2013) concluded in his study that innovativeness of the farmers had significant positive relationship with their adoption of intercropping with jackfruit by the farmers of Bhaluka upazila under Mymensingh district.

A study on adoption of recommended potato cultivation practices was carried out by Islam (2007). The study revealed that innovativeness of the farmers had significant positive relationship on their extent adoption of recommended potato cultivation practices.

Rahman (2005) found that the innovativeness of the farmers had no significant relationship with their adoption of modern rice varieties.

2.3.14 Knowledge about technology and adoption

Akther (2007) found that the agricultural knowledge of the farmers had significant relationship with their adoption of improved tomato varieties.

Hossain (2009) showed that knowledge on IPM of the farmers had positive significant relationship with their adoption of IPM practices.

Sarder (2002) in his study revealed that agricultural knowledge of the farmers had positively significant with their adoption of IPM practices.

Amin (2015) conducted a study at Rajapur upazila under Jhalokathi district in Bangladesh that showed a significant contribution of knowledge of modern technologies on adoption of modern technologies by the rice cultivators.

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 knowledge of the respondents and their adoption of integrated homestead farming technologies.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that agricultural knowledge of the farmers had significant relationship with their adoption of modern agricultural technologies.

Haque (2003) concluded in his study that knowledge in maize cultivation of the farmers had a significant positive relationship with their adoption of modern maize cultivation technologies.

Hossain (2006) in his study said that knowledge on HYV rice is very much positive and significant relationship with adoption of selected HYV rice.

2.3.15 Attitude towards technology and adoption

Ghose (2001) completed her study on adoption of improved cultivation practices by the sugarcane growers of non-mill zone area in Shibgang upazila and found insignificant negative relationship with attitude of growers and their adoption of improved practices.

Nira (2006) conducted a study on adoption of roof gardening at mirpur-10 area under Dhaka city. She found from her study that the attitude towards roof gardening of the respondents had a positive significance relationship with their adoption of roof gardening.

Kashem et al. (2005) conducted a research and observed that adoption of aquaculture technologies by the farmers had significant positive relationship with attitude of growers towards aquaculture technologies.

Rabbi (2006) observed that there was positive significant relationship between the attitude of farmers and their adoption of maize cultivation under sadar upazila of Thakurgoun district.

Ali (2006) conducted a study on adoption of organic manure for boro rice production at sadar upazila in Gazipur district and observed significant positive relationship between the attitude and their adoption of organic manure.

Sonia (2009) conducted a study on adoption of vegetables cultivation in Patuakhali district and found significant positive relationship between the attitude of growers and their adoption of vegetables cultivation.

Ahmed (2006) conducted a study on the adoption of selected wheat varieties by the farmers in Saintara union under Dinajpur district. He concluded that the attitude of the wheat growers towards wheat cultivation had positive significant relationship with their adoption of selected wheat varieties.

Islam (2002) revealed that the attitude of the farmers towards technology had significant positive relationship with their adoption of modern agricultural technologies.

Talukder (2006) carried out a study on the adoption of selected rice production practices by the farmers of char-land of Gomoti river. The researcher thus concluded that the attitude of the farmers towards modern agricultural technology had significant and positive relationship with their adoption of selected rice production practices.

From the past reviews, it could be concluded that the researchers have conducted researches on adoption of different farming aspects in Bangladesh. But no researcher had been conducted research to observe the adoption behavior of farmers towards hybrid rice cultivation in Khulna region. The findings of the study will fulfill the knowledge gap on this issue.

2.4 The Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute an important task. The conceptual framework of Townsend (1953) was kept in mind while framing the structural arrangement for the dependent and independent variables. The present study tried to focus two concepts: first, farmer's selected characteristics; and the second, the extent of adoption of hybrid rice varieties. The conceptual framework of the study has been presented below:

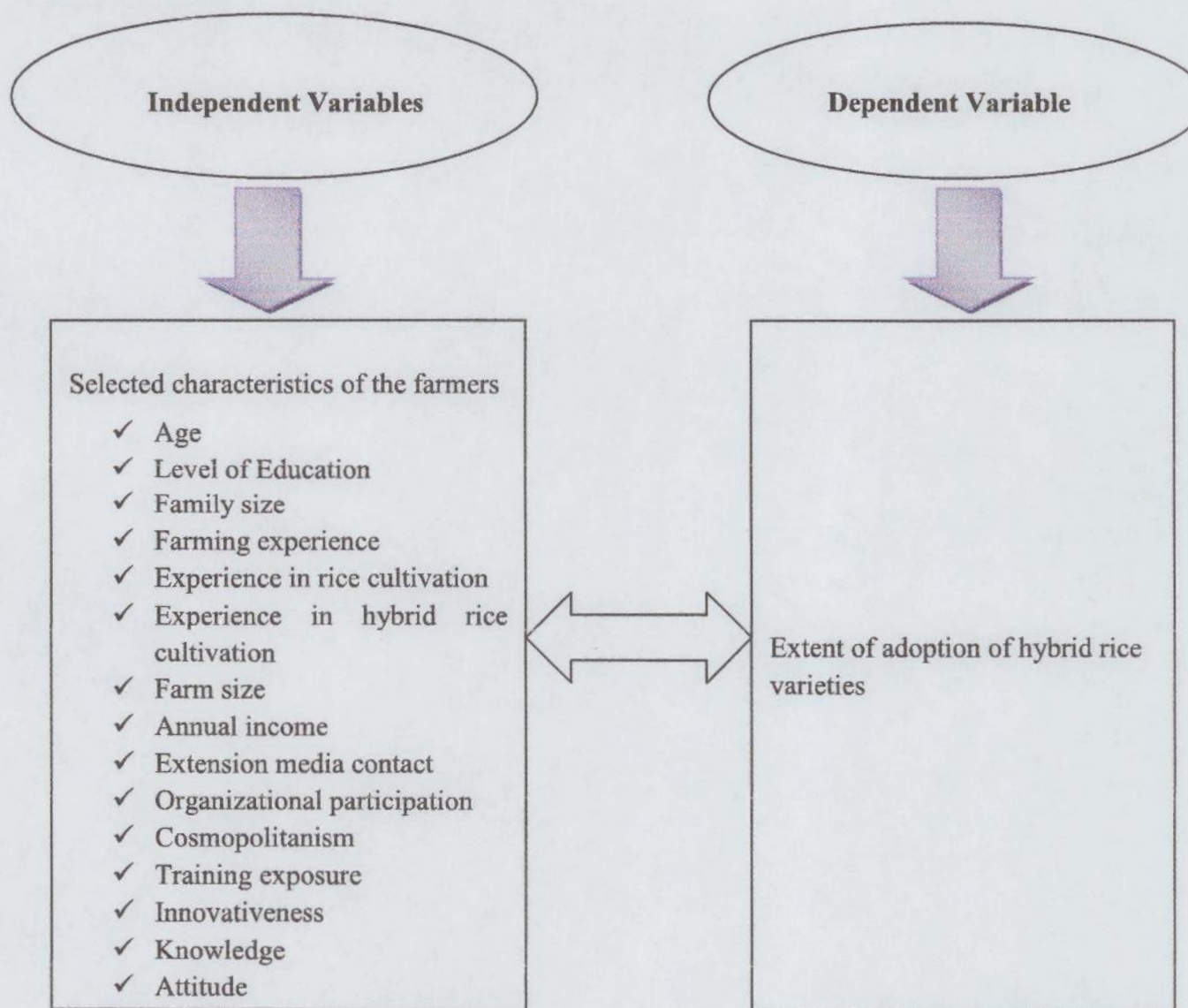


Figure 2.1: Conceptual framework of the study

CHAPTER III

METHODOLOGY

The value of scientific research is mostly based on methodology. So, methods and procedures used in conducting research need very careful consideration. An appropriate methodology that is conducted by the researcher can gather valid and reliable information. Information should properly analyze in order to arrive at correct conclusion.

The purpose of the chapter to explain comparative reflection of some variables used in the study and to analyze their dependency on each other. The methods and procedures followed in conducting the study have been discussed in this chapter. Also statistical methods and their use have been mentioned in the section of this chapter.

3.1 Design of the study

The study was carried out by following descriptive and diagnostic research design (Kothari, 2004). It was designed to determine the adoption behavior of farmers regarding hybrid rice cultivation.

3.2 Locale of the Study

The study was conducted at four selected villages of Dumuria Upazila under Khulna district. The study area is situated 8 km away from Khulna District. The area of Dumuria Upazila is 454.2 sq. km. According to the census of 2011, the Total Population: 279862; male 144334, female 135528. Map of Khulna district showing Dumuria Upazila presented in Figure 3.1 and map of Dumuria Upazila showing the study union is presented in Figure 3.2.

3.3 Population and Sampling

The farmers of the study area who were cultivating hybrid rice constituted the population of the study. Eighty (80) farmers were selected as sample through accidental sampling method from the four villages (20 from each of the villages).

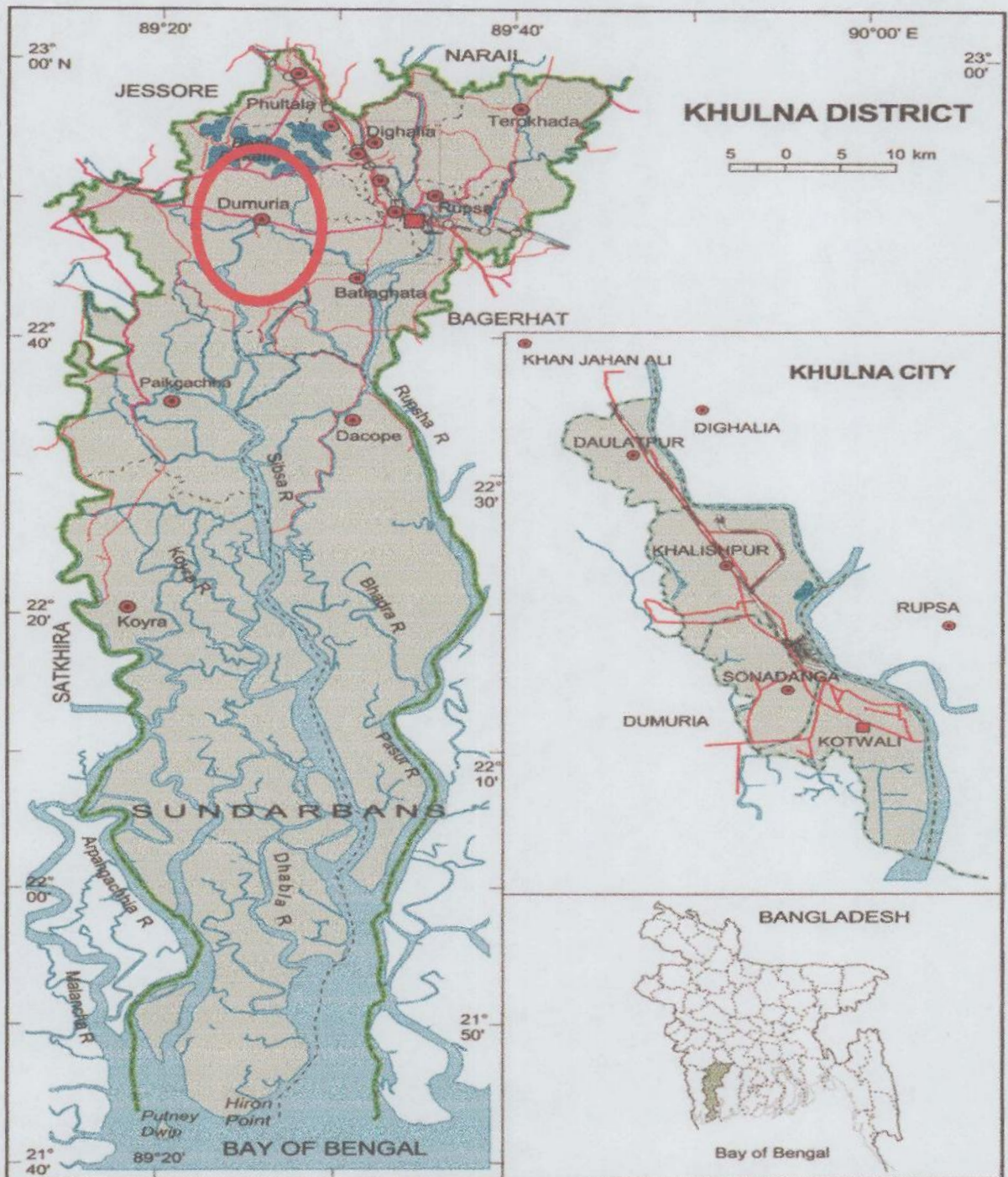


Figure 3.1: A map of Khulna district

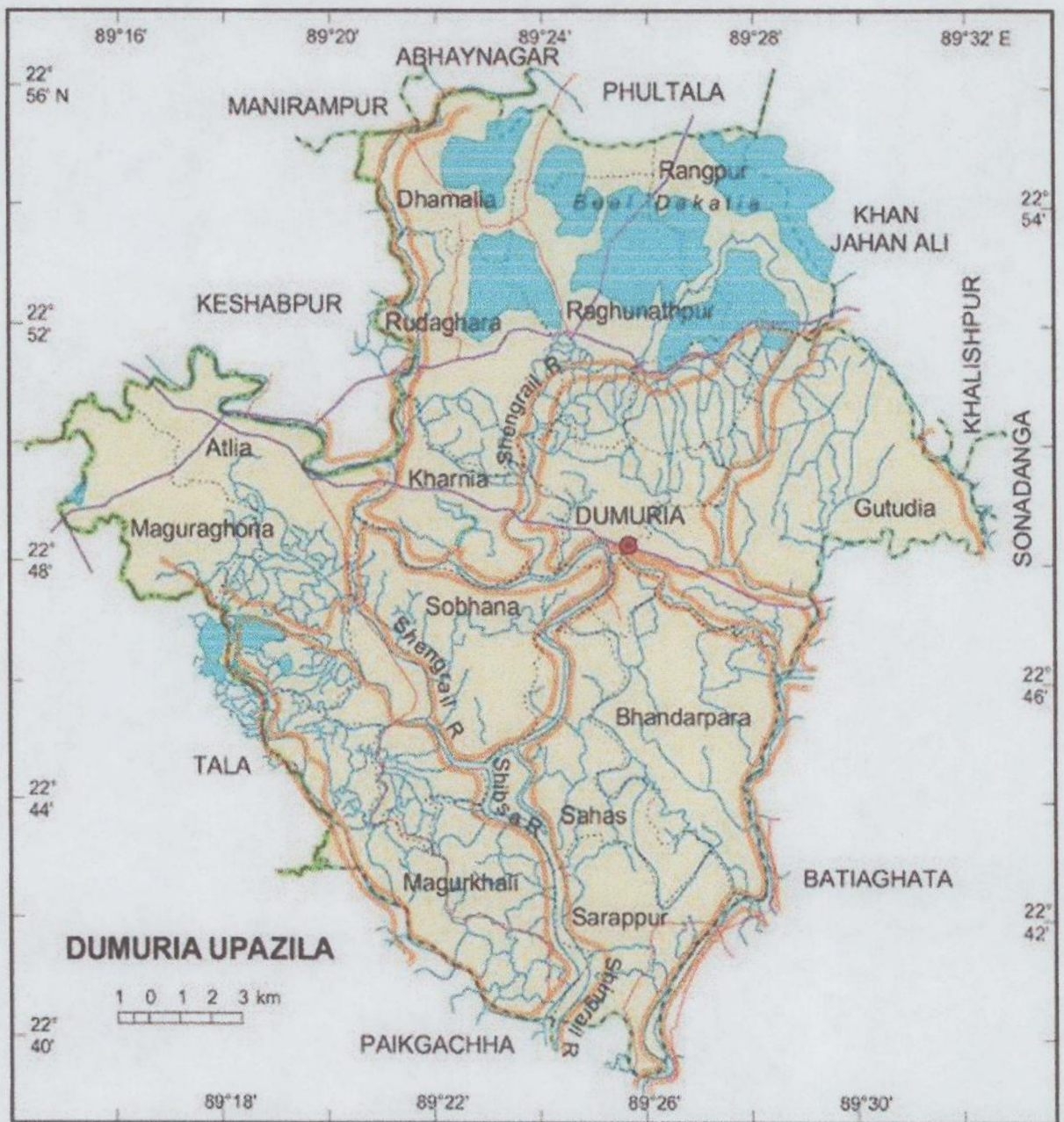


Figure 3.2: A map of Dumuria upazila showing the study union

3.4 Instrument for Data Collection

In order to collect relevant information from the respondents, an interview schedule was used. The schedule was carefully designed keeping the objectives of the study in view the dependent and independent variables. The schedule contained both open and closed questions. Most easy, simple direct questions and different scales were used to obtain the information. Direct questions were used to obtain information like age, level of education, farm size, family income, training, organizational participation etc. A closed form questions was designed to obtained information of extension media contact and attitude. Different scales were developed and used to measure organizational participation, extension media contact, attitude, cosmopolitanism etc. The questions were arranged systematically and presented clearly to help the respondents to comprehend the consequence easily. The interview schedule was pre-tested in the study area to finalize it for collection of research data. Necessary corrections, additions, alternations and adjustments were made in the interview schedule based on pretest experience. The interview schedule was then multiplied by printing in its final form for collection of data. The English version of the same interview schedule has been presented in the Appendix A.

3.5 Collection of Data

Data were collected personally by the researcher himself through face to face interview using the interview schedule. To familiarize with the study area and for getting local support, the researcher took help from the local leaders and UAO of the study upazila. The researcher made all possible efforts to explain the purpose of the study to the farmers. Rapport was established with the farmers prior to interview and the objectives were clearly explained by using local language as far as possible. Interviews of the respondents were taken at their homes and also during their farming activities. During answering questions they were mostly confident. However, if any respondent failed to understand any question, the researcher took utmost care to explain the issue. After completion of the interview, each statement was checked and verified to make sure that answer to each item had been properly recorded. Data were collected during the period of 12th January to 25th January, 2022.

3.6 Compilation of Data

After completion of field survey all the data of the interview schedule were compiled. Local units were converted into standard units. Appropriate coding and scoring technique were followed to convert the qualitative data into quantitative forms. The responses of the individual respondent contained in the interview schedules were transferred to a master sheet for entering the data into the computer. As soon as the data entered into the computer, it was then analyzed in accordance with the objectives of the study.

3.7 Statistical Analysis

Statistical measure such as number, percentage, minimum-maximum, rank order, mean and standard deviation were used in describing the independent and dependent variables of the study. For clarity of understanding tables were used to present the data. For exploring the relationships between the selected characteristics of the respondents and their extent of adoption of hybrid rice varieties Pearson's Product Moment Correlation Co-efficient (r) was computed. Data were analyzed by using software named SPSS version 25.

3.8 Selection and Measurement of variables

3.8.1 Selection of variables

Adoption behavior of farmers in terms of extent of adoption of hybrid rice was considered as dependent variable of the study where the selected characteristics of the farmers were treated as independent variables. Reviewing related studies, the researcher considered 15 characteristics of farmers as independent variables. The selected characteristics (independent variables) were age, level of education, family size, farming experience, experience in rice cultivation, experience in hybrid rice cultivation, farm size, annual income, extension media contact, organizational participation, cosmopolitanism, training exposure, innovativeness, knowledge and attitude.



3.8.2 Measurement of Variables

3.8.2.1 Measurement of adoption behavior of farmers in terms of extent of adoption of hybrid rice varieties (Dependent variable)

The overall extent of adoption of hybrid rice varieties was measured by using the following formula:

$$(\%) \text{ Extent of Adoption} = \frac{A_a}{P_a} \times 100$$

Where, A_a = Actual area under cultivation of hybrid rice varieties

P_a = Potential area for cultivation of hybrid rice varieties

Extent of Adoption of hybrid rice varieties was expressed in percentage. Based on the extent of adoption score, the respondents were classified into three categories as shown in the Table 3.1.

Table 3.1 Categories of respondents according to their extent of adoption

Categories	Score (%)
Low adoption	<60
Medium adoption	60-79
High adoption	≥ 80

3.8.2.1.1 Variety-wise Extent of Adoption and Rank order of Hybrid Rice Varieties

The farmers were directly asked to mention the name of the hybrid rice varieties as adopted by them with their extent. The extent of adoption of a particular variety was measured by using the following formula:

$$(\%) \text{ Extent of Adoption} = \frac{\sum E_a}{N_a} \times 100$$

Where, $\sum E_a$ = Summation of extent of adoption of a particular variety

N_a = Number of respondents adopt that particular variety

Extent of Adoption of hybrid rice varieties were expressed in percentage. Then it was ranked based on the percentage value in descending order.

3.8.2.2 Measurement of the selected characteristics (Independent Variables)

In this study selected fifteen (15) personal, economic, social and psychological characteristics of the farmers were considered as independent variables. Procedure for measuring independent variables mentioned under section 3.8.1 has been discussed.

3.8.2.2.1 Age

Age of the farmers refers to the period of time from his birth to the time of interview. It was measured in terms of actual years on the basis of his/her response to question no. 1 of the interview schedule (Appendix A). Based on age, the respondents were classified into different categories as shown in Table 3.2.

Table 3.2 Categories of the respondents according to their age

Categories	Score (Years)
Young aged	≤ 35
Meddle aged	36-50
Old aged	> 50

3.8.2.2.2 Level of Education

The level of education of a respondent was measured by the number of years of schooling. A score of one (1) was assigned for each year of schooling completed by the respondent. For example, if a respondent completed study of class five his/her education score was assigned as 5. The educational score of a respondent was '0' who could not read and write. Besides, a score of '0' was assigned for those who could sign their name only. Based on level of education score, the respondents were grouped into different categories as presented in Table 3.3.

Table 3.3 Categories of respondents according to their level of education

Categories	Score (Year of schooling)
Illiterate	0
Primary	1-5
Secondary	6-10
Higher secondary	11-12
Above Higher secondary	13-17

3.8.2.2.3 Family Size

The family size of a respondent was measured by the total number of his family members including himself, his family, children and other dependents who were eating and staying together. This variable has been shown in the question no. 3 of the interview schedule (Appendix A). Based on family size, the respondents were classified into different categories as shown in Table 3.4.

Table 3.4 Categories of respondents according to their family size

Categories	Score (No of family members)
Small sized family	1-4
Medium sized family	5-6
Large sized family	≥ 7

3.8.2.2.4 Farming Experience

Farming experience of a respondent was measured on the basis of years he/she involved in farming. For example, if a respondent involved in farming for one year his farming experience score was 1. Based on the farming experience scores, the respondents were grouped into following categories as shown in Table 3.5.

Table 3.5 Categories of the respondents based on farming experience

Categories	Score (Year of experience)
Low experience	1-15
Medium experience	16-30
High experience	>30

3.8.2.2.5 Experience in Rice Cultivation

The experience in rice cultivation of the respondents was measured on the basis of how long (year) they were involved in rice cultivation. For example, if a respondent was involved in rice cultivation for one year his experience in rice cultivation score was 1. Based on the rice cultivation experience scores, the respondents were grouped into following categories as shown in Table 3.6.

Table 3.6 Categories of the respondents based on experience in rice cultivation

Categories	Score (Year of experience)
Low experience	1-15
Medium experience	16-30
High experience	>30

3.8.2.2.6 Experience in Hybrid Rice Cultivation

The experience in hybrid rice cultivation of the respondent was measured on the basis of the years of his/her attachment in hybrid rice cultivation. The question to measure the experience in hybrid rice cultivation of the respondents presented in the item number 6 of the interview schedule (Appendix A). Based on the hybrid rice cultivation experience scores, the respondents were grouped into following categories as shown in Table 3.7.

Table 3.7 Categories of the respondents based on hybrid rice cultivation experience

Categories	Score (Year of experience)
Low experience	1-7
Medium experience	8-14
High experience	>14

3.8.2.2.7 Farm Size

Farm size was measured as area on which farmers continued his farming operations during the period of study. It included the area of homestead, land under family cultivation as well as those obtained from others as barga, given to others as barga and also taken as lease. The question to measure the farm size of the respondents has been presented in the item number 7 of the interview schedule (Appendix A).

The area was measured in terms of hectare. The farm size of a respondent was measured by using the following formula:

$$\text{Farm size} = A + B + 1/2(C + D) + E + F + G$$

Where,

- A. Homestead area
- B. Own land under own cultivation
- C. Own land under others cultivation
- D. Others land under own cultivation
- E. Leased in
- F. Pond/Ditches
- G. Others

Actual size of the farm was considered as the score of the farm size. For example, if a respondent had 0.05 ha of land then his score was 0.05. The data were first recorded in local unit and then converted to hectare. Based on farm size, the respondents were classified into five categories as shown in Table 3.8.

Table 3.8 Categories of respondents according to farm size

Categories	Score (ha)
Landless farmers	<0.02
Marginal farmers	0.02 -0.20
Small farmers	0.21- 1.0
Medium farmers	1.01-3.0
Large farmers	>3.00

3.8.2.2.8. Annual Income

Annual income is operationally defined as the total income of the respondents from farming and other sources for a period of one year including the income of his other family members. The response was obtained by asking the respondent the income he and his family members earned during the preceding year. Based on annual income, the respondents were classified into three categories as shown in Table 3.9.

Table 3.9 Categories of respondents according to their annual income

Categories	BDT
Low income	≤ 150000
Medium income	151000 -300000
High income	>300000

3.8.2.2.9 Extension Media Contact

It refers to the extent of exposure of the respondents to different sources of agricultural information during the last year. The procedure followed by Ranuji (2006) in order to assess the extent of exposure of the respondents in extension media with slight modification, the different activities were listed and they were asked to indicate their extent of exposure as regularly, sometimes, rarely and not at all. The scores assigned as 3, 2, 1 and 0 respectively. The extension media contact score was determined by adding all the score obtained by a respondent against 18 questions. The extension media contact score ranged between 0-54 where 0 indicate no extent and 54 indicate high extent. Based on extension media contact score, of the respondents were classified into different categories as shown in Table 3.10.

Table 3.10 Categories of respondents according to their extension media contact

Categories	Score
Low extension media contact	1-18
Medium extension media contact	19-36
High extension media contact	>36

3.8.2.2.10 Organizational Participation

Organizational participation of the respondent was measured on the basis of the number of organizations he/she involved considering the nature of participation. The organizational participation score was computed by adding all the scores against organizations he/she participated in the preceding year considering the nature of participation. Based on organizational participation scores, the respondents were grouped into following categories as shown in Table 3.11.

Table 3.11 Categories of the respondents based on organizational participation

Categories	Score
No Participation	0
Low participation	1-6
Medium participation	7-12
High participation	>12

3.8.2.2.11 Cosmopolitanism

Farmer's cosmopolitanism score was determined by the frequency of visit to the places other than his own social systems such as other villages, other union, own upazila sadar, other upazila sadar, own district sadar, other district sadar, Khulna and other cities. The score was added accordingly as frequently (3), occasionally (2), rarely (1) and not at all (0). The cosmopolitanism score was calculated by adding all the score obtained by the respondent against places of visit. The cosmopolitanism score ranged from 0 to 24 where 0 indicate no cosmopolitanism and 24 indicate high cosmopolitanism. This variable has been shown in the question no. 12 of the interview schedule (Appendix A). Based on cosmopolitanism score the respondents were classified into following categories as shown in Table 3.12.

Table 3.12 Categories of respondents according to their cosmopolitanism

Cosmopolitanism	Score
Low cosmopolitanism	1-8
Medium cosmopolitanism	9-16
High cosmopolitanism	>16

3.8.2.2.12 Training Exposure

Farmer's training score was determined by the number of training received by the respondents. For example, if a respondent received one training; his training score was '1' irrespective of its duration. This variable has been shown in the question no. 13 of the interview schedule (Appendix A). Based on training score the respondents were classified into following categories as shown in Table 3.13.

Table 3.13 Categories of respondents according to their training exposure

Categories	Score
No training exposure	0
Low training exposure	1
Medium training exposure	2-3
High training exposure	≥ 4

3.8.2.2.13 Innovativeness

Innovativeness refers to the degree to which an individual is earlier to adopt an innovation than other members of the social system. The innovativeness of the respondents about using hybrid rice varieties was determined based on time required from the first hearing to final adoption. For example, if a respondent spent one year for adoption of hybrid rice cultivation, his score was 1. The question to measure the innovativeness in using of hybrid rice varieties of respondents has been presented in the item number 17 of the Interview schedule (Appendix A). Based on the innovativeness score, the respondents were classified into following categories in Table 3.14.

Table 3.14 Categories of the respondents based on innovativeness

Categories	Score (Years)
Innovators $<(\bar{X} - 2Sd)$	<0.38
Early adaptor $(\bar{X} - 2Sd)$ to $(\bar{X} - Sd)$	0.38-3.24
Early majority $>(\bar{X} - Sd)$ to $\bar{X}$	3.25-6.10
Late majority $> \bar{X}$ to $(\bar{X} + Sd)$	6.11-8.96
Laggard $> (\bar{X} + Sd)$	>8.96

3.8.2.2.14 The Knowledge level of the respondents about Hybrid Rice

The knowledge of the respondents about hybrid rice was measured by asking 21 selected questions where a score of 2 was assigned to each of the questions. Full marks (2) were given for appropriate answer and partial score (1) was given for partially correct answer whereas 0 (zero) score was given for wrong or no answer. Knowledge score could range from 0 to 42 where 0 indicated no knowledge and 42 indicated high knowledge. Based on knowledge score, the respondents were grouped into 3 categories as shown in Table 3.15.

Table 3.15 Categories of the respondents based on knowledge about hybrid rice

Categories	Scores
Low knowledge	Up to <16.8 i.e. Up to <40%
Medium knowledge	16.8-24.78 i.e. 40%-59%
High knowledge	24.79-33.18 i.e. 60%-79%
Very High knowledge	≥33.19 i.e. ≥80%

3.8.2.2.15 Attitude of the respondents towards Hybrid Rice

To determine the attitude about hybrid rice cultivation a number of 24 statements was included in the interview schedule under item 15 (Appendix A). Each of the respondents was asked to express his/her opinion about 24 statements as either strongly agree/agree/undecided/disagree/strongly disagree. And a score of 5,4,3,2, and 1 was assigned against the particular scale respectively. The attitude score of the respondents was calculated by adding all the scores against the 24 statements. The attitude score of a respondent ranged from 24 to 120 where '24' indicate highly unfavorable attitude and '120' indicate very highly favorable attitude. The respondents were classified into following categories according to their attitude as shown in Table 3.16.

Table 3.16 Categories of respondents according to attitude towards hybrid rice

Categories	Scores
High Unfavorable attitude	1-24
Unfavorable attitude	25-48
Moderate favorable attitude	49-72
Highly favorable attitude	73-96
Very highly favorable attitude	>96

CHAPTER IV

RESULTS AND DISCUSSION

Data were collected from the respondents (farmers) and were carefully accomplished, coded, computed, tabulated and analyzed in accordance with the objectives of the study. After completion of those processes this chapter was written carefully. The findings of the study and logical interpretations of the results have been presented in this chapter.

4.1 Adoption Behavior of Farmers regarding Hybrid Rice Cultivation

4.1.1 Identification of Hybrid Rice as cultivated by the farmers of the study area

A number of 52 hybrid rice varieties were recommended by the National Seed Board of Bangladesh for cultivation in Khulna district. But the respondents adopted only 13 varieties such as SL- 8H, Tej Gold, Heera- 1, Heera- 2, Heera- 19, Sonar Bangla- 6, Shakti- 2, ACI- 1, ACI-2, ACI- 6, HRM- 604, S- 1203 and Ispahani- 2 in *boro* season and adopted 4 varieties such as Agrodhan-12, Agomoni, AZ- 7006 and Dhani Gold in *aman* season in the study area. Unfortunately there was no recommended hybrid rice variety for cultivation in *aus* season at that locality.

4.1.2 Extent of adoption of Hybrid Rice varieties of the respondents

The scores on extent of adoption of the respondents varied from 21 to 84 with a mean of 59.15 and standard deviation of 14.30. Based on extent of adoption, the respondents were classified into low (<60), medium (60-79) and high (≥ 80) percentage categories as presented in Table 4.1.

Table 4.1 Distribution of farmers according to their extent of adoption of hybrid rice

Categories	Scores (%)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low adoption	<60	31	38.75				
Medium adoption	60-79	46	57.5	21	84	59.15	14.30
High adoption	≥ 80	3	3.75				
Total		80	100				

Table 4.1 revealed that majority (57.5 percent) of the respondents showed medium adoption behavior followed by low (38.75 percent) and high (3.75 percent) adoption. The findings also

indicated that most (96.25 percent) of the respondents of the study area had low to medium level of adoption. Rahman (2001) conducted an investigation on knowledge, attitude and adoption of Aalok-6201 hybrid rice by the farmers. 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 cultivation respectively. The graphical representation of extent of adoption of hybrid rice was shown in Figure 4.1.

Hybrid rice was officially introduced in the study area in few years ago. If the extension workers work properly to popularize hybrid rice varieties it could be possible to reduce the gap between the high and medium adoption and also the percentage of low adoption would be minimized.

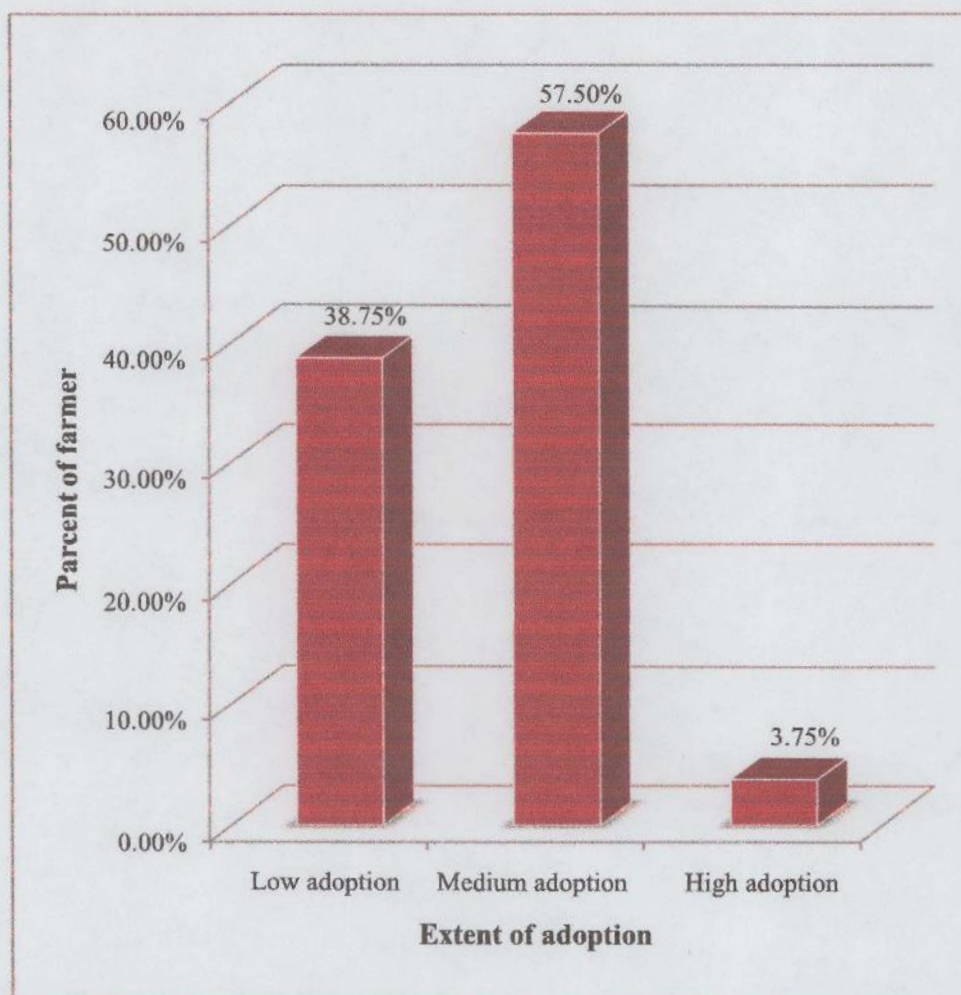


Figure 4.1: Extent of adoption of hybrid rice by the farmers

KU-lib - Acc/No- 4873.①
 12.9.2022

4.1.3 Variety-wise Extent of adoption of Hybrid Rice varieties

Table 4.2 Extent of adoption and Rank order of hybrid rice varieties

Sl. No	Hybrid Rice Variety	Extent of Adoption Index	Rank Order
1.	SL- 8H	63.5%	7 th
2.	Tej Gold	56.4%	14 th
3.	Heera- 1	62.5%	9 th
4.	Heera- 2	62.2%	10 th
5.	Heera- 19	67.5%	3 rd
6.	Sonar Bangla- 6	64.18%	6 th
7.	Shakti- 2	65.12%	5 th
8.	ACI- 1	52%	16 th
9.	ACI-2	63%	8 th
10.	ACI- 6	80%	1 st
11.	HRM- 604	65.8%	4 th
12.	S- 1203	72.6%	2 nd
13.	Ispahani- 2	55.25%	15 th
14.	Agrodhan-12	58.8%	12 th
15.	Agomoni	57.2%	13 th
16.	AZ- 7006	40%	17 th
17.	Dhani Gold	60%	11 th

Data presented in Table 4.2 indicated that variation in extent of adoption for different varieties was observed in the study area. However, farmers showed high adoption behavior to ACI- 6 (80%) while they showed less adoption behavior to AZ- 7006 (40%). The other major hybrid rice varieties as adopted by the farmers were S- 1203 (72.6%), Heera- 19 (67.5%), HRM- 604 (65.8%), Shakti- 2 (65.12%), Sonar Bangla- 6 (64.18%), SL- 8H (63.5%), ACI- 2 (63%), Heera- 1 (62.5%), Heera- 2 (62.2%), Dhani Gold (60%), Agrodhan- 12 (58.8%), Agomoni (57.2%), Tej Gold (56.4%), Ispahani- 2 (55.25%) and ACI- 1 (52%). Hossain

(2006) conducted a study with three HYV rice varieties i.e. BR26, BRRI Dhan28 and BRRI Dhan29. High extent of adoption (64.90%) was found for the variety of BRRI Dhan28 while medium and low extent of adoption was found for the varieties of BR26 (26.64%) and BRRI Dhan29 (11.68%) respectively. The graphical representation of variety-wise extent of adoption of hybrid rice varieties was shown in Figure 4.2.

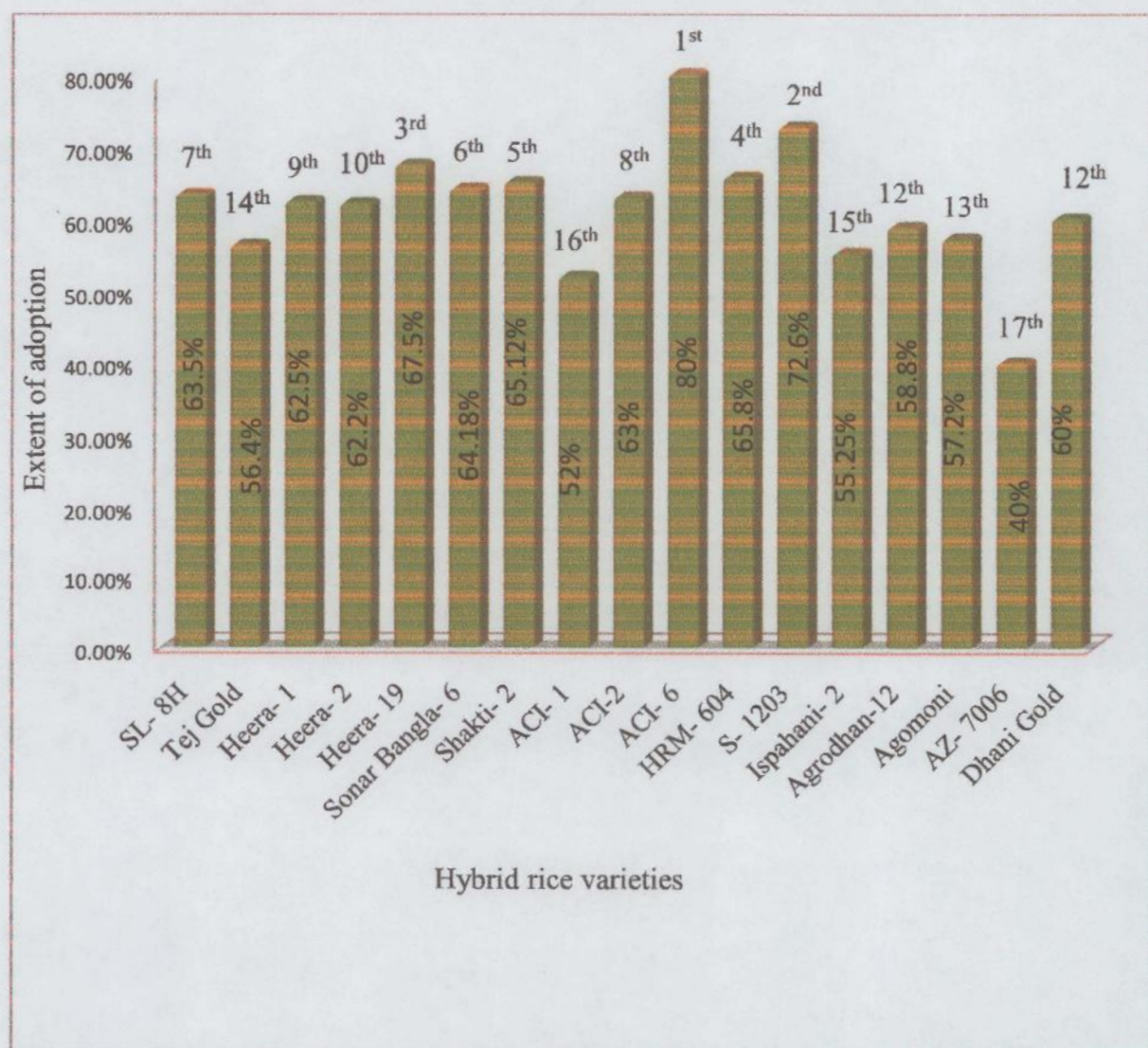


Figure 4.2: Variety-wise extent of adoption of hybrid rice by farmer

4.2 Selected Characteristics of the respondents

Fifteen characteristics of the farmers were selected to find out their relationship with the extent of adoption of hybrid rice. The selected characteristics included age, level of education, family size, farming experience, experience in rice cultivation, experience in hybrid rice cultivation, farm size, annual income, extension media contact, organizational participation, cosmopolitanism, training exposure, innovativeness, knowledge about hybrid rice and attitude towards hybrid rice. These characteristics of the farmers were described in this section.

4.2.1 Age

The age of the respondents ranged from 27 to 75 years, with a mean of 44.95 years and the standard deviation of 11.74. The distribution of the respondents according to their age categories was shown in Table 4.3.

Table 4.3 Distribution of respondents according to their age

Categories	Scores (Years)	Respondents(N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Young aged	≤35	21	26.3				
Middle aged	36-50	34	42.5				
Old aged	>50	25	31.3	27	75	44.95	11.74
Total		80	100				

Data presented in Table 4.3 indicated that the highest proportion (42.5 percent) of the respondents belonged to the middle-aged category compared to young aged (26.3 percent) and old aged (31.3 percent) categories. Data also revealed that 68.8 percent of the respondents comprised of young to middle-aged categories. Hussien (2001) also found the similar findings in his study. It was found that middle aged respondents were more interested to adopt hybrid rice. Generally young and middle aged people are receptive to new ideas and things. They have a favorable attitude towards new idea. However, the old farmers because of their longer farm experience might have valuable opinions in regard to adoption of an innovation. Sometimes traditional beliefs and dogmatism may be an obstacle of innovation-decision of old aged farmers but the middle and young aged farmers help them to get rid of from such obstacle.

4.2.2 Level of Education

The level of education score of the farmer ranged from 0-17, with a mean of 5.61 and standard deviation of 4.71. The distribution of the farmers according to their level of education categories was shown in Table 4.4.

Table 4.4 Distribution of farmers according to their level of education

Categories	Score (Years of schooling)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Illiterate	0	22	27.5				
Primary	1-5	19	23.8				
Secondary	6-10	29	36.3				
Higher secondary	11-12	6	7.5	0	17	5.61	4.71
Above Higher secondary	≥13	4	5				
Total		80	100				

Data presented in Table 4.4 revealed that highest proportion (36.3 percent) of the respondents belonged to the secondary level of education while 27.5 percent, 23.8 percent, 7.5 percent and 5 percent of the farmers belonged to illiterate, primary level, higher secondary level and above higher secondary level respectively. Rashid (2006) also observed that the highest proportion (47 percent) of the respondents had secondary level education in his study of adoption of maize production technologies by the farmers. The literacy rate of the study area (72.5 percent) was lower than national literacy rate (75.2 percent) of the country (BBS, 2021). Education broadens the horizon of outlook of farmers and expands their capability to analyze any situation related to adopt an innovation. An educated farmer is likely to be more responsive to the modern facts, ideas, and information such as hybrid rice.

4.2.3 Family Size

Family size of the respondents was ranged from 2-10, with a mean of 5.46 and standard deviation of 1.61. The distribution of the respondents according to their family size was shown in Table 4.5.

Table 4.5 Distribution of farmers according to their family size

Categories	Scores (Number)	Respondents(N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Small sized family	1-4	20	25				
Medium sized family	5-6	46	57.5	2	10	5.46	1.61
Large sized family	≥ 7	14	17.5				
Total		80	100				

Data showed in Table 4.5 demonstrated that majority (57.5 percent) of the respondents belonged to the medium sized family whereas one- fourth (25 percent) and about one- fifth (17.5 percent) of them belonged to small and large sized family respectively. Data also indicated that three-fourth (75 percent) of the respondents belonged to the medium to large family group. Talukder (2006) found similar findings in their study. Average family members of the study area were 5.46 which was higher than that of national average (4.2; BBS 2021). It means that the farmers of the study area were not aware about their family size and over- population problems. Family size can influence adoption of an innovation. Small to medium sized family members are more eager to take risk and have potentiality to take chance in case of new innovation. On the other hand, members of large family always remain busy to fulfill their basic needs and are afraid of loss of income due to adoption of new innovation.

4.2.4 Farming experience

The score related to farming experience of the respondents (farmers) ranged from 8-60 years with a mean of 22.3 years and standard deviation of 11.41. The distribution of the respondents according to their farming experience categories was shown in Table 4.6.

Table 4.6 Distribution of the farmers according to their farming experience

Categories	Scores (Years)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low	1-15	29	36.3				
Medium	16-30	33	41.3				
High	>30	18	22.5	8	60	22.3	11.41
Total		80	100				

Data arrayed in Table 4.6 demonstrated that highest proportion (41.3 percent) of the respondents were medium experienced whereas 36.3 percent and 22.5 percent were low and high experienced in farming respectively. Agriculture is a practical occupation and the farming experience of an individual helps him to learn new technologies and may lead him to adopt the right choice. Islam (2006) also found that the highest proportion (41.3 percent) of the farmers had medium farming experience with adoption of brinjal production technologies by the farmers of two selected villages of Islampur upazila in Jamalpur district of Bangladesh.

4.2.5 Experience in Rice Cultivation

The score related to rice cultivation experience of the respondents (farmers) ranged from 4-55 years with a mean of 20.3 years and standard deviation of 10.9. The distribution of the respondents according to their rice cultivation experience categories was shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their rice cultivation experience

Categories	Scores (Years)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low	1-15	33	41.3				
Medium	16-30	34	42.5	4	55	20.3	10.9
High	>30	13	16.3				
Total		80	100				

Data arrayed in Table 4.7 demonstrated that highest proportion (42.5 percent) of the respondents had medium experience in rice cultivation whereas 41.3 percent and 16.3 percent had low and high experience respectively. Adhikary et al. (2019) also found that the highest proportion (53.8 percent) of the farmers had medium experience in rice cultivation in their study of extent of adoption of BRRI recommended boro rice varieties.

4.2.6 Experience in Hybrid Rice Cultivation

The score related to experience in hybrid rice cultivation of the respondents (farmers) ranged from 1- 16 years with a mean of 6.35 years and standard deviation of 3.58. The distribution of the respondents according to their experience in hybrid rice cultivation categories was shown in Table 4.8.

Table 4.8 Distribution of the farmers according to their experience in hybrid rice cultivation

Categories	Scores (Years)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low	1-7	55	68.8				
Medium	8-14	20	25.0	1	16	6.35	3.58
High	>14	5	6.2				
Total		80	100				

Data showed in Table 4.8 demonstrated that majority (68.8 percent) of the respondents were low experienced in hybrid rice cultivation whereas 25 percent and 6.2 percent were medium and high experienced respectively. The findings also revealed that most (93.8 percent) of the respondents had low to medium experience in hybrid rice cultivation. Mou (2015) also found that the farmers belonged to high experience in vegetables cultivation category constituted the highest proportion (43.80%) followed by medium experience (34.80%), no experience (12.50%) and low experience (8.90 %) in her study of adoption of improved vegetables cultivation practices by the farmers in selected areas of Shajahanpur upazila under Bogra district.

4.2.7 Farm Size

The observed farm size scores of the farmers (respondents) varied from 0.08 hectare to 3.48 hectares. The average farm size was 0.425 hectares and the standard deviation was 0.426. The distribution of the farmers (respondents) according to their farm size categories was shown in Table 4.9.

Table 4.9 Distribution of respondents according to farm size

Categories	Score (ha)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Landless	<0.02	0	0				
Marginal	0.02-0.20	23	28.7				
Small	0.21-1.00	53	66.3	0.08	3.48	0.425	.426
Medium	1.01-3.00	3	3.8				
Large	>3.00	1	1.2				
Total		80	100				

The findings revealed that majority (66.3 percent) of the farmers possessed small sized farm while 28.7 percent, 3.8 percent and 1.2 percent having marginal, medium and large sized farm respectively. None of the respondents belonged to landless category. Azam (2006) also observed that most (85.6 percent) of the farmers possessed small sized farm in his study of adoption of wheat cultivation by the farmers of two selected villages of Basail upazila in Tangail district.

4.2.8 Annual Income

Annual income of the respondents (farmers) varied from 35000 BDT to 874000 BDT with a mean of 118918 BDT and standard deviation 110213. The distribution of the respondents according to their annual income categories was shown in Table 4.10.

Table 4.10 Distribution of farmers according to their annual income

Categories	Scores (‘000 BDT)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low income	≤ 150	66	82.5				
Medium income	151-300	10	12.5	35	874	118.91	110.21
High income	>300	4	5.0				
Total		80	100				

Data of Table 4.10 showed that most (82.5 percent) of the respondents belonged to low income whereas 12.5 percent belonged to medium income and 5 percent of the respondents had high income. Khan (2006) also found that majority (53.3 percent) had low income in his study. Table 4.10 also showed that the average annual family income of the study area was 118.91 thousand taka which was much lower than the national per-head income (219.08 thousand taka) (BBS, 2021). This might be due to the fact that the farmers in the study area were only engaged in agricultural activities. They were not earned from other sources, such as service, business etc. Besides, most (95 percent) of the respondents belonged to marginal to small sized farm categories (Table 4. 9).

4.2.9 Extension Media Contact

The observed extension media contact score of the respondents varied from 7 to 42 having an average of 22.61 with a standard deviation of 8.83. The distribution of farmers according to their extension media contact categories was shown in Table 4.11.

Table 4.11 Distribution of farmers according to their extension media contact

Categories	Scores	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low	1-18	28	35.0				
Medium	19-36	47	58.8	7	42	22.61	8.83
High	>36	5	6.2				
Total		80	100				

Data arrayed in Table 4.11 revealed that majority (58.8 percent) of the farmers exposed to medium extension media contact compared to 35 percent and 6.3 percent of them having low and high extension media contact respectively. From the Table 4.11, it might be concluded that most (93.8 percent) of the farmers had low to medium extension media contact. Haque (2005) observed almost similar findings regarding extension media contact for getting agricultural information. It could be concluded that extension agent or media of the study area were not so available for the farmers. They received information mainly from their neighbors, relatives, friends etc. So, it needs to vigorous extension works in the study area.

4.2.10 Organizational Participation

The observed organizational participation score of the farmers ranged from 0 to 8 with a mean of 1.10 and standard deviation of 1.79. The distribution of the respondents according to organizational participation categories was presented in Table 4.12.

Table 4.12 Distribution of the farmers according to their organizational participation

Categories	Scores	Respondents(N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
No	0	46	57.5				
Low	1-6	33	41.3				
Medium	7-12	1	1.3	0	8.00	1.10	1.79
High	>12	0	0				
Total		80	100				



Data presented in Table 4.12 revealed that majority (57.5 percent) of the respondents were belonging to no organizational participation category and 41.3 percent and 1.3 percent of them belonged to low and medium organizational participation categories respectively. None of the respondents belonged to high organizational participation category. Kabir (2006) also found that the highest proportion (36.2 percent) of the respondents had low participation in organizations in his study. It also revealed that majority of the respondents of the study area were confined in their farming activities. They worked hard in their crop lands to ensure two square meals. They could not make time to be involved in organizations. However, if the respondents had the opportunity to involve in more organizations it would be more helpful to adopt an innovation such as hybrid rice.

4.2.11 Cosmopolitanism

The score of cosmopolitanism of the respondents ranged from 7-27 with an average of 12.97 and a standard deviation of 4.02. The distribution of farmers (respondents) according to their cosmopolitanism categories was shown in Table 4.13.

Table 4.13 Distribution of farmers according to their cosmopolitanism

Categories	Scores	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
No cosmopolitanism	0	0	0				
Low cosmopolitanism	1-8	12	15.0				
Medium cosmopolitanism	9-16	54	67.5	7.00	27.00	12.97	4.02
High cosmopolitanism	>16	14	17.5				
Total		80	100				

Data furnished in Table 4.13 demonstrated that majority (67.5 percent) of the respondents had medium cosmopolitanism compared to 17.5 percent and 15 percent respondents had high and low cosmopolitanism respectively. None of the respondents belonged to no cosmopolitanism category. Similarly Ahmed (2006) found that the overwhelming majority (78.7 percent) of the farmers had medium cosmopolitanism in the study of adoption of selected wheat varieties by the farmers in Saintara union under Dinajpur district. Since most (85 percent) of the farmers had medium to high cosmopolitanism, it could be said that farmers of the study area were more cosmopolite.

4.2.12 Training Exposure

The observed training exposure score of the farmers varied from 0 to 6 with mean of 0.8 and standard deviation of 1.12. The distribution of the respondents according to their training exposure categories was presented in Table 4.14.

Table 4.14 Distribution of respondents according to training exposure

Categories	Scores (Number)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
No	0	41	51.2				
Low	1	25	31.3				
Medium	2-3	11	13.8	0	6	0.80	1.12
High	≥ 4	3	3.8				
Total		80	100				

Data contained in Table 4.14 indicated that majority (51.2 percent) of the respondents belonged no training exposure category whereas 31.3 percent and 13.8 percent of them were belonging to the low and medium training exposure categories respectively. On the other hand, only 3.8 percent of the respondents had high training exposure. Results revealed that most (96.2 %) of the respondents were in the categories of having no to medium level training exposure. Similar findings also found by Haque (2003).

4.2.13 Innovativeness

The score range for innovativeness was 1 to 12 with mean of 6.10 and standard deviation of 2.86. Based on innovativeness, the respondents were distributed into five categories as shown in Table 4.15.

Table 4.15 Distribution of respondents according to their innovativeness

Categories	Score (Years)	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Innovator	<0.38	0	0				
Early adaptor	0.38-3.24	14	17.5				
Early majority	3.25-6.10	34	42.5	1.00	12.00	6.10	2.86
Late majority	>6.10-8.96	12	15				
Laggard	>8.96	20	25				
Total		80	100				

Data furnished in Table 4.15 evolved that the highest proportion (42.5%) of the respondents were early majority in adopting hybrid rice varieties compared to early adopter (17.5%), laggard (20%) and late majority (12%). None of the respondents was innovator in adoption of hybrid rice varieties. It may be concluded that the farmers of the study area were not so much innovative. Innovativeness of a farmer can influence the adoption because if farmers understand that new technology has high relative advantages, compatibility with cropping system, simple to practice then persuasion and adoption will occur among the farmers towards particular innovation like hybrid rice.

The findings of this study was almost similar to the findings of Adhikary et al. (2019), who illustrated that innovator, early adopter, early majority, late majority and laggard constituted 0%, 11.3%, 71.3%, 7.5% and 10% of the respondents in their study.

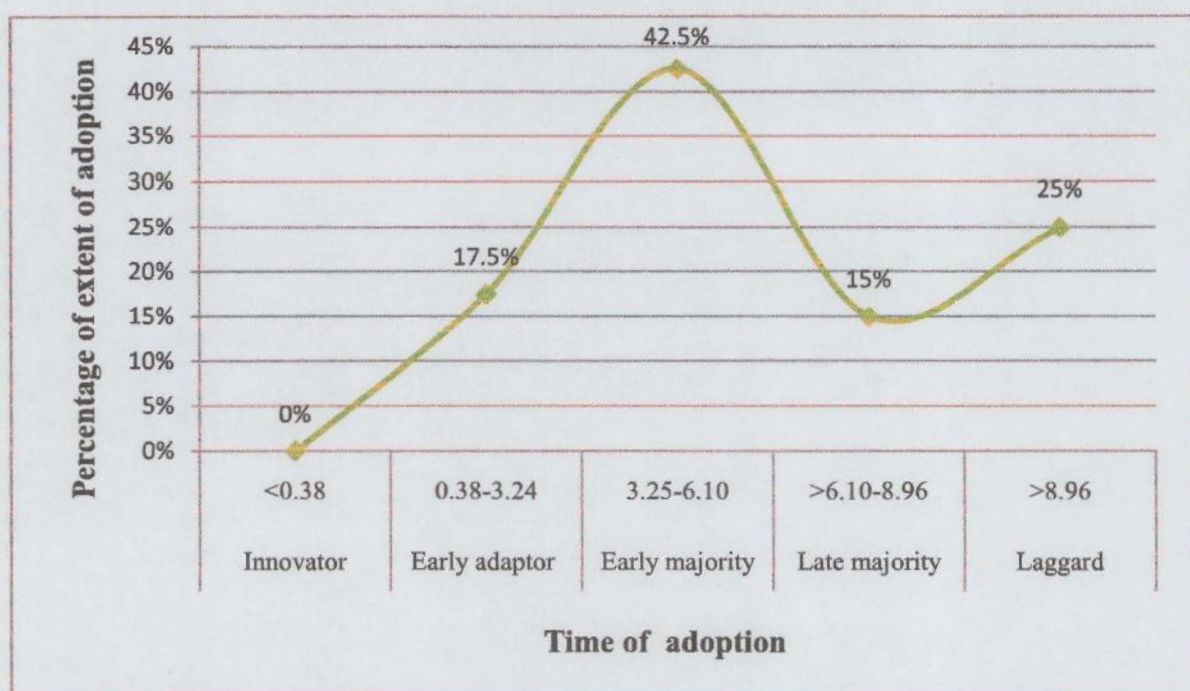


Figure 4.3: Adopter categories based on innovativeness

4.2.14 Knowledge

Knowledge of the respondents ranged from 16 to 38 with a mean of 28.86 and standard deviation of 6.07. The distribution of farmers (respondents) according to their knowledge categories was shown in Table 4.16.

Table 4.16 Distribution of farmers according to knowledge about hybrid rice

Categories	Scores	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
Low	Up to <16.8 i.e. Up to <40%	1	1.3				
Medium	16.8-24.78 i.e. 40%-59%	22	27.5				
High	24.79-33.18 i.e. 60%-79%	33	41.3	16	38	28.86	6.07
Very High	≥ 33.19 i.e. $\geq 80\%$	24	30				
Total		80	100				

Data furnished in Table 4.16 showed that highest proportion (41.3 percent) of the respondents had high knowledge about hybrid rice and 1.3 percent had low knowledge whereas 27.5 percent and 30 percent of the respondents had medium and very high knowledge respectively about hybrid rice. It also revealed that majority (71.3 percent) of the farmers in the study area

had high to very high knowledge about hybrid rice. Similar findings were found by Sardar (2002). Knowledge about hybrid rice makes the respondents aware to adopt it. Farmer's knowledge helps them to find out their problem as well as the solution of the problem. When farmers have proper knowledge on hybrid rice cultivation they can apply their knowledge and be able to find out scientific efforts in hybrid rice cultivation so that they can contribute to the national food security.

4.2.15 Attitude towards Hybrid Rice

The attitude score of the respondents varied from 46 to 104 with a mean of 73.17 and standard deviation of 13.99. The distribution of farmers according to their attitude was shown in Table 4.17.

Table 4.17 Distribution of farmers according to their attitude towards hybrid rice

Categories	Scores	Respondents (N=80)		Range		Mean	SD
		Number	Percentage	Min	Max		
High Unfavorable Attitude	1-24	0	0				
Unfavorable Attitude	25-48	1	1.2				
Moderate Favorable Attitude	49-72	39	48.8	46	104	73.17	13.99
Highly Favorable Attitude	73-96	36	45				
Very Highly Favorable Attitude	>96	4	5				
Total		80	100				

The data presented in Table 4.17 depicted that about half (48.8 percent) of the respondents had moderate favorable attitude towards hybrid rice while 45 percent, 5 percent and 1.2 percent of them had highly favorable, very highly favorable and unfavorable attitude respectively. None of the respondents had highly unfavorable attitude towards hybrid rice. Nira (2006) also found that majority (55%) of the respondents had moderate favorable attitude towards roof gardening. From the data it was clear that majority of the respondent farmers had positive attitude toward hybrid rice, which helped them to adopt it.

4.3 Relationship between the selected characteristics of the respondents and their extent of adoption of Hybrid Rice

Coefficient of correlation was computed in order to explore the relationship between the selected characteristics of the respondents and their extent of adoption to 17 hybrid rice varieties. The selected characteristics of the farmers constituted independent variables and extent of adoption of hybrid rice constituted the dependent variable of the study. In this section relationship between fifteen selected characteristics (independent variables) of the respondents and extent of adoption of hybrid rice (dependent variables) had been described.

Person's Product Moment Co-efficient of Correlation (r) had been used to test the hypothesis concerning the relationship between two variables. Five percent and one percent level of probability were used as the basis for rejection of a hypothesis. The Table value of ' r ' was calculated at $(80-2) = 78$ degrees of freedom. The summary of the results of the co-efficient of correlation indicating the relationships between the selected characteristics of the respondents and their extent of adoption of hybrid rice was shown in Table 4.18.

Table 4.18 Relationship between the selected characteristics of the farmers and their extent of adaption of Hybrid Rice

Characteristics(Independent variables)	Dependent variable (Focus Variable)	Pearson Correlation coefficient (r)
a) Age	Extent of Adaption of Hybrid Rice Varieties	-.402**
b) Level of education		.762**
c) Family size		.081 ^{NS}
d) Farming experience		-.454**
e) Experience in rice cultivation		-.436**
f) Experience in hybrid rice cultivation		.279**
g) Farm size		.149 ^{NS}
h) Annual income		.113 ^{NS}
i) Extension media contact		.740**
j) Organizational participation		.427**
k) Cosmopolitanism		.516**
l) Training exposure		.346**
m) Innovativeness		-.629**
n) Knowledge		.745**
o) Attitude		.687**

NS= Non-significant ** Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed)

Table 4.18 revealed that level of education, farming experience, experience in rice cultivation, experience in hybrid rice cultivation, extension media contact, organizational participation, cosmopolitanism, training, knowledge and attitude was positively correlated with extent of adoption of hybrid rice.

Wherever, age, farming experience, experience in rice cultivation and innovativeness of farmers was negatively correlated with extent of adoption of hybrid rice. But farm size, family size and annual income had no correlation with extent of adoption.

4.3.1 Age and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was “There is no relationship between age of farmers and their extent of adoption of Hybrid rice.” The computed value of the co-efficient of correlation (r) between age of the farmers and their extent of adoption of hybrid rice was found to be $-.402^{**}$ as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a. The relationship showed a negative trend.
- b. A high relationship was found to exist between the two variables.
- c. The computed value of “ r ” ($-.402^{**}$) was found to be greater than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected, so it can be said that age of the farmers and their extent of adoption of hybrid rice was negatively correlated with each other. The existing relationship between the concerned variables indicated that with increase of age of the farmers, the extent of adoption of hybrid rice decrease. Rahman (2005) also found that age of the farmers had significant and negative relationship with their adoption of modern rice variety. Young farmers were mostly ready to accept risk associated with investment for the adoption of hybrid rice production compared to older farmers. So, the age significantly contributed to the adoption of hybrid rice production.

4.3.2 Level of Education and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was “There is no relationship between level of education of the farmers and their extent of adoption of hybrid rice.” The computed value of the co-efficient of correlation (r) between level of education of the farmers and their extent of adoption of hybrid rice was found to be $.762^{**}$ as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A high relationship was found to exist between the two variables.
- c) The computed value of “ r ” ($.762^{**}$) was found to be larger than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected, so it can be said that level of education of the farmers and their extent of adoption of hybrid rice was positively correlated with each other. The existing relationship between the concerned variables indicates that with increase of the level of education of the farmers, the extent of adoption of hybrid rice increase. Similar findings were also observed by Hasan (2003). Education enables individuals to gain knowledge and thus increase their power of understanding. So, adoption of hybrid rice varieties would be higher by the farmers who were relatively more educated than the others.

4.3.3 Family Size and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between family size of farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between family size of the farmers and their extent of adoption of hybrid rice was found to be .081^{NS} as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A negligible relationship was found to exist between the two variables.
- c) The computed value of " r "(.081^{NS}) was found to be smaller than the tabulated value ($r=\pm 0.219$) with 78 degrees of freedom at 0.05 level of probability.

Based on the findings, the null hypothesis was accepted and it was concluded that family size of the farmers was not an important factor for extent of adoption of hybrid rice. It means family size of the farmers had no influence on extent of adoption of hybrid rice. Every farmer with small or large sized family can adopt hybrid rice. Similar result also revealed by Khan (2005) in his respective study. He concluded that family size had no significant relationship with the adoption of modern varieties of selected field crops.

4.3.4 Farming Experience and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between farming experience of farmers' and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between farming experience of the farmers and their extent of adoption of hybrid rice was found to be -.454** as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a negative trend.
- b) A high relationship was found to exist between the two variables.
- c) The computed value of “r”(-.454**) was found to be greater than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected, so it can be said that farming experience of the farmers and their extent of adoption of hybrid rice was negatively correlated with each other. The old aged farmers had high farming experience and generally they were not interested to adopt new technology. So, the existing relationship between the concerned variables indicates that with increase of the farming experience of the farmers, the extent of adoption of hybrid rice decrease. Similar result was found by Hoque (1993). He concluded that farming experiences had negative significant relationship with the adoption of improved practices in sugarcane cultivation.

4.3.5 Experience in Rice Cultivation and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was “There is no relationship between farmer’s experience in rice cultivation and their extent of adoption of hybrid rice.” The computed value of the co-efficient of correlation (r) between rice cultivation experience of the farmers and their extent of adoption of hybrid rice was found to be -.436** as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a negative trend.
- b) A high relationship was found to exist between the two variables.
- c) The computed value of “r”(-.436**) was found to be greater than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected, so it can be said that rice cultivation experience of the farmers and their extent of adoption of hybrid rice was negatively correlated with each other. The old aged farmers had high experience in rice cultivation and generally they were not interested to adopt new technology. So, the existing relationship between the concerned variables indicates that extent of adoption of hybrid rice decreased with the increased of the rice cultivation experience of the farmers. Adhikary et al. (2019) found that the experience in rice cultivation had negative but non-significant relationship in their study of extent of adoption of BRRI recommended boro rice varieties.

4.3.6 Experience in Hybrid Rice Cultivation and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between farmer's experience in hybrid rice cultivation and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between hybrid rice cultivation experience of the farmers and their extent of adoption of hybrid rice was found to be .279** as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A high relationship was found to exist between the two variables.
- c) The computed value of " r "(.279**) was found to be greater than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected, so it can be said that hybrid rice cultivation experience of the farmers and their extent of adoption of hybrid rice was positively correlated with each other. The existing relationship between the concerned variables indicates that with the increase of the hybrid rice cultivation experience of the farmers, the extent of adoption of hybrid rice increase. Similarly, Mou (2015) observed significant and positive relationship between experience in vegetables cultivation and adoption of improved vegetables cultivation practices by the farmers in selected areas of Shajahanpur upazila under Bogra district.

4.3.7 Farm Size and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between farm size of farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between farm size of the farmers and their extent of adoption of hybrid rice was found to be .149^{NS} as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A negligible relationship was found to exist between the two variables.
- c) The computed value of " r "(.149^{NS}) was found to be smaller than the tabulated value ($r=\pm 0.219$) with 78 degrees of freedom at 0.05 level of probability.

Based on the findings, the null hypothesis was accepted and it can be said that the variables of the farm size of farmers and their extent of adoption of hybrid rice were not dependent on each other. It means farm size of farmers had no influence on extent of adoption of hybrid rice. Hossain (2006) also found that the farm size of the farmers had non significant positive relationship with their adoption of selected HYV rice in Rajpat union under Kasiani upazila of Gopalganj district.

4.3.8 Annual Income and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between annual income of the farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between annual income of the farmers and their extent of adoption of hybrid rice was found to be .113^{NS} as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A negligible relationship was found to exist between the two variables.
- c) The computed value of " r "(.113^{NS}) was found to be smaller than the tabulated value ($r=\pm 0.219$) with 78 degrees of freedom at 0.05 level of probability.

Therefore, the concerned null hypothesis in this aspect could not be rejected. Based on the findings, the null hypothesis was accepted and it can be said that the variables of the annual income of farmers had no influence on their extent of adoption of hybrid rice. Any farmer having low or high annual income can adopt hybrid rice. Khanam (2012) also found that annual family income of the famers had non-significant positive relationships with the adoption of selected rice varieties.

4.3.9 Extension Media Contact and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between extension media contact of the farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between extension media contact of the farmers and their extent of adoption of hybrid rice was found to be .740** as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A high relationship was found to exist between the two variables
- c) The computed value of "r" (.740**) was found to be larger than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Hence, the null hypothesis was rejected and it can be said that extension media contact of the farmers and their extent of adoption of hybrid rice was positively correlated with each other. The existing relationship between the concerned variables indicates that with increase of the extension media contact of the farmers, the extent of adoption of hybrid rice increase. Aurangozeb (2002) observed the similar significant and positive relationship between these two variables. The finding is quite logical because extension contact makes the farmers innovative and strengthens their basic knowledge. So, the farmers having high extension media contact were highly eager to adopt hybrid rice cultivation.

4.3.10 Organizational Participation and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between organizational participation of the farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between organizational participation of the farmers and their extent of adoption of hybrid rice was found to be .427** as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A high relationship was found to exist between the two variables
- c) The computed value of "r" (.427**) was found to be larger than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Hence, the null hypothesis was rejected and it can be said that organizational participation of the farmers and their extent of adoption of hybrid rice was positively correlated with each other. This revealed that with the increase of the organizational participation of the farmers, the extent of adoption of hybrid rice increase. Rahman (2001) stated similar relationship in his respective study. People usually keep contact with different organization for enhancing their knowledge about a new innovation. They receive detail information about a technology from different sources as well as different organization. More organizational participation

Hence, the null hypothesis was rejected and it can be said that training exposure of the farmers and their extent of adoption of hybrid rice was positively correlated with each other. This expressed that the training of the farmers increases the extent of adoption of hybrid rice. Haque (2003) also found the similar findings.

4.3.13 Innovativeness and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between innovativeness of the farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between innovativeness of the farmers and their extent of adoption of hybrid rice was found to be $-.629^{**}$ as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a negative trend.
- b) A high relationship was found to exist between the two variables
- c) The computed value of " r " ($-.629^{**}$) was found to be larger than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected which expressed that existing relationship between the concerned variables indicated negative correlation with each other. This indicated that innovativeness of farmers could influence their adoption behavior towards hybrid rice where with the increase of innovativeness the extent of adoption of hybrid rice increase. This findings was deviated the findings of Masud (2007). He found that innovativeness of the respondents has no relationship with their adoption of modern maize cultivation by the farmers of Sundalpur union under Daudkandi upazila of Comilla district.

4.3.14 Knowledge and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was "There is no relationship between knowledge of the farmers and their extent of adoption of hybrid rice." The computed value of the co-efficient of correlation (r) between knowledge of the farmers and their extent of adoption of hybrid rice was found to be $.745^{**}$ as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A high relationship was found to exist between the two variables
- c) The computed value of “r” (.745**) was found to be larger than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Based on the above findings, the null hypothesis was rejected which means variables were dependent on each other and it can be expressed as with the increase of knowledge of the farmers about hybrid rice, the extent of adoption of hybrid rice increase. Sardar (2002) studied, adoption of IPM practices by the farmers under PETRRA Project of BDRS. He found that agricultural knowledge had positive significant relationship with their adoption of IPM practices.

4.3.15 Attitude and Extent of Adoption of Hybrid Rice

The Null Hypothesis (H_0) stated in this regard was “There is no relationship between attitude of the farmers and their extent of adoption of hybrid rice.” The computed value of the coefficient of correlation (r) between attitude of the farmers and their extent of adoption of hybrid rice was found to be .687** as shown at Table 4.18. The following observations were made regarding the relationship between two variables based on the variables on the correlation values.

- a) The relationship showed a positive trend.
- b) A high relationship was found to exist between the two variables
- c) The computed value of “r” (.687**) was found to be higher than the tabulated value ($r=\pm 0.287$) with 78 degrees of freedom at 0.01 level of probability.

Thus, the null hypothesis was rejected it can be said that attitude of the farmers and their extent of adoption of hybrid rice was positively correlated with each other. It means farmer's positive attitude towards the hybrid rice showed high extent of adoption of hybrid rice. Islam (2002) also found the similar significant and positive relationship between these two variables.



CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter represents the summary of findings, conclusion and recommendations of the study.

5. 1 Summary

Rice is one of the most important cereal crops in the world which is the staple food for the people of Bangladesh. However, the agriculture of Bangladesh suffers from various problems such as small, unviable and fragmented land holdings, frequent natural disasters, water stagnation, salinization, limited technological progress and low productivity of resources. There is a pressing need, however, to improve rice production to meet the demands of the growing population. To meet this challenge, it's necessary to find rice varieties with higher yield potential and in this situation hybrid rice technology is the most feasible and readily adoptable option. Hybrid rice is the first generation (F_1) crop grown from the cross of two distantly-related rice varieties and due to heterosis, hybrid rice can produce 15-30% yield advantage over the conventional rice varieties. Chinese scientists Yuan Long bred the world's first hybrid rice in 1974. In order to feed the growing population, hybrid research in Bangladesh was initiated in 1993 at the Bangladesh Rice Research Institute (BRRI). In 1998-99 widespread floods led to shortfalls in domestic seed supply, leading the National Seed Board (NSB) to allow the import of four hybrid rice varieties from China and India. In 2001, the government of Bangladesh released their first governmentally developed national hybrid, a variety called BRRI hybrid dhan-1. Meanwhile, the Department of Agriculture Extension (DAE), the mainstream extension agency of the country, is focusing on dissemination of hybrid rice among farmers. Consequently, farmers are quickly adopting hybrid rice. Khulna district is located in the south western region of Bangladesh and is familiar for rice cultivation but this area is severely saline affected. So, it is a great opportunity to adopt hybrid rice in Khulna since hybrid rice is widely adopted varieties in saline condition. There has been tremendous change in adoption of hybrid rice variety in the south-western part of Bangladesh. Farmers are eagerly adopted hybrid rice varieties because of its higher yield than traditional. After the release of hybrid varieties, due to the lack of information flow and experience with the new varieties, adoption was limited and slow. In order to prepare programs and courses of action for wider adoption of hybrid rice, it is important to know the current status of hybrid rice cultivation in Bangladesh. In this study, an effort has been made

to know the extent of adoption and to identify the existing popular hybrid rice variety as well as to measure the influence of selected characteristics of the farmers on extent of adoption of hybrid rice varieties in the study area. Data was accumulated from the hybrid rice growers of four villages namely Khalsi, Sajiara, Golna and Hajidanga of Dumuria union under Dumuria upazila of Khulna district. About 80 hybrid rice growers were treated as sample of the study. Data were collected through interview method by the researcher himself using an interview schedule during 12th January to 25th January, 2022.

5.1.1 Major Findings

5.1.1.1 Adoption Behavior of Farmers regarding Hybrid Rice Cultivation

A number of 52 hybrid rice varieties were recommended for cultivation in the coastal region of Khulna. But the respondents adopted only 13 varieties such as SL- 8H, Tej Gold, Heera- 1, Heera- 2, Heera- 19, Sonar Bangla- 6, Shakti- 2, ACI- 1, ACI-2, ACI- 6, HRM- 604, S- 1203 and Ispahani- 2 in *boro* season and also adopted 4 varieties such as Agrodhan-12, Agomoni, AZ- 7006 and Dhani Gold in *aman* season in the study area. Unfortunately there was no recommended hybrid rice variety for cultivation in *aus* season at that locality. Variation in extent of adoption for different varieties was observed in the study area. Farmers showed high adoption behavior to ACI- 6 (adoption 80%) while they showed less adoption behavior to AZ- 7006 (adoption 40%). Majority (57.5 percent) of the respondents showed medium adoption followed by low (38.75 percent) and high (3.75 percent) adoption.

5.1.1.2 Relationship between the characteristics of the respondents and their extent of adoption of Hybrid Rice

Out of fifteen independent variables level of education, experience in hybrid rice cultivation, extension media contact, organizational participation, cosmopolitanism, training exposure, knowledge and attitude of the respondents showed significant positive relationship with their extent of adoption while age, farming experience, experience in rice cultivation and innovativeness showed negative significant relationship with their extent of adoption. The remaining characteristics of the farmers, family size, farm size and annual family income had no significant relationship with their extent of adoption of hybrid rice cultivation.

5.1.1.3 Selected Characteristics of the respondents

The highest proportion (42.5 percent) of the respondents was fall in the middle-aged category compared to young aged (26.3 percent) and old aged (31.3 percent) categories. The highest proportion (36.3 percent) of the respondents belonged to the secondary level of education category while 27.5 percent, 23.8 percent, 7.5 percent and 5 percent of the farmers belonged to illiterate, primary level, higher secondary level and above higher secondary level respectively. The majority (57.5 percent) of the respondents belonged to the medium sized family whereas one-fourth (25 percent) and about one-fifth (17.5 percent) of the respondents belonged to small and large sized family respectively. The highest proportions (41.3 percent) of the respondents were medium experienced whereas 36.3 percent and 22.5 percent were low and high experienced in farming respectively. The highest proportion (42.5 percent) of the respondents had medium experience in rice cultivation whereas 41.3 percent and 16.3 percent had low and high experience respectively. Majority (68.8 percent) of the respondents were low experienced in hybrid rice cultivation whereas 25 percent and 6.2 percent were medium and high experienced respectively. Majority (66.3 percent) of the farmers possessed small sized farm while 28.7 percent, 3.8 percent and 1.2 percent having marginal, medium and large farm respectively. None of the respondents belonged to landless category. Most (82.5 percent) of the respondents belonged to low income whereas 12.5 percent belonged to medium income and 5 percent of the respondents had high income. Majority (58.8 percent) of the farmers exposed to medium extension media contact compared to 35 percent and 6.3 percent of them having low and high extension media contact respectively. Majority (57.5 percent) of the respondents were belonging to no organizational participation on the other hand, 41.3 percent and 1.3 percent were belonged to low and medium organizational participation categories respectively. None of the respondents belonged to high organizational participation category. Majority (67.5 percent) of the respondents having medium cosmopolitanism compared to 17.5 percent and 15 percent respondents having high and low cosmopolitanism respectively. None of the respondents belonged to no cosmopolitanism category. Majority (51.2 percent) of the respondents had no training exposure whereas 31.3 percent and 13.8 percent respondents were belonging to the low and medium training exposure categories respectively. The highest proportions (42.5%) of the respondents were early majority in adopting hybrid rice varieties compared to early adopter (17.5%), laggard (20%) and late majority (12%). None of the respondents were innovator in adoption of hybrid rice varieties. The highest proportion (41.3 percent) of the respondents

had high knowledge about hybrid rice and 1.3 percent had low knowledge whereas 27.5 percent and 30 percent of the respondents had medium and very high knowledge respectively about hybrid rice. About half (48.8 percent) of the respondents had moderate favorable attitude towards hybrid rice while 45 percent, 5 percent and 1.2 percent of the farmers had highly favorable, very highly favorable and unfavorable attitude respectively. None of the respondents had highly unfavorable attitude towards hybrid rice.

5.2 Conclusions

Among the recommended 52 hybrid rice varieties by the National Seed Board the respondent of the study area were adopt only 17 varieties in Boro and Aman seasons. The farmers highly adopted ACI- 6 (80%) while they showed less adoption behavior regarding AZ- 7006 (40%). Majority of the respondents had medium adoption followed by low and high extent of adoption of hybrid rice varieties. Among fifteen selected characteristics of the respondents level of education, experience in hybrid rice cultivation, extension media contact, organizational participation, cosmopolitanism, training exposure, knowledge and attitude of the respondents showed significant positive relationship with their extent of adoption while age, farming experience, experience in rice cultivation and innovativeness showed negative significant relationship. The findings of the study indicated that farmers' adoption of hybrid rice production has not up to the marks.

5.3 Recommendations

Recommendations have been divided into two sub sections, viz. recommendation for policy implementation and recommendation for the further study. Based on the findings and the conclusions of the study the following recommendations for policy implementation are presented below:

5.3.1 Recommendations for policy implication

1. Increased adoption rate of hybrid rice varieties are important for increasing the yield of rice. But most (96 percent) of the farmers had medium to low adoption of the hybrid rice. It is therefore, recommended that an effective steps should be taken by the Department of Agricultural Extension (DAE) and Non-government organizations (NGOs) for strengthening extension services for dissemination of hybrid rice varieties.

2. It is recommended that more result demonstration, field visit etc. should be performed in the farmer's fields to enhance the adoption of hybrid rice varieties.
3. Education of the respondent had significant contribution with the adoption of hybrid rice by the farmers. Therefore, it may be recommended that attempts should be taken to establish adult learning centers to increase educational level of the farmers in the study area.
4. Most of the farmers under the study area possessed marginal and small types of farm size. These farmers could give more attention to their farming operation as they generally work on their farm. Hence, the extension workers should utilize the marginal and small farmers in their extension activities to introduce hybrid rice varieties in a significant scale.

5.3.2 Recommendations for further study

The following recommendations might be helpful for the further research:

1. The present study was conducted in Dumuria Upazila of Khulna district. It is recommended that similar study should be conducted in different agro-ecological zones of the country to understand and generalize the findings.
2. The study was undertaken to explore the relationships of fifteen selected characteristics of the farmers with their extent of adoption of hybrid rice varieties as dependent variable. Therefore, it could be recommended that further studies should be conducted considering more characteristics of the farmers.
3. Adoption is the measurement of implementation by the farmers as well as vital indicator of agricultural development. It is a continuous process due to change of social system, technologies, human behavior, cropping patterns, adoption patterns etc. So, it is suggested that there should be continuous adoption research in various aspects for agricultural development.
4. Research should be undertaken on the effectiveness of agricultural extension services and other related organizations in helping farmers for adoption of technologies especially hybrid rice varieties.
5. The present study was exclusively confined to determine the adoption behavior of hybrid rice varieties. Further studies should be conducted to determine various aspects of program of other government and non-government organizations.

REFERENCES

- Adhikary, M. M., Juthi S. R., Ahmed, M. B., Billah, M. and Amin, R. 2019. Extent of Adoption of Bangladesh Rice Research Institute (BRRI) Recommended Boro Rice Varieties. *Acta Scientific Agriculture*, 3(11): 73-79.
- Ahmed, B. 2006. Adoption of selected wheat varieties by the farmers in Saintara union of Chirirbandar upazila under Dinajpur district. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Akther, L. 2007. Adoption of Improved Tomato Varieties by the Farmers in a Selected Area of Bangladesh. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Ali, M. M. 2006. Adoption of Organic Manure for Boro rice Growers at Sadar Upazila in Gazipur District. *M.Sc. (Ag. Ext. and Rural Dev.) Thesis*, Department of Agricultural Extension and Rural Development. Bangabandhu Sheikh Mujibur Rahman Agricultural University. Salna, Gazipur. pp. 31-49.
- Amin, M. R. 2015. Adoption of Modern Technologies by the Rice Cultivators in the Selected Areas of Jhalokathi District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Aurangozeb, M. K. 2002. Adoption of integrated homestead farming technologies by the rural women in RDRS. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Awal, M. A. and Siddique, M. A. B. 2011. Rice Production in Bangladesh Employing by Arima Model. *Bangladesh Journal of Agricultural Research*, 36(1): 51-62.
- Awal, M. A., Habib, A. K. M. A. and Hossain, M. A. 2007. A study on comparative performances of hybrid and conventional rice varieties in aman season. *Journal of Agriculture & Rural Development*. 5(1&2): 13-16.

- Azam, M. A. 2006. Adoption of Wheat Cultivation by the Farmers of Two Selected Villages of Basail Upazila in Tangail District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- BBS, 2016. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Ministry of planning. Government of the People's Republic of Bangladesh.
- BBS, 2021. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Ministry of planning. Government of the People's Republic of Bangladesh.
- Begum, S. 2001. Adoption of cauliflower production technologies in homestead Area by the rural housewives in savar Upazila of Dhaka District. *M.Sc. (Ag. Ext. and Rural Dev.) Thesis*, Department of Agricultural Extension and Rural Development. Bangabandhu Sheikh Mujibur Rahman Agricultural University. Salna, Gazipur. pp. 32-34.
- Bhosale, U. S. 2010. Participation of rural youth in paddy farming in Anand district of Gujarat state. *M. Sc. (Agri.) Thesis*. AAU, Anand (Gujarat).
- BNNC, 2000. Bangladesh National Nutrition Council, Dhaka, Bangladesh.
- BRRI, 2004. Adhunik Dhaner Chas, 2004 (Bangle version). Bangladesh Rice Research Institute, Gazipur, Bangladesh.
- Chowdhury, A. H. 2003. Farmers Attitude Towards Crop Diversification. *M. S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Chowdhury, A.K.M.H.U., Haque, M.E., Hoque, M.Z. and Rokonuzzaman, M., 2012. Adoption of BRRI Dhan47 in the coastal saline areas of Bangladesh. *Agricultural Journal*, 7(5): 286-291.
- El-Namaky, R.A. and Demont, M., 2013. 13 Hybrid Rice in Africa: Challenges and Prospects. *Realizing Africa's rice promise*, p.p. 173.
- Ghimire, B. and Kafle, N. 2014. Integrated Pest Management Practice and its Adoption Determinants among Apple Farmers in Mustang District of Nepal. *School Journal of Agriculture. Veterinay. Science*. 1(2): 83-89.

- Ghose. S. R. 2001. Adoption of improved cultivation practices by the sugarcane growers of now one area in Shibgang Upazila. *M.Sc. (Ag. Ext. and Rural Dev.) Thesis*, Department of Agricultural Extension and Rural Development. Bangabandhu Sheikh Mujibur Rahman Agricultural University. Salna, Gazipur. pp. 53-57.
- Goode, W. J. and Hatt, P. K. 1952. *Methods in Social Research*. Mc Graw Hill Book Company, Inc. New York.
- Haider, M. R., Halim, A. and Kashem, M. A. 2001. Adoption of improved package of practices for transplanted Aman rice cultivation. *Bangladesh Journal of Nuclear Agriculture*. 2(16 & 17): 77-84.
- Haque, M. S. 2003. A Study on the Adoption of Improved Practices in Sugarcane Cultivation in Some Selected Areas of Jossore District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Hasan, M. M. 2003. Adoption of recommended potato cultivation practices by the farmers in some selected area of Rajshahi district. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Hoque, M. F. 2005. Adoption of Selected Modern Boro Rice Varieties by the Farmers in Three Selected Villages of Sadar Upazila of Mymensing District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Hoque, M. M. 1993. Adoption of Improved Practices in Sugarcane Cultivation by the Sugarcane Growers of Sreepur Upazila Under Gazipur District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Hossain M. A. 2004. Adoption of Moder Boro Rice Cultivation Technologies by the Farmers of Homna Upazila in Comilla District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Hossain, M. K. 2006. Adoption of Selected High Yielding Varieties of Rice by the farmers of Rajpat Union under Kasiani Upazila in Gopalganj District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.

- Hossain, M. M. 2009. Use of Integrated Pest Management Practices by the Farmers of Brahmanbaria District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Hossain, M. M. 2003. Farmer's knowledge and adoption of modern boro rice cultivation practices. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Hossain, M., Bose, M. L. and Mustafi, B. A. A. 2006. Adoption and Productivity Impact of Modern Rice Varieties in Bangladesh. *The Developing Economies*, 44(2): 149-166.
- Hossain, M., Jajaiah, A. and Husain, M. 2003. Hybrid Rice in Bangladesh- Farm level Performance. *Economic and Political Weekly*, 38 (25): 2517-2522.
- Hossain, S. M. 2000. Farmers' Knowledge and Perception of Binadhan-6. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Hossen, M. M. 2013. Adoption of Intercropping with Jackfruit by the Farmers of Bhaluka upazilla under Mymensingh District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Hussen, M. A. M. 2001. Farmers' knowledge and adoption of modern sugarcane cultivation practices. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Islam, M. M. 2005. Adoption of pashu pusti in cattle rearing at farmers' level of Gazipur district. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Islam, M. S. 2002. Adoption of modern agricultural technologies by the farmers of Sandip. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

- Islam, M. S. 2006. Adoption of Brinjal production Technologies by the farmers of Two Selected Villages of Islampur Upazila in Jamalpur District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Islam, M. Z. 2007. Adoption of BRRI dhan29 Production Technologies by the Farmers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Jodder, R., Haque, M.A., Kumar, T., Jahiruddin, M., Rahman, M.Z. and Clarke, D., 2016. Climate change effects and adaptation measures for crop production in South-West coast of Bangladesh. *Research in Agriculture Livestock and Fisheries*, 3(3):pp.369-378.
- Julfikar, A. W. 2002. Hybrid Rice Research and Development in Bangladesh: Hybrid Rice for Food Security. In *Poverty Alleviation and Environmental Protection*, Hanoi, Vietnam. pp. 235-245.
- Kabir, M. H. 2006. Adoption of Selected T. Aman Production Technologies by the Farmers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Kashem, M. A., Janseen, J., Ali, M. M. and Karmakar, S. 2005. Adoption of Aquaculture Technologies by the Farmers. *Bangladesh Journal of Extension Education*, 17(1&2): 17-31.
- Khalje, M. I., Jondhale, S. G. and Walke, P. K. 2008. Knowledge and adoption of recommended package of practices for paddy crop. *Maharashtra Journal Extension Education*, 17: 33-36.
- Khan, A. I. 2006. Adoption of Modern Agricultural Technologies and Classification of the Adopters at Ramrail Union in Brahmanbaria District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Khan, A. S. M. A. 2005. Innovativeness of The farmers in The Adoption of Modern Varieties of Selected Field Crops. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

- Khan, M. A. 2002. Adopter Categories in Respect of Binasil Rice Variety in two Selected Villages of Ohagra Union of Mymensingh District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Khan, M. O. 2018. Adoption of selected hybrid rice production technologies by the farmers of Joypurhat district. Doctoral Dissertation. Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Khanam, A. 2012. Adoption of Selected Rice Varieties at Farm Level. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Kothari, C.R. 2004. Research Methodology-methods and techniques (2nd Edn). *New Age International Publishers*: New Delhi.
- Mahmud. A. B. M. S. 2006. Adoption of Modern Wheat Cultivation Technologies by the Farmers of Birganj Upazila under Dinajpur District. *M.Sc. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Rural Development. Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur.
- Masangano, C. M. and Miles, C. A. 2004. Factors Influencing Farmer's Adoption of Kalima Bean (*Phaseolus vulgaris* L.) Variety in Malawi. *Journal of Sustainable Agriculture*, 24(2): 117-129.
- Masud. M. A. 2006. Adoption of High Yielding Varieties of Rice by the Farmers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Masud. M.A. 2007. Farmer's Adoption of Modern Maize Cultivation. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Mazumder, M. G. H. 2006. Adoption of Improved Practices in Litchi Cultivation by the Litchi Growers in Sadar thana of Dinajpur district. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

- Mia, M. A. T. 2005. Adoption of Integrated Pest Management (IPM) Practices by the Vegetable Growers of Magura District. *M.S. (Ag. Ext. Edu.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Miajy, M. A. 2005. Adoption of Hybrid Varieties of Maize by the Farmers in Two Selected Unions Under Gaibandha Sadar Upazila. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Mondol, S. 2009. Adoption Behavior of Farmers Regarding Hybrid Rice Cultivation in Mymensingh District. *M. S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Mou, M. M. 2015. Adoption of Improved Vegetable Cultivation Practices by The Farmers in Selected Areas of Shajahanpur Upazila Under Bogra District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Nira, K. N. 2006. Adoption of Roof Gardening at Mirpur-10 Area under Dhaka City. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Nirmala, B. and Suhasini, K. 2013. Farmer's Experience with Hybrid Rice Technology: A Case Study of Khunti District of Jharkhand State of India. *African Journal of Agricultural Research*, 8(29): 3973-3975.
- PANAP, 2007. Hybrid Rice in Asia: Sowing the Seeds of Dependency, A Fact Sheet on Hybrid Rice. Pesticide Action Network Asia and the Pacific (PANAP), Penang, Malaysia.
- Patel, K. M. 2007. Time lag in adoption of tissue culture raised paddy plants for middle Gujarat. *Ph.D. Thesis* G.A.U., Anand (Gujarat).
- Podder, S. K. and Kashem, M. A. 2000. Use of extension contract media by the farmers in the adoption of mehersagar banana. *Bangladesh Journal of Extension Education*. 11&12(1&2): 89-94.

- Rabbi, A. H. M. F. 2006. Adoption of Maize Production Technologies Under Sadar Upazila of Thakurgaon District. *M.Sc. (Ag. Ext. and Rural Dev.) Thesis*, Department of Agricultural Extension and Rural Development. Bangabandhu Sheikh Mujibur Rahman Agricultural University. Salna, Gazipur. pp. 14-26.
- Rahman, M. M. 2005. Adoption of Modern Rice Varieties By The Farmers of Bhabakhali Union of Mymensingh. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Rahman, M. S. 2001. Knowledge, Attitude and Adoption of the Farmers Regarding Aalok-6201 Hybrid Rice in Sadar Upazilla of Mymensingh District. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Rahman, S. 2003. Environmental Impacts of Modern Agricultural Technology Diffusion in Bangladesh: An Analysis of Farmers' Perceptions and Their Determinations. *Journal of environmental Management*, 68(2): 183-191.
- Ranuji, C. R. 2006. A study on entrepreneurial behaviour of dairy farmers. *Ph. D Thesis*, University of Agriculture Science, Dharwad.
- Rashid, H. A., Julfikar, A. W., and Ali, S. 2011. History, Impact and Current Status of Hybrid Rice Research, Development and Delivery in Bangladesh. Dhaka: Agricultural Advisory Society (AAS).
- Rashid, M. M. 2006. Adoption of Maize Production Technologies by the Farmers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.
- Reza, M. S. 2007. Adoption of Modern Maize Cultivation Technologies by the Farmers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Rogers, E. M. 1995. Diffusion of innovations, 4th Edn. The Free Press. New York.
- Sadekuzzaman, M. 2007. Adoption of Intercropping in Sugarcane by the Farmers. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka.

- Sardar, M. H. U. 2002. Adoption of IPM practices by the farmers under PETRA project of RDRS. *M.S. (Ag. Ext. Ed.) Thesis*, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.
- Shah, M. M. I., Grant, W. J. and Stocklmayer, S. 2014. Adoption of hybrid rice in Bangladesh: farm level experience. *Journal of Agricultural Science*, 6 (7): 157–171.
- Shelley, I. J., Nosaka, M. T., Nakata, M. K., Haque, M. S. and Inukai, Y. 2016. Rice Cultivation in Bangladesh: Present Scenario, Problems, and Prospects. *Journal of International Cooperation for Agricultural Development*. 14: 20-29.
- Shiyam, J.O., Binang, W.B. and Ittah, M.A., 2014. Evaluation of growth and yield attributes of some lowland chinese hybrid rice (*Oryza sativa* L.) varieties in the Coastal Humid Forest Zone of Nigeria. *IOSR Journal of Agriculture and Veterinary Science*, 7(2):70-73.
- Sonia, 2009. Adoption of Vegetables Cultivation in Selected Area of Patuakhali District. *M.Sc. (Ag. Ext. and Rural Dev.) Thesis*, Department of Agricultural Extension and Rural Development. Bangabandhu Sheikh Mujibur Rahman Agricultural University. Salna, Gazipur . pp. 28-41.
- Swinkeles, R. A., Shepherd, K. D., Franzel, S., Ndufa, J. K., Ohisson, E., Sjogren, H., Franzel, S. and Scherr, S. J. 2002. Assessing the adoption potential of hedgerow intercropping for improving soil fertility, Western Kenya. Trees on the farm- Assessing the Adoption Potential of Agroforestry Practices in Africa, International Centre for Research in Agroforestry and CABI Publishing, p.p. 86-110.
- Talukdar, M. M. R. 2006. Adoption of Selected Rice Production Practices by the Farmers of Char-Land of Gomoti River. *M.S. (Ag. Ext. Ed.) Thesis*, Sher-e-Bangla Agricultural University, Dhaka.
- Townsend, J. C. 1953. Introduction to Experimental Methods. Mc Graw Hill Book Company Inc. New York.

APPENDIX A

AN INTERVIEW SCHEDULE

Agrotechnology Discipline

Khulna University

Khulna

Adoption Behavior of Farmers Regarding Hybrid Rice Cultivation in Khulna Region

Sample no.

Date:

Name of the respondent:			
Father /Husband name:			
Village:	Union:	Upazilla:	District:
Contact No. (must provide):			

1. Age (year):

2. Educational Qualification: Please put tick mark (✓) against the correct response

- a) Can't read and write
- b) Can sign only.....
- c) Class Passed
- d) PEC/JSC/SSC/HSC/Degree/Honr's/Masters Passed

3. Family size (number of member):

4. Farming experience:.....years

5. Experience in rice cultivation:..... years

6. Experience of hybrid rice cultivation:..... years

7. Farm size:

Sl No	Type/Ownership of Land	Area		Remark
		Local Unit	Hectare	
1.	Homestead area			
2.	Own land under own cultivation			
3.	Own land under others cultivation			
4.	Others land under own cultivation			
5.	Leased in			
6.	Pond/Ditches			
7.	Others			
	Total			

8. Occupation:

A) Major occupation.....() B) Subsidiary.....()

9. Annual family income:

Please mention you and your family member annual income from different sources:

A. Income from agricultural sectors

How much money did you receive from the following agricultural sectors in the preceding year?

Sl No	Income sources	Sources	Total production (Local unit)	Price/Unit (Taka)	Total price (Taka)
1.	Agriculture	Crops			
		Vegetables			
		Fruits			
2.	Livestock rearing	Cattle			
		Goat			
		Poultry			
		Others (specify)			
3.	Fisheries				
4.	Social forestry				
5.	Homestead gardening				
6.	Others (specify)				
	Total				

B. Income from non-agricultural sectors

How much money did you receive from the following non-agricultural sectors in the preceding year?

Sl. No.	Income sources	Total value (Taka)
1.	Service	
2.	Business	
3.	Day labor	
	Total	

Total income = A+B (BDT) = ... Taka



10. Extension media contact

Please state where you get the information about agricultural technology

Sl No	Communication media	Frequency of contact			
		Not at all (0)	Rarely (1)	Occasionally (2)	Regularly (3)
A.	Personal media contact				
1.	Upazilla Agricultural Officer (UAO)				
2.	Agricultural Extension Officer (AEO)				
3.	Sub Assistant Agricultural Officer (SAAO)				
4.	Other extension Officers (Livestock, Fisheries)				
5.	NGO workers				
6.	Friend/Neighbor/Relatives				
7.	Farmer Cooperative Organization				
B.	Group media contact				
1.	Village meeting				
2.	Result demonstration				
3.	Farmers field day				
C.	Mass media contact				
1.	Television				
2.	Radio				
3.	Internet/Web media				
4.	News Paper				
5.	Poster				
6.	Leaflet/Bulletin				
7.	Agriculture related book/magazine				
8.	Krishi Mela				

11. Organizational participation:

A) Are you involved in any organization? Yes () /No ()

B) If yes, then answer the following question

SI No	Name of the Serial organization (Non-political)	Extent of involvement				Duration (year)
		No Involvement (0)	General Member (1)	Executive Member (2)	Executive Officer (3)	
1.	Youth Organization					
2.	Farmer's Club					
3.	Committee (mosque/Temple /church/Mondir)					
4.	Organization (other than NGO and GO)					
5.	NGO maintained association					
6.	Government maintained association					

12. Cosmopolitanism

Please state your frequency of visits outside your town or village:

SI No	Place of visit	Frequency of visit			
		Not at all(0)	Rarely(1)	Occasionally(2)	Frequently(3)
1.	Other village				
2.	Other union				
3.	Own Upazilla Sadar				
4.	Other Upazilla Sadar				
5.	Own District Sadar				
6.	Other District Sadar				
7.	City (Khulna)				
8.	Other cities				

13. Training exposure:

Are you trained?"Yes" or "No"

If your answer is "Yes", please giving me the following information

Sl No	Title of training(s)	Duration (Days)	Venue of training	Organized by	Remark
1.					
2.					
3.					

14. The Knowledge level of farmer about hybrid rice

Sl No	Statement	Mark Assign (2)	Obtain Mark
1.	Name of some hybrid rice varieties.		
2.	Which varieties of rice produce higher yield?		
3.	What is the average yield of the hybrid rice variety?		
4.	Which varieties of rice require less production cost?		
5.	Which is the planting season of hybrid rice?		
6.	What is the duration of this rice variety?		
7.	Which is the harvesting time of hybrid rice?		
8.	What is the seed rate for hybrid rice cultivation?		
9.	What is the planting distance for hybrid rice?		
10.	Which varieties of rice have less fertilizer requirement?		
11.	What type of fertilizer is usually applied in hybrid rice production?		
12.	When and how to apply these fertilizers?		
13.	Which varieties of rice are usually less infested by insect?		
14.	Which insects usually attack hybrid rice more?		
15.	Which disease is more prevalent in hybrid rice varieties?		
16.	What type of pesticide is usually used for hybrid rice cultivation?		
17.	When and how to spray these pesticide?		
18.	When and how many times the land is irrigated in case of hybrid rice?		
19.	At which stage water requirement of hybrid rice is high?		
20.	Which stage of hybrid rice is more susceptible to weed infestation?		
21.	How many times it need to do weeding?		
	Total		

15. Attitude of farmer towards the cultivation of hybrid rice

SI No	Statement	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
1.	Hybrid rice plays an important role in agricultural production					
2.	Hybrid rice provides good yield in Khulna region					
3.	It is suitable for southwestern coastal area					
4.	Hybrid rice is more saline tolerant than other variety					
5.	Production of hybrid rich is higher compared to high yielding rice varieties					
6.	Hybrid rice cultivation is cost effective					
7.	Market price of hybrid rice is high					
8.	Nutritional quality of hybrid rice is high					
9.	Hybrid rice cultivation is more economic than high yielding varieties					
10.	Farmer is satisfied to the yield and production of this rice varieties					
11.	There are sufficient hybrid rice varieties released in Bangladesh					
12.	Quality hybrid rice seed is available in this region					
13.	There is available scientific knowledge for hybrid rice production					
14.	Lifespan of hybrid rice variety is short					
15.	Seed rate of hybrid rice is less than the other varieties					
16.	Hybrid rice is adapted with high planting distance					
17.	Fertilizer requirement of hybrid rice is less compared to other varieties					
18.	Disease infestation percentage is lower than the high yielding variety					
19.	Insect attack rate is low in hybrid rice varieties					

20.	Water requirement is low compared to high yielding variety					
21.	Weed infestation rate is low in hybrid rice					
22.	Cultivation method of hybrid rice is easier					
23.	Government support to adopt hybrid rice is sufficient					
24.	There is a need of training facilities for farmer about hybrid rice cultivation					

16. Adoption of hybrid rice variety in Khulna region

Season	Sl No	Variety	Potential area		Actual area	
			Local Unit	Hectare	Local Unit	Hectare
Boro	1.	SL- 8H				
	2.	Tej Gold				
	3.	Heera- 1				
	4.	Heera- 2				
	5.	Heera- 19				
	6.	Sonar Bangla				
	7.	Shakti- 2				
	8.	ACI- 1				
	9.	ACI-2				
	10.	ACI- 6				
	11.	HRM- 604				
	12.	S- 1203				
	13.	Ispahani				
	14.	Sufola				
	15.	Sathi				
	16.	Naveen				
	17.	Balia-1				
	Other variety (specify)					
	18.					
	19.					
Aman	1.	Agrodhan-12				
	2.	Agomoni				
	3.	AZ- 7006				
	4.	Dhani Gold				
	Other variety (specify)					
	5.					
Aus	1.					
	2.					
	3.					