USE OF INTEGRATED CROP MANAGEMENT (ICM) PRACTICES BY THE FARMERS OF PIROJPUR DISTRICT

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JUNE, 2018

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A Thesis

Submitted to the Faculty of Agricultural Extension,
Sher-e-Bangla Agricultural University, Dhaka-1207
In partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE (MS)

IN

AGRICULTURAL EXTENSION

SEMESTER: JAN-JUN, 2018

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CERTIFICATE

This is to certify that the thesis entitled **"Use of Integrated Crop Management (ICM) Practices by the Farmers of Pirojpur District"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTERS OF SCIENCE (M.S.) in AGRICULTURAL EXTENSION**, embodies the result of a piece of bona fide research work carried out by **Subarna Mazumder**, Registration No.**11-04575** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

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Dedicated to
My
Beloved Parents

ACKNOWLEDGEMENTS

The author seems it a much privilege to express his enormous sense of gratitude to the almighty for there ever ending blessings for the successful completion of the research work.

*The author feels to express her heartfelt thanks to the honorable Chairman**.** along with all other teachers and staff members of the, Sher-e-Bangla Agricultural University, Dhaka, for their co-operation during the period of the study. Agricultural University, Dhaka, for his continuous direction, constructive criticism, encouragement and valuable suggestions in carrying out the research work and preparation of this thesis.*

*The author wishes to express her earnest respect, sincere appreciation and enormous indebtedness to **Dr. Muhammad Humayun Kabir** her reverend Supervisor, Associate Professor, Department of, Agricultural Extension and Information System Sher-e-Bangla Agricultural University, Dhaka, for his scholastic supervision, helpful commentary and unvarying inspiration throughout the research work and preparation of the thesis.*

*The author wishes to express her earnest respect, sincere appreciation and enormous indebtedness to **Md. Zahidul Haque, prodessor,** Cosupervisor, Associate Professor, Department of, Agricultural Extension and Information System Sher-e-Bangla Agricultural University, Dhaka, for his scholastic supervision, helpful commentary and unvarying inspiration throughout the research work and preparation of the thesis.*

The author feels proud to express her deepest and endless gratitude to all of her course mates and friends to cooperate and help him during taking data from the field and preparation of the thesis. The author wishes to extend her special thanks to her lab mates, class mates and friends for their keen help as well as heartiest co-operation and encouragement.

The author expresses her heartfelt thanks to her beloved parents, Elder Sister and Brother and all other family members for their prayers, encouragement, constant inspiration and moral support for her higher study. May Almighty bless and protect them all.

The Author

USE OF INTEGRATED CROP MANAGEMENT (ICM) PRACTICES BY THE FARMERS OF PIROJPUR DISTRICT

ABSTRACT

The purpose of this study was to determine the extent of use of integrated crop management (ICM) practices by the farmers and to explore the relationship between selected characteristics of the growers and their use of ICM practices. The selected characteristics were age, education, family labor size, farm size, annual family income, training exposure, times spent in farming, contact with extension media and knowledge on ICM. Data were gathered from proportionally and randomly selected 110 respondents (farmers) of Kawkhali upazila under Pirojpur district by using a pretested interview schedule during the period of 1st January to 30 March, 2019. Apart from descriptive statistical methods, Pearson's Product Moment Correlation Co-efficient analysis was used in order to analyze the data. Findings indicated that the majority (96.37%) of the respondents had low to medium use of ICM and 3.63% had high use of ICM. Out of nine selected characteristics of the respondents, education, farm size, training exposure, extension contact and knowledge on ICM had positive and significant relationship with their use of ICM. To increase the use of ICM practices by the farmers, the policy makers should consider the above significant factors.

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ABBREVIATIONS AND ACRONYMS

AEZ	=	Agro-Ecological Zone
BBS	=	Bangladesh Bureau of Statistics
BCSRI	=	Bangladesh Council of Scientific Research Institute
cm	=	Centimeter
CV %	=	Percent Coefficient of Variation
DAS	=	Days After Sowing
DMRT	=	Duncan's Multiple Range Test
et al.,	=	And others
e.g.	=	exempli gratia (L), for example
etc.	=	Etcetera
FAO	=	Food and Agriculture Organization
g	=	Gram (s)
i.e.	=	id est (L), that is
Kg	=	Kilogram (s)
LSD	=	Least Significant Difference
m^2	=	Meter squares
ml	=	MiliLitre
M.S.	=	Master of Science
No.	=	Number
SAU	=	Sher-e-Bangla Agricultural University
var.	=	Variety
^oC	=	Degree Celceous
%	=	Percentage
NaOH	=	Sodium hydroxide
GM	=	Geometric mean
mg	=	Miligram
P	=	Phosphorus
K	=	Potassium
Ca	=	Calcium
L	=	Litre
µg	=	Microgram
USA	=	United States of America
WHO	=	World Health Organization

CHAPTER I

INTRODUCTION

1.1. General Background

Agriculture plays a vital role in the development of Bangladesh economy through production, employment generation and poverty alleviation. As the population of the country is ever increasing, the farm holding size of a family is ever decreasing. Practically nowadays all cultivable land is in use and the pressure of increasing population reduced the average size of the farm holding from 1.69 acres in 1996 to 1.48 acres (BBS-2014). At present we are in need of food for vast population. Production status of agricultural and livestock crop and others production related to nutrition are not sufficient according to our demand. It urgently needed to increase production of crops. Integrated Crop Management (ICM) practices can be served as an important issue to increase production of crops.

Integrated Crop Management (ICM) is a common sense approach to farming. It combines the best of traditional methods with appropriate modern technology, balancing the economic production of crops with positive environmental management (Asiabaka, 2002). It is based on understanding the intricate balance between our environment and agriculture and is a whole-farm approach in achieving a proper balance. Basic components of ICM are crop management, nutrient management, pest management, and financial management. Each of these components of ICM is associated with agricultural Best Management Practices (BMP). Each BMP overlaps between the broader components of ICM. The relationship between farm management and BMP implementation is very dynamic. For instance, crop rotations can be used for reduced erosion and nutrient mobility, increased pest prevention, and better nutrient balancing through the use of nitrogen fixing plants (Jamal, 2009). Through the process of ICM, farmers make better use of on-farm resources. In the end, ICM and subsequent improved

use of on-farm resources cause a reduced dependency on outside inputs of fertilizers, pesticides, and herbicides through the integration of farm management components and best management practices.

ICM is an approach to farming which aims to balance production with economic and environmental considerations by means of a combination of measures including crop rotation, cultivations, appropriate crop varieties and careful use of inputs. Integrated Crop Management can be thought of as a concept defining ideals and goals which then have to be 'translated' into definitions that can be implemented by farmers. Simply put, the concept is to integrate the management of individual crops in order to benefit from the interactions between them. In many respects integrating crop production strategies to provide benefits such as pest control, maintain soil fertility, etc. is an ancient technique (Suhendrata, 2008). However, ICM also takes advantage of modern technology to improve on the system.

Kawkhali upazila under Pirojpur district is an important place of various crop (cereal, pulse, vegetables and fruit) cultivation in this country. ICM production techniques can be implemented instead of conventional farming to increase production of crops and also for safe food. To expand this technique, the knowledge on the present situation of ICM in this region would be contributory to design appropriate programs for its widespread necessity. Therefore, it is necessary to conduct a study on use of integrated crop management (ICM) practices by the farmers of Pirojpur district.

1.2 Statement of the problems

Despite the fact that ICM also emerged in response to perceived problems inherent in conventional agriculture the original underlying ideology is considerably less radical than organic production. Rather than being initially conceived as an

alternative system to be operated instead of conventional farming, ICM has evolved to address perceived problems with conventional production from within the system by extending (sometimes significantly) and building on the concept of Good Agricultural Practice (Sunding and Zilberman, 2000). In keeping with this placement, ICM production techniques are not as radical as organic prescriptions, although they may still involve considerable departures from conventional production practice for many farmers. Whilst in organic production chemical inputs are frowned upon and synthetic formulations prohibited, ICM views them as harmful only in excess and the response is to reduce their use rather than to ban them completely.

Among all other agricultural practices, ICM is the best to increase the crop production by reducing the effect of harmfulness of human body and environmental pollution. Some farmers realized the benefits of the practices and responded positively to adopt this practice. Some farmers in contrast, showed totally reverse attitude. These happenings are certainly due to a number of factors. Use of ICM technologies for crop cultivation are influenced by the farmer's demographic and socio-economic position. An understanding about the same will be useful to the researchers, planners and extension workers in doing research, planning and execution of extension programs for enhancing use of ICM practice. In these respects, the answers to the following questions would be very much pertinent.

1. What is the extent of use of ICM practices by the farmers?
2. What are the characteristics of the farmers?
3. What are the relationships between farmers selected characteristics and the extent of use of ICM practices in crop cultivation?

1.3 Objectives of the Study

The following objectives are framed out in order to give an appropriate track to the research work-

1. To assess the extent of use of ICM practices by the farmers;
2. To determine and describe following selected personal and socio-economic characteristics of the farmers:
    a) Age
    b) Education
    c) Family labor size
    d) Farm size
    e) Annual family income
    f) Training exposure
    g) Times spent in farming
    h) Contact with extension media and
    i) Knowledge on ICM
3. To explore the relationship between extent of use of ICM practices by the farmers and each of their selected characteristics

1.4 Justification of the Study

The integrated crop management, which has an important role in sustainable agriculture, is described as the integrative use of all available production technologies to achieve the higher crop production. In ICM, especially eco-friendly management for sustainable agriculture has a vital importance as the alternatives to synthetic compounds use. Since the use of chemical to control insect, pest, diseases, weed etc. is not solely effective on some aspects. Besides it has unwanted side effects such as health threat, environmental pollution and pest

resistance factors give an alternative opportunity to growers to use biological and biotechnological control methods. In Bangladesh, biological control and pheromone traps are used to manage some pests. Organic manures are used instead of chemical fertilizers. Mechanized cultivation system is used to reduce traditional methods. Most of the farmers in our country are poor. They are not able to use chemical fertilizer, pesticide that will readily kill the pest. But these pesticides are toxic in nature and are hazardous to environment and human health. ICM is safe in nature and eco-friendly. On the basis of the findings of the present study specific recommendation would be made for realistic policy formulation which would help the farmers to become aware about using ICM practices instead of traditional practice.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode and Hatt, 1952). The researcher had the following assumptions in his mind while undertaking this study:

The respondents included in the sample were capable of furnishing proper responses to the questions set up in the interview schedule.

- The respondents included in the sample were capable of furnishing proper responses to the questions set up in the interview schedule.
- Views and opinions furnished by the respondents included in the sample were the representative views and opinions of the whole population of the study area.
- The responses furnished by the respondents were reliable. They expressed the truth about their convictions and awareness
- The researcher acted as interviewer was very well adjusted to the social and cultural environment of the study area. Hence, the respondents furnished their correct opinions without any kind of hesitation.

- The data collected by the researcher were free from bias and they were normally and independently distributed.
- The items included in the interview schedule for measuring use of ICM practices were adequate to reflect the extent of use of ICM practices by the farmers of that locality.

1.6 Limitations of the Study

The present study was undertaken with a view to know the extent of using ICM practices by the farmers. In order to conduct the research in a meaningful and manageable way, it became necessary to impose some limitations in certain aspects of the study. Considering the time, money, labor and other necessary resources available to the researcher, the following limitations have been observed throughout the study:

- The study was confined to three villages namely Asoa, Amrajhuri and Kumian of Kawkhali union under Kawkhali upazila under Pirojpur district.
- Characteristics of the farmers were many and varied but only nine characteristics were selected for investigation in this study.
- The extent of using ICM practices of farmers was measured on the basis of their response to the selected statements.
- The findings could be applicable for the study area and similar situations in physical, socio-economic cultural and geographic conditions only.
- Finally, for collection of information, the researcher had to depend on the data furnished by the respondents during their interview with him. As none of the farmers kept records of their farming activities, they furnished information to the different questions by recall.
- In some cases, the researcher faced unexpected interference from the over interested side talkers while collecting data from target respondents.

However, the researcher tried to overcome the problems as far as possible with sufficient tact and skill.

1.7 Definition of Terms

A concept is an abstract of observed thing, events or phenomenon or in other words, it is a short hand representation of variety of facts (Wilkinson and Bhandarkar, 1977). A researcher needs to know the meaning and contents of every term that he uses. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted as follows:

1.7.1 Age

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

1.7.2 Education

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

1.7.3 Family labor size

Family labor size is defined as the number of family members are involved in agricultural activities directly or indirectly.

1.7.4 Farm size

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

1.7.5 Annual family income

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

1.7.6 Training exposure

It referred to the total number of days that a respondent had exposure training from DAE, NGOs or other organizations under different training program.

3.7.7 Times spent in farming

Time spent in refers that the family members who are directly or indirectly related to his/her own agricultural production and how many times they spent in their agricultural activities in a week.

3.7.8 Contact with extension media

It is referred to the respondent's becoming accessible to the influence of different information media through different extension teaching methods.

3.7.9 Knowledge on ICM Practices

Literally knowledge means knowing or what one knows about a subject, fact, person etc. Knowledge on ICM practices referred to farmers' understanding of the facts, phenomena and methods in different aspects of ICM practices.

1.7.10 Variable

A general indication in statistical research of characteristic that occurs in a number of individuals, objects, groups etc. and that can take on various values, for example the age of an individual.

1.7.11 Hypothesis

Defined by Goode and Hatt (1952), a proposition which can be put to "a test to determine its validity". It may be true or false, it may seem contrary to or in accord with common sense. However, it leads to an empirical test.

1.7.12 Null hypothesis

The hypothesis which is picked for statistical test is null hypothesis (Ho). In this study the null hypothesis was stated that there was no relationship between the concerned variables and use of selected recommended ICM practices.

1.7.13 Integrated crop management (ICM)

Integrated Crop Management (ICM) is a common sense approach to farming. It combines the best of traditional methods with appropriate modern technology, balancing the economic production of crops with positive environmental management (Jamal, 2009).

ICM is a method of farming that balances the requirements of running a profitable business with responsibility and sensitivity to the environment. It includes practices that avoid waste, enhance energy efficiency and minimize pollution. ICM combines the best of modern technology with some basic principles of good farming practice and is a whole farm, long term strategy.

ICM is a 'whole farm approach' which is site specific and includes:

- the use of crop rotations
- appropriate cultivation techniques
- careful choice of seed varieties
- minimum reliance on artificial inputs such as fertilizers, pesticides and fossil fuels
- maintenance of the landscape
- the enhancement of wildlife habitats

CHAPTER II

REVIEW OF LITERATURE

The rationale of this chapter is to review the literature having consequence to the present study. Therefore, the findings of such studies related to the extent of use of integrated crop management (ICM) by the farmers and other partial studies have been reviewed in this chapter. The reviews are accessibly existed here based on the major objectives of the study. This chapter consists of three sections. The first section deals with the general use of various practices related to ICM practices by the farmers; second section is dedicated to an observation on the findings related to the relationship between the selected characteristics of the ICM adopters and their trend of use and third section is approach the conceptual framework of the study.

2.1 Review of literature on general content of using technology

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

Hossain (2009) conducted a study on use of integrated pest management practices by the farmers of Brahmanbaria district. The study revealed that 57 percent of the farmers were medium users, while 22 percent were low users and 21 percent were high users of IPM practices.

Hossain (2006) revealed that the highest proportion (49 percent) of farmers had medium use, while 26 percent had high use and 25 percent had low use of selected high yielding varieties of rice.

Rahman (2003) revealed that about half (47 percent) of the growers had medium use, 44 percent had low and 1 percent had high use of year round homestead fruit cultivation practices.

Haque (2003) found that the majority (47 percent) of the growers had medium use of modern maize cultivation technologies while 28 percent had high use and 25 percent low use.

Rahman (2003) found that ninety seven percent of the pineapple growers adopted 2-4 intercrops *viz*, Zinger, turmeric, sweet ground and aroid in pineapple cultivation.

Salam (2003) found that an overwhelming majority (94 percent) of the respondents were found having high constraints in adopting environmentally friendly farming practices while 6 percent had medium constraints. No farmer was found having low constraint.

Hasan (2003) found that majority (60 percent) of the farmers had medium use while 33 percent had low use and 7 percent had high use of recommended potato cultivation practices.

Rahman (2003) revealed that about half (47 percent) of the growers had medium use, 44 percent had low and 9 percent had high use of year-round homestead fruit cultivation practices.

Sardar (2002) studied on use of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high use of IPM practices.

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

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

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

Sardar (2002) studied on "use of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high use of IPM practices.

Aurangojeb (2002) studied on the extent of use of integrated farming technology by the rural women in RDRS. He observed that the highest percent of rural women (64%) used high level, 28% of the women used medium level and only 8% used low level integrated homestead farming technologies.

Haider *et al*. (2001) observed that one-third (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 two thirds (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.

Haider *et al*. (2001) studied the use level of improved Package of practices for T. aman rice cultivation in Gouripur upazila of Mymensingh district. He found that the use level of farmers categories were 5 percent non use, 62 percent low use, 24.5 percent medium adopter and 8.5 percent high adopter. Vast majority (95 percent) of the farmers adopted MV programme of T. aman rice.

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

Mostafa (1999) studied the use of recommended mango cultivation practices by the mango growers of Nawabganj Sadar thana. He found that about half (49 percent) of the mango growers had “low use” 31 percent “very low” use and 20 percent had “medium” use of fertilizers.

Muttaleb *et al*. (1998) found that over all use of plant protection practices was medium. Among the plant protection practices high use were observed in fungicides, insecticide and soil treatment and low use were found that treatment

and low use were found in suberization of cut tuber hand picking of cutworm and rouging of diseased plant.

Islam (1996) carried out a study on farmer's use of indigenous technical knowledge (ITK) in the context of sustainable agricultural development. He found the extent use of ITK by individual farmers that, the highest proportion (42.73 percent) of the respondents belonged to the lower user category as compared to 41.82 percent in the moderate user category and 15.45 percent in the higher user category, respectively.

Hasan (1996) found in his study that the highest proportion (44 percent) of the respondents perceived the existence of medium use, compared to 26 percent low use and 3 percent high use in respect of selected agricultural technologies.

Siddaramaiha *et al*. (1995) studied use of improved Seri-cultural practices among big and small farmers. They indicate that there was cent percent use in following the recommended system of planting by both big and small farmers. Other practices use by a large percentage of farmers was: optimum time of planting (95%), use of recommended irrigation schedule (93.75%), recommended spacing (91.25%) and the use of improve variety of mulberry crop (87.50%). Nearly half of the respondents used the recommended quantity of farmyard manure and plant protection chemicals in mulberry cultivation.

Nikhade *et al*. (1995) found that the use gap about the use of recommended technology of cotton among cotton growers was found to be about 30 percent which was quite high.

Nikhade *et al*. (1993) observed in their study on use of improved practices of soybean cultivation that cent percent adopted improved varieties. More than 82 percent had complete use of package practices like timely sowing, spacing and

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

Kashem *et al*. (1992) conducted a study on use behaviour of sugarcane growers of Zilbangla Sugar Mill, Dewanganj. Jamalpur, Bangladesh. They found among the sugarcane growers, 89 percent had high level of use of recommended practices of sugarcane.

2.3 Relationship between Farmers' Characteristics with their Use of ICM practices

ICM includes the integration of some modern practices like IPM, IDM, IWM, INM, improved agricultural technologies like high yielding varieties, mechanized cultivation etc. Relationship between farmers' characteristics with their use of ICM practices are given below under the following headings:

2.3.1 Age and use of ICM

Hossain (2009) found that age of the farmers had positive significant relationship with their use of IPM practices.

Hossain (2006) conducted a study on use of integrated pest management practices in Rice field by the farmers in Tapodhan union under Rangpur District. He found that age of the farmers had no significant relationship with their use of IPM practices.

Talukder (2006) found that the age of the farmers had a significant positive relationship with their use of selected rice production practices.

Khan (2003) observed that there was significant and positive relationship between age of the farmers and their use of IPM Practices.

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

Sardar (2002) found that the age of the farmers had positive significant negative correlation with their use of IPM practices.

Aurangozeb (2002) observed that there was significant negative relationship between age and use of integrated homestead farming technologies.

Hussen (2001) found that the age of the farmers had negative significant relationship with their use of modern sugarcane cultivation practices.

Sarker (1997) observed that there was no significant relationship between ages of the farmers with their use of improved potato cultivation practices.

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

Islam (1993) observed that there was no relationship between the age of potato growers with their use of improved practices in potato cultivation. Similar results were observed by Karim and Mahaboob (1986), Rahman (1986), Kher (1992), Pathak *et al*. (1992),

Kashem and halim (1991) observed that there was positive and significant relationship between the age of the marginal farmers with their use of jute technologies. Similar results were found by Ali *et al*. (1986), Singh and Rajendra (1990), Okoro *et al*. (1992), Narwal *et al*. (1991).

2.3.2 Education and use of ICM

Hossain (2006) concluded that the education of the farmers had a significant and positive relationship with their use selected of HYV rice. Similar findings were also observed by Haque (1993).

Hossain (2003) concluded that education of the farmers had a significant and positive relationship with their use of modern Boro rice cultivation practices.

Sardar (2002) found that the education of the farmers had significant positive relationship with their use of IPM practices.

Aurangozeb (2002) studied on the extent of use of integrated homestead farming technologies by the rural women in RDRS. He observed that there was positive relationship between education and use of integrated homestead farming technologies.

Hussen (2001) indicate that the education had positive significant relationship with their use of modern sugarcane cultivation practices.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato cultivation practices in five villages of Comilla District. He found that education of potato growers had significant relationship with their use of improved potato cultivation practices. Similar results were found by

Hasan (1996) concluded a study on use of some selected agricultural technologies among the farmers as perceived by the frontline GO and NGO workers. He observed that education have no significant relationship with the perceived use of selected agricultural technologies. Similar results were found by Kher (1992) and Islam (1996). Bavalatti and Soundaarswamy (1990) observed no significant relationship between education of the farmers and their use of dry land farming practices.

Kaur (1988) found that education influenced the opinion of the women about use of vegetable gardening animal husbandry etc.

2.3.3 Family labor size and use of ICM

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

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

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

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

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

Hossain (1991) in his study in sadar thana of Jamalpur observed that family labor size of the farmers had no significant effect on their use of improved farm practices. Similar results were observed by Hoque (1993), Bashar (1993),

Hossain (1999) also found that family size of the farmers had positive significant relationship with the use of agro-chemical. Similar results were also observed by Pal (1995), Muttalab (1995), Sarker (1997), Rahman (1986), Hoque (1993) and Khan (1993).

2.3.4 Farm size and use of ICM

Hossain (2006) found that the farm size of the farmers had an insignificant relationship with their use of selected HYV rice.

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

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

Rahman (2001) conducted a study on knowledge, attitude and use of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that farm size of the farmers had a significant and positive relationship with their use of Aalok 6201 hybrid rice.

Hussen (2001) found that the farm size had positive significant relation with their use of modern sugarcane cultivation practices.

Alam (1997) studied the use of improved farm practices in rice cultivation by the farmers. The findings of the study showed that the farm size had a significant relationship with their use of improved farm practices in rice cultivation. Islam (1996) found that there was significant and negative relationship between the farm size of the farmers with their extent of use of indigenous technical knowledge. Ali *et al*. (1986), Hoque (1993) and Hasan (1996) observed similar relationships.

Hossain and Crouch (1992) studied the relationship of farm size with use of farm practices. They found positive relationship between the farm size and use of farm practices. Similar result was found by Kashem (1991).

Gogoi and Gogoi (1989) in their study observed that size of land holding of farmers had a significant relationship and positive effect on their use of plant protection practices.

Hossain (1983) found that size of the farm of transplanted aman farmers in Bhabakhali union of Mymensingh district had a negative relationship with their use of HYVT-aman rice.

2.3.5 Annual family income and use of ICM

Hossain (2003) revealed that annual income of the farmers had a significant relationship with their use at modern Boro rice cultivation practices.

Aurangozeb (2002) observed that there was a positive relationship between annual income from field crop and use of integrated homestead farming technologies.

Rahman (2001) conducted a study on knowledge, attitude and use of the farmers regarding Alok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that annual income of the farmers had a significant and positive relationship with their use of Aalok 6201 hybrid rice.

Hussen (2001) found that the annual income had positive significant relationship with their use of modern sugarcane cultivation practices.

Sarker (1997) found that family income of potato growers had a significant positive relation with their use of improved potato cultivation practices. Similar results were observed by Hossain (1999), Rahman (1986), Kashem (1991), Pal (1995), Islam (1993), and Khan (1993).

Islam (1996) found a significant negative relationship between the annual income of the farmers and their extent of use of ITK. Hossain (1983) and Hoque (1993) found similar results.

Singh (1991) in a study found that income of the farmers was significantly associated with the level of use of plant protection measures.

2.3.6 Training exposure and use of ICM

Haque (2003) found that training exposure of the respondent had positive significant relationship with their practices in farmer's use of modern maize cultivation technologies.

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

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

2.3.7 Times spent in farming and use of ICM

Islam (1993) found a significant relationship between time spent in farming of the farmers and their use of recommended doses of fertilizer and plant protection measures in potato cultivation.

Kashem and Halim (1991) repotted that time spent of the farmers had significant positive correlation with their use of modern rice technology use of communication media in live stock production.

2.3.8 Contact with extension media and use of ICM

Hossain (2006) concluded that the extension contact of the farmers had positive significant relationship with their use of selected HYV rice.

Haque (2003) concluded that extension contact of the farmers had significant positive relationship with their use of modern maize cultivation technologies.

Sardar (2002) concluded that the extension contact had positively significant relationship with their use of IPM practices.

Aurangozeb (2002) observed that there was significant relationship between contact with extension media and use of integrated homestead farming technologies.

Rahman (2001) conducted a study on knowledge, attitude and use of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that extension contact of the farmers had a significant and positive relationship with their use regarding Aalok 6201 hybrid rice.

Hussen (2001) found that the extension media contact had positive significant relationship with their use of modern sugarcane cultivation practices.

Sarker (1997) observed a positive and significant relationship between extension contact and use of improved potato cultivation practices. Karim (1973), Kashem *et al*. (1990), Kashem (1991), Pathak *et al*. (1992), Kher (1992), Islam (1993), Hoque (1993) and Pal (1995) also found the similar results.

Slade *et al*. (1988) studied that use rates among farmers receiving one or more VEW visits per month were generally higher than those farmers who were not visited by VEW'S contact farmers were better adopter of some technologies that non contact farmers.

Osunloogun *et al*. (1996) studied use of improved Agricultural practices by co-operative farmers in Nigeria. The findings of the study indicated a positive relationship between extension contact and use improved practices.

Bezbora (1980) studied use of improved agricultural technology by the farmers of Assam. The study indicated a positive relationship between extension contact and use of improved cultivation practices.

2.3.9 Knowledge on ICM Practices and use of ICM

Most of the researchers found very high relationships between farmers' knowledge on a particular technology and its use. Koch (1985) conducted a study in the North Western organize free state of South Africa concerning perception of agricultural innovations aspiration, knowledge and innovation use. He observed that there was a strong positive relationship between knowledge and practice use.

Reddy *et al*. (1987) found that the significant association between knowledge and use of improved package of practices in paddy production by participant and non-participant farmers.

Rahman (1995) in his study observed no significant relationship between farmers' use of improved practices and their knowledge on improved practices of potato cultivation.

Moullik *et al*. (1996) conducted a study on predictive values of some factors of adopting nitrogenous fertilizers by the north Indian farmers in India. He found a significant positive relationship between agricultural knowledge and use of nitrogenous fertilizers among the cultivators.

Alam (1997) observed that agricultural knowledge of the rice growers had significant relationship with their use of farm practices in rice cultivation.

Sarkar (1997) found that potato production knowledge of potato growers had a positive and significant relationship with their use of improved potato cultivation practices.

Sardar (2002) studied use of IPM practices by the farmers under PETRRA Project of BDRS. He found that agricultural knowledge had positive significant relationship with their use of IPM practices.

Ahmed (2006) found in his study that knowledge on wheat cultivation of the respondents had significant positive relationship with their use of selected wheat varieties.

2.4 The Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute an important task. Properly constructed hypothesis of any research contain at least two variables namely, causal variable and focus variable. Selection and measurement of those variables is also crucial. Based on these above discussion and the review of literature, the conceptual framework of this study has been formulated and shown in figure 2.1.

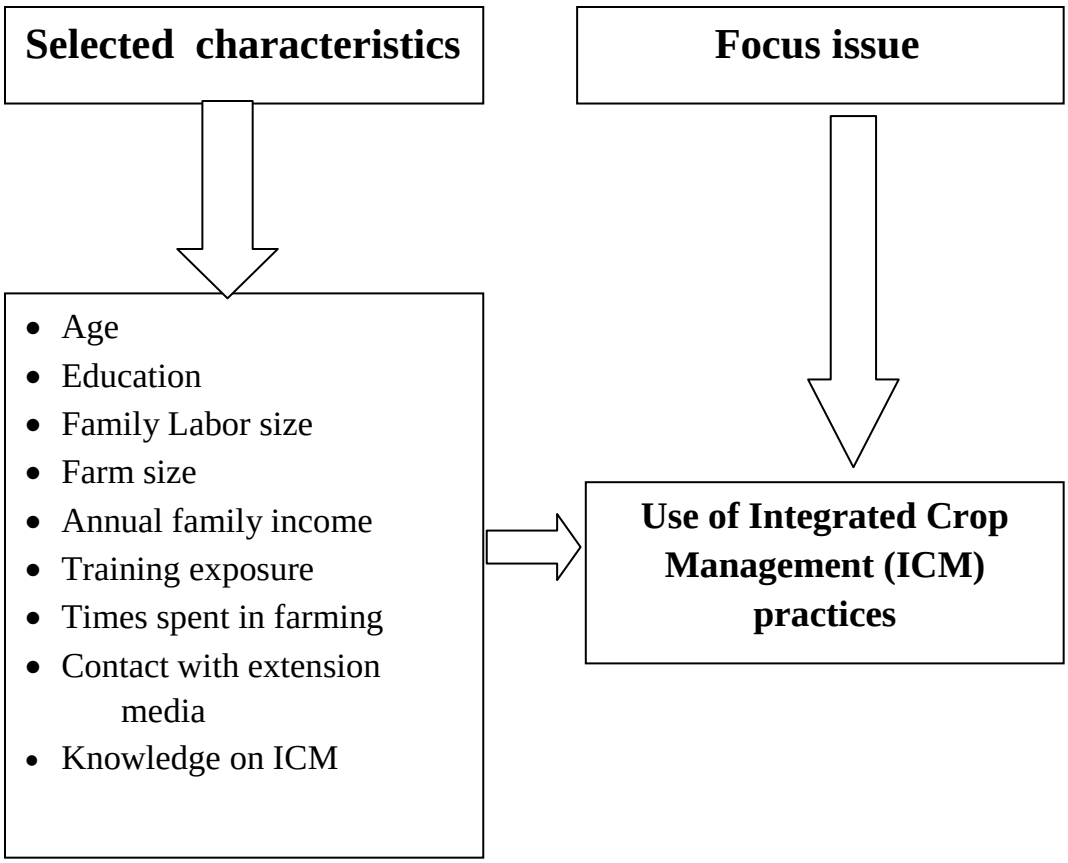

Fig. 2.1 Conceptual Framework of the study

CHAPTER III

MATERIALS AND METHODS

Methodology deserves a very careful consideration in a scientific research. This chapter covers precise method and procedure followed during the course of research work as well as preparation of manuscript. The blueprint used in carrying out investigation has been outlined in this chapter. It is one of the most important parts before conducting a research work. The researcher has great responsibility to describe clearly as to what sorts of research design, methods and procedures he would follow in collecting valid and reliable data and to analyze and interpret those to arrive at correct summery and conclusion. Further, the chapter includes the operational format and comparative reflection of some variables used in the study. Also statistical methods and their use have been mentioned in the later section of this Chapter. The bifurcation of research methodology adopted is given under following heads:

3.1 Locale of the study

Kawkhali upazila under Pirojpur district was selected for the study purposively. The union as well as the villages were selected randomly. Out of 5 Unions, Kawkhali was selected and then three villages namely Asoa, Kumian and Amrajhuri were selected as the locale of the study. A map of Pirojpur district showing Kawkhali upazila and a map of Kawkhali upazila showing study area have been shown in figure 3.1 and 3.2 respectively.

The researcher himself with the cooperation of local leaders and concerned Sub-Assistant Agriculture Officer (SAAO) collected an updated list of all the farmers of the selected villages of respective union. The total numbers of farm families (different crop growers) in these villages were 553 which constituted the population of the study.

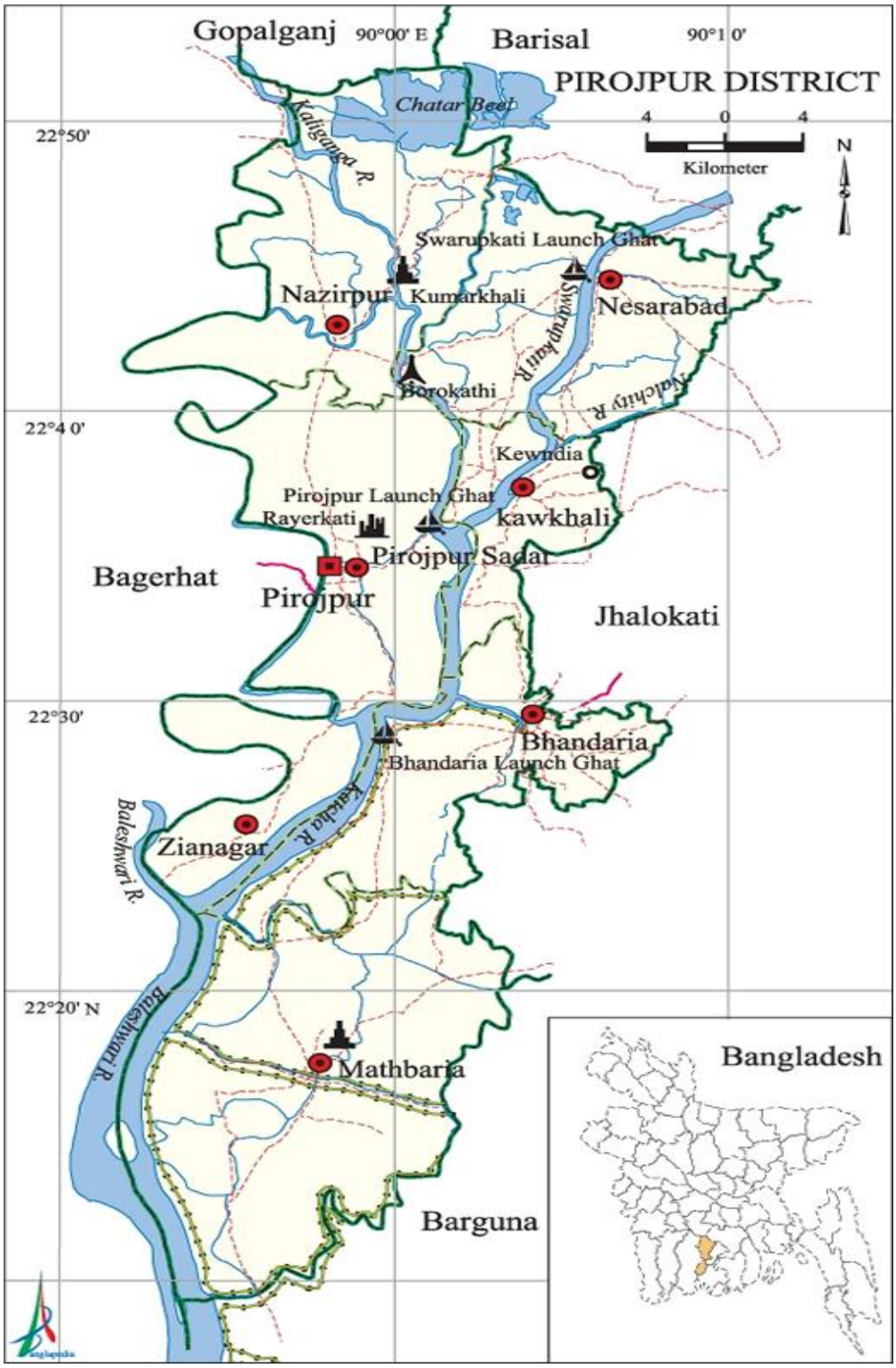

Figure 3.1 Map of Pirojpur district showing Kawkhali upazila

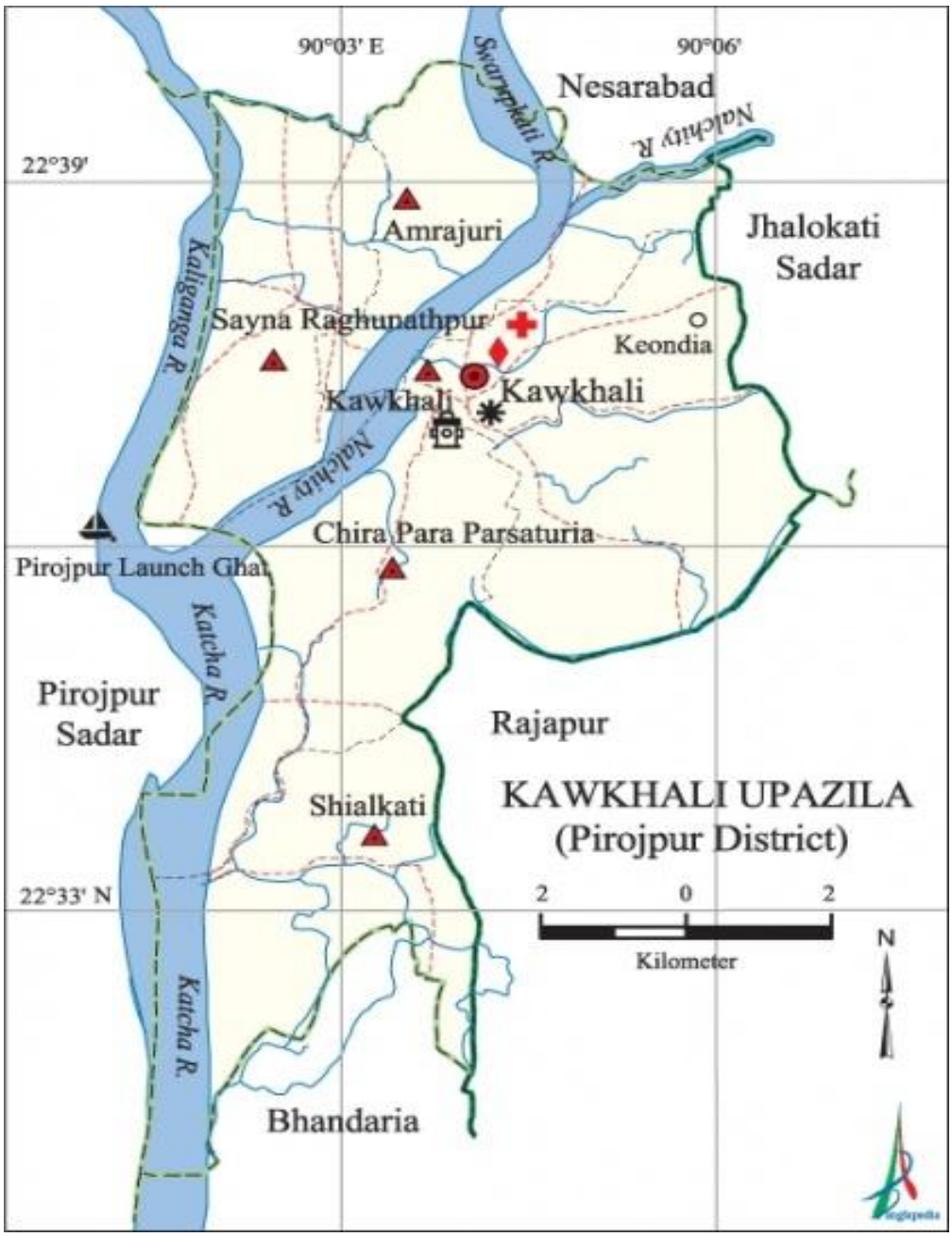

Figure 3.2 Map of Kawkhali upazila showing the study area

3.2 Population and sampling design

An up to date list of all farm family heads of the selected villages were prepared with the help pilot survey and Sub-Assistant Agricultural Officer. The list comprised a total of 553 farmers in the study area. These farmers constituted the population of this study. Most of the farmers are lead to follow ICM practices more or less. There were 202 farmers in Asoa village, 140 farmers in Kumian village and 211 farmers in Amrajhuri village under the union of Kawkhali.

For better representation proportionate random sampling method was used to select 110 farmers. A sample population was obtained by taking 20 percent of the estimated population of three randomly selected villages under Kawkhali union. Thus 110 farmers constituted the sample of the study. Further 11 farmers were selected randomly which constituted the reserve list and those would be interviewed when any farmers from the sample were not available at the first time of interview.

The distribution of the farmers included in the population, sample and those in the reserve list appears in Table 3.1.

Table 3.1 Distribution of population and sample of respondents in three selected villages

Sl. No.	Name of village	Total number of farmers (Growers)	Sample size	Number of farmers in the reserve list
1	Asoa	202	40	4
2	Kumian	140	28	3
3	Amrajhuri	211	42	4
Total		553	110	11

3.3 Instruments for data collection

Data were collected using a previously selected interview schedule. Both open and closed forms of questions were included in the schedule. Before finalization, the interview schedule was pre-tested with 10 farmers of the study area which were excluded from the sample. On the basis of the pre-test experiences necessary corrections, modifications and alterations were made before finalizing the interview schedule for final data collection. During modification of the schedule, valuable suggestions were received from the research supervisor and relevant experts. A copy of interview schedule in English version is placed in Appendix.

3.4 Variables of the Study

In the present study, selected characteristics of the respondents, *viz*. age, education, family labor size, farm size, annual family income, training exposure, times spent in farming, contact with extension media and knowledge on ICM were the causal variables and their use of ICM practices in crop cultivation constituted the focus variable.

3.5 Measurement of variables

The different level of knowledge and various characteristics of the rice growers might have affect on their use of integrated crop management (ICM) practices. The causal variables of this study were nine (9) selected characteristics of the farmers. These were: age, education, family labor size, farm size, annual family income, training exposure, times spent in farming, contact with extension media and knowledge on ICM. The procedures followed in measuring the causal variables are briefly discussed below:

3.5.1 Age

Actual age of a farmer was measured by counting the actual years from his/her

birth to the time of collecting data with an interview schedule. It was expressed in terms of complete years. This variable appears in item number one (1) in the interview schedule as presented in Appendix-A.

3.5.2 Education

Education of a farmer was measured by the number of years of schooling completed in an educational institution. A score of one (1) was given for each year of schooling completed. If a farmer didn't know how to read and write, his education score was zero, while a score of 0.5 was given to a farmer who could sign his name only. If a farmer completes primary level of education his/her score was considered as 5 as well as 10 for secondary level of education and above 10 means higher education. This variable appears in item number two (2) in the interview schedule as presented in Appendix-A.

3.5.3 Family labor size

At first total family members (male and female) including him/her, children and other dependents was counted. Family labor size of a respondent was determined by the total number of members in his/her family involved in agricultural activities. The scoring was made by the actual number of family members (male or female) who are involved in agricultural activities expressed by the respondents. For example, if a respondent had five members in his/her family who are involved in crop production, his/her score was given as 5. This variable appears in item number three (3) in the interview schedule as presented in Appendix-A.

3.5.4 Farm size

Farm size of a respondent is referred to the total area of cultivable land on which his/her family carried out farming operations including homestead area, own land

under own cultivation, land taken from others on borga and land taken from others on lease. This variable appears in item number four (4) in the interview schedule as presented in Appendix-A. The farm size was measured in hectares for each farmer using the following formula:

$$FS=A_1+A_2+1/2\ (A_3+A_4)\ +A_5$$

Where,

FS= Farm size

A_1 = Homestead area

A_2= Own land under own cultivation

A_3= Land given to others on borga

A_4= Land taken from others on borga

A_5= Land taken from others on lease

3.5.5 Annual family income

The income of a farmer is an important indicator that shows how much he can invest in his rice cultivation. Annual income of a respondent was measured in taka on the basis of total yearly earnings from crop production and other sources in which the respondent as well as his family members were involved. The method of determining income from farming involved different aspects. The aspects are: agriculture, poultry rearing, domestic animal, fish, service, business and others. In calculating the annual income of the respondents, the total yield from all the sources making in the preceding year were converted into cash income according to the prevailing market price and added together to obtain total income of a respondent. However unit score of 1 was taken for every Tk 1000/- of annual income. This variable appears in item number five (5) in the interview schedule as presented in Appendix-A.

3.5.6 Training exposure

Training exposure of a respondent was identified on the basis of number of days of agriculture based training prgramme received from different sources in the last five years. Training exposure score of a respondent was measured in terms of number of days for receiving training. For example, if a farmer received no training his/her score was zero (0) and score one was assigned for receiving one day training. This variable appears in item number six (6) in the interview schedule as presented in Appendix-A.

3.5.7 Times spent in farming

Time spent in farming was measured by computing on working time in the farm per week basis. According to time spent in farming the respondent were categorized into 3 types *viz*. no working, occasionally and regular. It was measured on the basis of how many hours work per week. This variable appears in item number seven (7) in the interview schedule as presented in Appendix-A.

3.5.8 Contact with extension media

It was defined as one's extent of exposure to different communication media related to farming activities. Contact with extension media of a respondent was measured by computing extension media contact score on the basis of their nature of contact with eighteen extension media by taking seven personal, four group and seven mass media. Each respondent was asked to indicate his nature of contact with four alternative responses, like frequently, occasionally, rarely and not at all basis to each of the eighteen media and score of three, two, one and zero were assigned for those alternative responses, respectively (Hasan, 2006). These four options for each medium were defined specially to each medium considering the situation, rationality and result of pre-test.

Extension media contact of the respondent was measured by adding the scores of eighteen selected extension media. Thus extension media contact score of a respondent could range from 0 to 54, where zero indicated no extension media contact and fifty four indicated highest level of extension media contact. This variable appears in item number eight (8) in the interview schedule as presented in Appendix-A.

3.5.9 Knowledge on ICM Practices

After thorough consultation with relevant experts and reviewing of related literature, 11 questions regarding ICM practices were selected and those were asked to the respondent to determine their knowledge on ICM practices. Scores two (2) and three (3) scoring were assigned according to question type for each correct answer and zero (0) for wrong or no answer. Partial score was also assigned for partially correct answer. Thus, possible scores for the knowledge on ICM practices of the respondents could range from 0 to 26, where 0 indicating no knowledge and 26 indicate very high knowledge on ICM practices. This variable appears in item number nine (9) in the interview schedule as presented in Appendix-A.

3.5.10 Measurement of use of ICM practices

The extent of ICM practices used by the farmers was measured on the basis of 13 selected ICM practices. The practices are crop diversification, alternations in cropping patterns, legume crop cultivation, use of frog, praying bird etc., use of sweeping net, manually weed management (rouging ,eradication etc.), use of light trap, use of perching, collection and destroy eggs and larvae of insects, use of pesticide as a last measurement, maximize the use of organic material, destroy crop residues, use of mulching. The respondents were asked to express their degree of use in the form of frequently, occasionally, rarely and never, while

scores assigned to the above four responses were 3, 2, 1 and 0, respectively. The total score range was 0-39 where 0 indicated no ICM practices and 39 indicated highest level of ICM uses. This variable appears in item number ten (10) in the interview schedule as presented in Appendix-A.

$$\text{Use of ICM} = \frac{\text{No. of practices use}}{\text{Total practices}} \times 100$$

3.6 Statement of Hypothesis

As defined by Goode and Hatt (1952) 'A hypothesis is a proposition, which can be put to a test to determine its validity.' It may prove valid or invalid of a proposition. In any event, however, it leads to a practical test. In studying contribution among variables, research hypotheses are formulated which state anticipated contribution among variables.

However, for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no relationship among the concerned variables. If a null hypothesis is rejected on the basis of a statistical test, it is assumed that there is a relationship among the concerned variables.

The following null hypotheses were formulated for this study:

"*There was no relationship between each of the farmers selected characteristics and their use of ICM practices*".

The characteristics were: age, education, family labor size, farm size, annual family income, training exposure, times spent in farming, contact with extension media and knowledge on ICM.

3.7 Collection of Data

Data were collected personally by the researcher himself through face to face interview. To familiarize with the study area and for getting local support, the researcher took help from the local leaders and the field staffs of Upazila Agriculture Office. 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. Data were collected during the period from 10 January to 30 March, 2019.

3.8 Data Processing

After completion of field survey, all the data were coded, compiled and tabulated according to the objectives of the study. Local units were converted into standard units. All the individual responses to questions of the interview schedule were transferred in to a master sheet to facilitate tabulation, categorization and organization. In case of qualitative data, appropriate scoring technique was followed to convert the data into quantitative form.

3.9 Statistical Analysis

The collected data were assembled, tabulated, coded and analyzed in accordance with the objectives of the study. Qualitative data were quantified by mean of suitable scoring techniques. The statistical measures such as number and percentage distribution were used for describing the variables of the study. In order to explore the relationships between use of ICM practices by the farmers and each of their selected characteristics, the Pearson Product Moment Correlation was computed.

Correlation matrix was also computed to determine the interrelationships among the variables. Five percent (0.05) level of significance was used as the basis of rejecting any null hypothesis.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter deals with the result and discussion of present research work. Necessary explanations and appropriate interpretations have also been made showing possible and logical basis of the findings. However, for convenience of the discussions, the findings are systematically presented according to the objectives of the study.

4.1 Selected characteristics of the respondents

This section deals with the classification of the farmers according to their various characteristics. Behavior of an individual is largely determined by his characteristics. In this section the findings on the farmer's selected nine characteristics have been discussed. The selected characteristics are (i) age, (ii) education, (iii) family labour size, (iv) farm size, (v) annual family income, (vi) training exposure, (vii) extension contact, (viii) innovativeness and (ix) cosmopoliteness. Range, mean and standard deviations of these characteristics of the growers are described in this section. A summary profile of the farmer's characteristics has been given in Table 4.1.

Table 4.1 Prominent features of the selected characteristics of the respondents

Sl. No.	Characteristics (with measuring unit)	Range		Mean	Standard deviation
		Possible	Observed		
1.	Age (years)	--	28-61	46.23	6.84
2.	Education (schooling years)	--	0-12	3.02	2.90
3.	Family labor size (number of active members)	--	3-6	4.25	0.77
4.	Annual family income	--	59.6-875	115.89	96.71

	(‘000’Taka)				
5.	Farm/land size (ha)	--	0.34-2.30	0.77	0.36
6.	Training exposure (number of days)	--	0-3	0.26	0.59
7.	Times spent in farming (hour/week)	--	13-56	47.76	6.92
8.	Extension contact (obtained score)	0-54	24-47	40.32	4.42
9.	Knowledge on ICM (obtained score)	0-26	12-22	17.61	2.12

4.1.1 Age

Age of the respondents varied from 28 to 61 years, the average being 46.23 years with the standard deviation of 6.84 (Table 4.1). According to their age, the respondents were classified into three categories as “young aged” (up to 35 years), “middle aged” (36- 50 years) and “old aged” (above 50 years). The distribution of the farmers according to their age is shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories	Basis of categorization	Respondents	
		Numbers	Percent
Young age	Up to 35 years	9	8.18
Middle age	36 to 50 years	73	66.36
Old age	Above 50 years	28	25.45
Total		110	100

Age is one of the most vital factors concerning to one’s livelihood. The highest percentage of the farmers was in middle aged followed by older and younger respectively. An overall majority of the farmers (91.81%) were middle to old aged. Data represented in Table 4.2 indicates that about 66.36 percent of the respondents were middle aged as compared to 8.18 percent being young and 25.45

percent old. This seems logical because heads of the farm families were selected as respondent. With the increase in age they find few alternatives for livelihood except farming activities in parents' farm thus become committed in agricultural activities. This lead to understanding that use of ICM would reflected more by the middle-aged group in the present study.

4.1.2 Education

Education level of the respondents ranged from 0-12 in accordance with year of schooling. The average education score of the respondents was 3.02 with a standard deviation of 2.90 (Table 4.1). On the basis of their level of education, the farmers were classified into five categories as shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their level of education

Categories	Basis of Categorization (schooling years)	Respondents	
		Numbers	Percent
Illiterate	0	8	7.27
Can sign only	0.5	43	39.09
Primary	1-5	38	34.55
Secondary	6-10	20	18.18
Above secondary	Above 10	1	0.91
Total		110	100

The finding shows that 18.18 percent respondents had secondary level of education compared to 34.55 and 0.91 percent having primary level and above secondary level of education respectively. On the other hand, 7.27 percent of the respondents were illiterate. It was revealed that higher level of education of an individual is likely to be more receptive to the modem facts and ideas. They have much mental strength in deciding on a matter related to problem solving. Possession of some education by the ICM user is a positive aspect in the context of use of ICM practices. Education helps the farmers to gain knowledge on

different improved cropping practice by reading books, leaflets, bulletins and other printed materials. Thus, farmers in the study area may be well considered as a suitable ground for use of ICM practices.

The findings of this study, however, indicate that 46.36 percent of the farmers were illiterate or could sign their name only which is supposed to face a great difficulty in use of ICM. Such consideration indicates the need for improving literacy level among the farmers for practicing ICM. Although 18.18 percent farmers had secondary education and they are already involved in ICM practices.

4.1.3 Family labor size

The number of family labor size of the respondents ranged from 3 to 6 with an average of 4.25 and standard deviation of 0.77 (Table 4.1). Based on the family labor size the respondents were classified into three categories as small, medium and large family as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their family labor size

Categories	Basis of categorization (Mean ±SD)	Respondents	
		Numbers	Percent
Small family	Up to 3	15	13.63
Medium family	4 to 5	63	57.27
Large family	Above 5	32	29.10
Total		110	100

Data furnished in the Table 4.4 indicates that the highest proportion (57.27 percent) of the respondents had medium family labor size consisting of 4 to 5 members, while 29.10% of the respondents belonged to the category of high family labor compared to 13.63% of them having small family labor size. Data

indicated that the average family labor size (4.25) of the respondents in the study area is nearest to the national average of 5.6 (BBS, 2009).

4.1.4 Family income

The observed ranged of the annual family income of the respondents varied from 59.6 to 877 thousand taka with a mean of 115.89 thousand taka and standard deviation of 96.71 (Table 4.1). On the basis of annual family income, the respondents were categorized into three classes namely low, medium and high income categories shown in Table 4.5.

Table 4.5 Distribution of farmers regarding annual family income

Categories	Observed range ('000' taka)	Respondents	
		Numbers	Percent
Low income	Up to 300	98	89
Medium income	300 to 600	10	9
High income	Above 600	2	2
Total		110	100

Data shown in Table 4.5 presents that the highest proportion of the respondents (89 percent) had low annual family income while 9% and 2% of them had medium and low annual family income, respectively. Findings reveal that the most (98%) of the respondents had low to medium annual family income in the selected study area.

This might be due to the fact that the farmers of the study area were not engaged in agriculture only, they earned from other sources such as service, business etc. Farmers with low income generally invest less in their farms and most of them are interested to high return with low input. It is therefore, likely that in most of the ICM might be hampered with high synthetic inputs for better returns.

4.1.5 Farm Size

Farm size of the respondents ranged from 0.34 ha to 2.30 ha with the mean of 0.77 ha and standard deviation of 0.36 (Table 4.1). On the basis of their farm size, the farmers were classified into three categories followed by DAE (1999) as shown in Table 4.5.

Table 4.6 Distribution of farmers according to their farm/land size

Categories	Basis of categorization Observed range	Respondents	
		Numbers	Percent
Marginal farmer	Up to 0.02 ha	29	26
Small farmer	0.02 to 1.0 ha	46	42
Medium farmer	Above 1.0 ha	35	32
Total		110	100

Data presented in the Table 4.6 demonstrates that highest proportion (42 percent) of the farmers had small farm compared to 26% and 32% having marginal large farm respectively. The findings indicated that overwhelming majority (68 percent) of the farmers had marginal to small farm size.

Table 4.6 also shows that overwhelming majority (68%) of the total respondent as well as ICM user had marginal to medium size of farm. Hossain *et al*. (2011) also found similar findings in his study. The average farm size of the farmers of the study area (0.77 hectares) was less than that of national average (0.60 hectare) of Bangladesh (BBS, 2014).

4.1.6 Training exposure

The score of training exposure on use of ICM the farmers ranged from 0-3 days. The mean was 0.26 days and standard deviation was 0.59 (Table 4.1). On the basis

of training exposure on ICM, the respondents were categorized into three groups as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their training exposure

Categories	Basis of categorization (Days)	Respondents	
		Numbers	Percent
No training	0	88	80.00
Low training	1-2	21	19.09
Medium training	>2	1	0.91
Total		110	100

Data presented in the Table 4.7 shows that 80% of the total respondents had no training on ICM while 19.09% of the farmers had low training exposure and only 0.9% percent had medium training exposure. It means that an overwhelming majority (99 percent) of the farmers had no or low training exposure.

4.1.7 Times spent in farming hour/week

The observed times spent in farming hour/week of the respondents ranged from 13 to 56 hours (Table 4.1). However, the average was 47.76 and the standard deviation was 6.92. Based on their times spent in farming/week, the respondents were classified into three categories: “No”, “Occasionally” and “Regular”. The distribution of the respondents according to their times spent in farming/week is shown in Table 4.8.

Table 4.8 Distribution of the farmers according to their times spent in farming hour/week

Categories	Basis of categorization Observed range (hour/week)	Respondents	
		Numbers	Percent
No	Up to 18	20	18.20
Occasionally	19-37	36	32.72
Regular	>37	54	49.10
Total		110	100

The finding shows that majority (49.10 percent) of the farmers spent their time in farming in regular basis where rest of the farmers (32.72) was in occasionally work. About 18.20 percent farmers do not spent time for work in their farm.

The finding reveals that maximum respondents do not have outward exposure in terms of times spent in farming/day which has a positive attitude towards use of ICM.

4.1.8 Extension contact

The score of extension contact on ICM practice ranged from 24-47 with possible score range of 0-54. The mean was 40.32 and standard deviation was 4.42 (Table 4.1). On the basis of extension contact, the respondents were categorized into three groups as shown in Table 4.9.

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

Categories	Observed range	Respondents	
		Numbers	Percent
Low contact	Up to 18	16	14.55
Medium contact	19 to 36	58	52.73
High contact	Above 36	36	32.72
Total		110	100

Data presented in Table 4.9 indicates that more than fifty percent the respondents (52.73 percent) had medium extension contact while 32.73% had high and 14.55% farmers had low extension contact.

It is generally known that extension contact may be a good source of different information. Extension contact helps the farmers for better understanding and to get recent information regarding ICM innovation. In order to increase ICM practice, contact with different media of the fanners should be increased. The

findings of the study indicate that most of the respondents had medium and high extension contact with various information sources for getting necessary agricultural information. Bashar (1993), Pal (1995) and Hussen (2001) observed almost similar findings regarding contact for getting agricultural information.

4.1.9 Knowledge on ICM

Knowledge on ICM score of the respondents ranged from 12 to 22 against the possible range of 0 – 26 having an average of 17.61 and standard deviation of 2.12 (Table 4.11). On the basis of knowledge scores, the respondents were classified into three categories namely, 'low knowledge', 'medium knowledge' and 'high knowledge'. The distribution of the respondents according to their knowledge on ICM is given in Table 4.10.

Table 4.10 Distribution of the farmers according to their knowledge on ICM

Categories	Observed range	Respondents	
		Numbers	Percent
Low	0-7	12	10.91
Medium	8-14	68	61.82
High	Above 14	30	27.27
Total		110	110

Data of Table 4.10 shows that 61.82 percent of the respondents felt in medium knowledge category followed by 27.27 percent in high knowledge category and 10.91% respondent were in low knowledge category.

Knowledge is to be considered as vision of an explanation in any aspect of the situation regarding ICM. It is act or state of understanding; clear perception of fact or truth, that helps an individual to foresee the consequence he may have to face in future. It makes individuals to become rational and conscious about related field.

To perform optimum production and processing of food, farmers should have adequate knowledge on different aspects of production technology.

4.2 Focus variable: Use of ICM

Use of ICM practices by the farmers score of the respondents ranged from 16 to 28 against the possible range of 0 – 39 having an average of 22.16 and standard deviation of 2.10 (Table 4.11). On the basis of use of ICM scores, the respondents were classified into three categories namely, 'low, 'medium and 'high' use. The distribution of the respondents according to their use of ICM is given in Table 4.11.

Table 4.11 Distribution of the farmers according to their use of ICM

Categories	Basis of categorization (score)	Respondents		Mean	Standard deviation
		Numbers	Percent		
Low	0-9	15	13.64	22.16	2.10
Medium	10-18	91	82.73		
High	>18	4	3.63		
Total		110	110		

Data of Table 4.11 shows that 82.73 percent of the respondents felt in medium use of ICM category followed by 3.64 percent in high use of ICM category and 13.63 percent respondents were in low use of ICM category. To perform optimum production and processing of food, farmers should receive proper ICM practices.

4.3 Relationship between the selected characteristics of the farmers and their use of ICM

Co-efficient of correlation was computed in order to explore the relationship between the sleeted characteristics of the farmers and their use of ICM. Pierson's Product Moment Co-efficient of Correlation (r) has 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 of acceptance or rejection of a hypothesis. The Table value of 'r' was calculated at (110-2) = 108 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 use of ICM is shown in Table 4.12.

Table 4.12 Co-efficient of correlation showing relationship between selected characteristics of the farmers and knowledge on ICM

Dependent variable	Independent variable	Computed value of "r"	Tabulated value of "r" with 108 degrees of freedom	
			at 0.05 level	at 0.01 level
Use of ICM	Age	0.12^{NS}	0.184	0.241
	Education	0.358(**)		
	Family labor size	0.161^{NS}		
	Annual family income	-0.089^{NS}		
	Farm size	0.375(**)		
	Training exposure	0.203(*)		
	Times spent in farming/day	-0.042^{NS}		
	Extension media contact	0.495(**)		
	Knowledge on ICM	0.526(**)		

^{NS} Correlation is not significant
* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed)

4.3.1. Relationship between education of the respondents and their use of ICM

The co-efficient of correlation (r) between the concerned variables was computed and found to be 0.358 presented in Table 4.12 which led to the following observations:

- The relationship showed a positive direction.
- The computed value of 'r' (0.358) was found to be greater than the Table value of 'r' (0.241) with 108 degrees of freedom at 1% level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 1% level of probability.

The finding implies that the education of the respondents had significant positive relationship with their use of ICM. The finding is quite balanced because education helps to adopt ICM through gathering knowledge and experience easily.

4.3.2. Relationship between farm size of the respondents and their use of ICM

The co-efficient of correlation (r) between the concerned variables was computed and found to be 0.375 presented in Table 4.12 which led to the following observations:

- The relationship showed a positive direction.
- The computed value of 'r' (0.375) was found to be greater than the Table value of 'r' (0.241) with 108 degrees of freedom at 1% level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 1% level of probability.

The finding implies that the farm size of the respondents had significant positive relationship with their use of ICM. The finding is quite rational because higher crop production practice is relatively costly. Hence, large growers get more scope than the small growers as they can invest more money for more production.

4.3.3 Relationship between training exposure of the respondents and their use of ICM

The co-efficient of correlation (r) between the concerned variables was worked out and found to be 0.203 presented in Table 4.12 which directed to the following observations:

- The relationship showed a positive indication.
- The computed value of 'r' (0.203) was higher than the Table value of 'r' (0.184) with 108 degrees of freedom at 5% level of probability.
- Hence, the concerned null hypothesis was rejected.
- The correlation co-efficient between the training exposure of the farmers and their use of ICM was significant.

The finding implies that the training exposure of the farmers had significant relationship with their use of ICM. Training makes the farmers skilled and helps them to acquire deep knowledge about the respected aspects. Trained farmers can face any kind of challenges about the adverse situation in their cultivation.

4.3.4 Relationship between extension media contact of the respondents and their use of ICM

The co-efficient of correlation (r) between the concerned variables was computed and found to be 0.495 presented in Table 4.12 which led to the following observations:

- The relationship showed a positive direction.

- The computed value of ‘r’ (0.495) was found to be greater than the Table value of ‘r’ (0.241) with 108 degrees of freedom at 1% level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 1% level of probability.

The finding implies that the extension contact of the respondents had significant positive relationship with their use of ICM. In addition, the sign of the coefficient value indicates higher the extension contact higher the knowledge on ICM.

4.3.5 Relationship between knowledge of ICM of the respondents and their use of ICM

The co-efficient of correlation (r) between the concerned variables was computed and found to be 0.526 presented in Table 4.12 which led to the following observations:

- The relationship showed a positive direction.
- The computed value of ‘r’ (0.526) was found to be greater than the Table value of ‘r’ (0.241) with 108 degrees of freedom at 1% level of probability.
- The concerned null hypothesis was rejected.
- The co-efficient of correlation between the concerned variable was significant at 1% level of probability.

The finding implies that the knowledge on ICM of the respondents had significant positive relationship with their use of ICM. Moreover, it can be said that the farmers who has more knowledge on ICM have higher attitude for use of ICM.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

the study title was undertaken as titled “use of integrated crop management (ICM) practices by the farmers of pirojpur district” with the objectives of (i) To determine the extent of use of ICM practices by the farmers in crop cultivation, (ii) To determine and describe some selected personal and socio-economic characteristics of the farmers (age, education, family labor size, farm size, annual family income, training exposure, times spent in farming, contact with extension media and knowledge on ICM) and (iii) To compare the extent of use of different ICM practices in crop cultivation; and (iv) To explore the contributory factors related to the extent of use of ICM practices by the farmers in crop cultivation and their selected characteristics. Kawkhali upazila under Pirojpur district was the locale of the study. The sample of 110 farmers was drawn from a population of 405. Data were collected during 1st January to 30 March, 2019 using a pre-tested interview schedule. A summary of the major findings is given below:

5.1.1 Individual characteristics of the respondents

Age: Age of the respondents ranged from 28 to 61 years with an average of 46.23 years. Majority of the respondents (66.36%) were middle aged followed by 8.18% and 25.45% young and old-aged respectively.

Education: The highest proportions (46.36%) of the farmers were in the no or low education level. Primary, above secondary, can sign only and illiterate level of literacy found 34.55, 0.9139.09 and 7.27 percent, respectively. It means, a major portion of the respondents (46.36%) of the respondent were illiterate or having education up to primary level.

Family labor size: The highest proportion (57.27%) of the farmers had medium family labor size, while 29.10% and 13.63% belonged to the large and small family labor size respectively.

Annual family income: The highest proportion (89%) had low annual family income compared with 9% having low medium and 2% having high annual family income.

Farm size: The highest proportion (42%) of the farmers had small farm size, while 32% belonged to medium farm.

Training exposure: Most of the respondents (80%) had no training compared to 19.09% and 0.91% having low training and medium training, respectively.

Times spent in farming/day: Most of the farmers (49.10%) were involved in regular for times spent in farming/week where 32.72% was in occasional category.

Extension contact: Most of the respondents (52.73%) had medium extension contact compared to 32.72% having high extension contact, respectively.

Knowledge on ICM: The highest proportion (61.82%) of the respondents was in medium knowledge category followed by 27.27% in high knowledge category.

5.1.2 Use of ICM: The majority (96.37%) of the respondents had low to medium use of ICM and 3.63% had high use of ICM.

5.1.3 Relationship between the selected characteristics of the farmers with their use of ICM

Nine null hypotheses were formulated to explore the relationship between the selected characteristics of the farmers and their use of ICM. For testing each of the hypotheses the co-efficient of correlation (r) test was used.

Correlation analysis indicates that education, farm/land size, training exposure, extension media contact and knowledge on ICM had significant positive relationship with their use of ICM. Hence, the null hypotheses concerning these five variables were rejected by the researcher. On the other hand, age, family labor size, annual family income and times spent in farming/day of the farmers had no significant relationship with their use of ICM. Hence, the null hypotheses concerning these four variables were accepted by the researcher.

5.2 Conclusions

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

I. Finding shows that majority (82.73%) of the farmers had medium levels use on ICM. Besides 27.27 percent farmers had high knowledge on ICM. Therefore, it can be concluded that knowledge on ICM belongs to moderate satisfactory level and needs more improvement.
II. Education of the farmers showed that there was significant relationship with their use of ICM. So, it may, therefore be concluded that formal education of the respondents had contribution to increase their knowledge on ICM.
III. Farm size of the farmers had significant positive relationship with their use of ICM. The farmers having large farms and being economically solvent always try to increase their use of good management practices like ICM.
IV. Contact with different extension media of the farmers had positive and significant relationship with their use of ICM practices. So, higher the extension contact higher the use of ICM practices.

V. It can be concluded from the analysis that training helped farmers to increase the use of ICM probably the farmers increased their through trainings.

5.3 Recommendations

5.3.1 Recommendations for policy implications

Based on the findings and conclusions of the study, the following recommendations are presented:

i. It may be recommended that attempts should be taken by DAE and other extension providers to arrange more training, mostly focus on ICM practice.
ii. The higher the farm size the higher the use of ICM practices. The SAAO should motivate more the farmers having small farm for using ICM practices.
iii. Education of the respondent had significant positive relationship with their use of ICM. Therefore it may be recommended that attempts should be taken to establish adult learning centre to increase educational level as well as awareness on use of ICM.
iv. Extension agencies should realize the existing problems regarding ICM practices and take necessary steps to minimize these problems. Necessary inputs such as quality seeds, seedling, manure and fertilizers, safe protection measures against insect and pest to be made available to the respondents at right time and at fair prices.

5.3.2 Recommendations for further study

A small piece of study as has been conducted which cannot provide all information for the proper understanding of ICM. Therefore, the following suggestions are made for further study:

I. The present investigation explored the relationships of the nine characteristics of the respondents with their use of ICM. Further research may be conducted by taking other characteristics to observe relationships with their use of ICM.

II. The present study was conducted in two villages of Kawkhali upazila under Pirojpur district. So, similar studies may be undertaken in other parts of the country to verify the findings of the present study.

III. A positive trend of relationship was obtained between education of the growers and their use of ICM. Hence, further studies are necessary to verify the relationship between the concerned variables.

IV. The present study has been carried out among the male farmers only. So, a similar study may be conducted with the farm women to examine their views and opinions regarding the use of ICM.

V. The present study was concerned only with the use of ICM. It is therefore, suggested that future studies should include.

REFERENCES

Ahmed, B. 2006. Use 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 & Information System, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.

Alam, M.S. 1997. Use of improved farm practices in rice cultivation by the farmers. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Ali, M.K., S.A. Chowhdury, M.A. Kader and M.O. Gani 1986. Factors Influencing Use of Improved Sugarcane Production Technologies Among the Growers of Sugar Mills Zone. *Bangladesh J. Ext. Edu*., **1**(2): 25-31.

Asiabaka, C. 2002. Promoting Sustainable Extension Approaches: Farmer Field School (FFS) and its role in sustainable agricultural development in African. *Int. J. Agric. Rural Dev*., **3**: 46–53.

Aurangozeb, M.K. 2002. Use 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.

Bashar, M.K. 1993. Adopton of Intercropping in Sugarcane Cultivation. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Bavalatti, V.G. and B. Sundaraswamy 1990. "Use of Dryland Farming Practices by the Farmers of Bijapur District". *Indian J. Ext. Edu,* **26** (3 & 4): 67-69.

BBS (Bangladesh Bureau of Statistics). 2014. Statistical Year Book of Bangladesh. Statistics and Informatics Division (SID). Ministry of Planning, Government of the People's Republic of Bangladesh.

BBS (Bangladesh Bureau of Statistics). 2009. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics. Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

Bezbora, S.N. 1980. Factors Affecting Adoption of Improved Agricultural Technologies for Paddy Cultivation by the Farmers of Assam. Summary of Extension Research. 6: 24-27. Department of Extension Education, Punjab Agricultural University, Ludhiana.

Chowdhury, M.S.A. 1997. Use of Selected BINA Technologies by the Farmers of Boyra Union in Mymensingh District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

DAE, 1999. Agricultural Extension Manual. Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh.

Ezekiel, M. and Fox, K.A. 1959. Method of Correlation and Regression Analysis. 3rd Edn. New York, John Wiley and Sons, Inc.

Gebre, T.M. Nigussie and D. Tanner. 2002. Maize Technology Use in Ethiopia: experiences from the Sasakawa Globe 2000. Agriculture Programme. Enhancing the Contribution of Maize to Food Security in Ethiopia.

Proceedings of the second National Maize Workshop of Ethiopia, 12-16 November, 2001. 153-156, Addis Ababa.

Ghimire, B. and Kafle, N. 2014. Integrated Pest Management Practice and its Use Determinants among Apple Farmers in Mustang District of Nepal. *Sch. J. Agric. Vet. Sci*., **1**(2):83-89.

Gogoi, S.K. and Gogoi, D.K. 1989. Adoption of Recommended Plant Protection Practices in Rice. *Indian J. Ext. Edu*., **25** (1&2): 26-29.

Goode, W.J. and P.K. Hatt 1952. Methods of Social Res earch. New York: McGraw-Hill Book Company, Inc.

Haider, M.R. Halim, A. and Kashem, M.A. 2001. Use of Improved Package of practices for Trans-planting Aman Rice Cultivation. *Bangladesh J. Nucl. Agric*., **17**: 77-84.

Haque, M. M. 2003. Farmer's Use of Modern Maize Cultivation Technologies. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Haque, M.M. 2003. Farmers' Use of Modern Maize Cultivation Technologies. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Hasan, M.M. 2003. Use 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, Bangladesh.

Hasan, M. K. 2006. Participation in Farming Activities by Conventional and Organic Farmers. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Hasan, M.Z. 1996. Use of some Selected Agricultural Technologies among the Farmers as Perceived by the Frontline GO and NGO Workers. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh, Bangladesh. Hoffer, C.R. and D. Stangland, 1958. Farmers Attitude and Values in Relation to Use of Approved Practices in Corn Growers. *Rural Sociology*., **23**: 112-120.

Hoque, M.M. 1993. Use 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, Bangladesh.

Hossain, K. 2006. Use of Selected High Yielding Variety of Rice by the Farmers of Rajpat Union Under Kasiani upzila in Gopalgonj District.

Hossain, M. M. 2009. Use of Integrated Pest Management Practices by the Farmers of Brahmanbaria District. M.S. Thesis, Department of Agricultural Extension & Information System, Sher-E-Bangla Agricultural University, Dhaka.

Hossain, M.A. 1991. Use Behaviour of Contact Wheat Growers in Sadar Upazila of Jamalpur District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Hossain, M.M. 2003. Farmers' knowledge and Use of Modern Boro Rice Cultivation Practices. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Hossain, M.N. 1999. Farmers Perception of the Effects of Agro-chemicals on Environment. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh, Bangladesh.

Hossain, S.M.A. and Crouch, B.R. 1992. "Patterns Determinations of Use of Farm Practices: Some Evidence from Bangladesh." *Agric. Systems.*, **38** (1): 1-15.

Hossain, M. M. (2011). Adoption of Modern 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.

Hussen, M.A. 2001. Farmers' Knowledge and Use of Modern Sugarcane Cultivation Practices. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Islam, M. S. 2002. Use of Modern Agricultural Technologies by the Farmers of Sandwip. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Islam, M.M. 1993. Use of Improved Practices on Potato Cultivation by the Potato Farmers of Sonatola Union Under Bogra District. M.S. (Ag. Ext. Ed.)

Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Islam, M.M. 1996. Farmers use of Indigenous Technical knowledge (ITK) in the Context of Sustainable Agricultural Development. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Jamal, E. 2009. Assessment of farmer field school in integrated crop management of rice commodity: Case study in Blitar and Kediri Regency, West Java. *J. Policy Anal*., **7(**4): 377–349.

Karim, A.S.M.Z. and S.F. Mahaboob. 1986. Farmers Characteristics and other Factors Associated with Adoption of HYV Wheat in Kushtia Union of Mymensingh District. *Bangladesh J. Ext. Edu*., **1**(1): 17-24.

Kashem, M. A. and Halim, A. 1991. Use of Communication Media in the Transfer of Technologies of Farmers: a Farm Level Study. Research Monigraph No. 2. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mynensingh.

Kashem, M.A. and M.A. Hossain. 1992. "Use Behaviour of Sugarcane Growers". *Indian J. Ext. Edu*., **28**(1 & 2): 92-96.

Kashem, M.A. and M.M. Islam 1990. Comparative Analysis of Knowledge, Attitude and Adoption of Agricultural Practices between the Contact and Non-contact Farmers Under the T & V System. *Bangladesh J. Ext. Edu*., **5**(1&2): 1-7.

Kaur, M.R. 1988. An Evaluation study of Women Development Programme under Indo-German Dhauhadhar Project Palampur District Kumgra, H.P. Harayana Agricultural University. *Thesis Abstract*., **16**(4): 258.

Kerlinger, F.N. 1973. Foundations of Behabioural Research. 2nd Edn. Delhi: Surjeet Publications.

Khan, M. A. H. 2003. Use of Insecticides and Related Issues in the Villages of Pachon Union, Madaripur District. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Khan, M.A. H. 1993. Use of Insecticides and Related Issues in the Villages of Pachon Union, Madaripur District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Kher, S.K. 1992. "Adoption of Wheat Cultivation Practices". *Indian J. Ext. Edu*., **22**(1 & 2): 97-99.

Koch, B.H. 1985. "The Role of knowledge in the use of agricultural development practices". *South African J. Agric. Ext*., **XXVI** (374):86-91.

Mostofa, M.G. 1999. Use of Recommended Mango Cultivation Practices by the Mango Growers of Nawabganj Sadar Thana. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Moulik, T.K., J.P. Hrabovxzky, and C.S. S. Rao, 1966. Predictive values of some factors of use of nitrogenous fertilizers by the north indian farmers. *Rural Sociology*., **31**(4): 467-477.

Muttaleb, M.A., M.N. Islam and M.A. Hossain. 1998. Use of Selected Plant Protection Practices in Potato Cultivation. *Bangladesh J. Ext. Education*., **9**(2): 2027-30.

Narwal, R.S., V.B. Dixit and S.S. Dahiya. 1991. Correlation of Farmers Attitude towards Buffalo Management Practices. *Indian J. Exte. Edu*., **27**(1&2): 97-100.

Nikhade, D.M., R.S. Bhople and N.M. Kale, 1995. Use Gaps Among Small and Big Cotton Growers. *Indian J. Ext. Edu.,* **XXXI** (1 to 4): 120-123.

Nikhade, M.D., S.R. Bhople and S.V. Sharkarkar. 1993. Use of Improved Practices of Soybean Cultivation. *Indian J. Ext. Edu*., **29**(3 & 4):173-177.

Okoro, F.U. and L.U. Obibuaka 1992. Factors Influencing the Use of Improved Oil Palm Management Practices Among Small Holders in IMO States, Nigeria. *Bangladesh J. Ext. Edu*., **7**(1&2): 45-52.

Osunloogun, A., Ademoyo, R. and Anyanwu, E. 1996. "The Adoption of Innovations by Co-operative Farmers in Nigeria." *Tropical Agric*., **63**(2): 158-160.

Pal, S.K.1995. Use of Recommended Sugarcane Cultivation Practices by the Farmers of Two Selected Centres of North Bengal Sugar Mills. M.S. (Ag.

Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Pathak, S. and B.C. Sasmal 1992. Use of Jute Technologies. *Indian J. Ext. Edu*., **27**(1&2): 77-80.

Rahman, M.H. 2003. Use of Year round Homestead Fruit Cultivation Practices in Selected Area of Meherpur District. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Rahman, M.L. 1995. Farmers' knowledge on improved practices of potato cultivation. M.S. (Ag.Ext.Ed.) Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Rahman, M.M. 1999. Use of Balanced Fertilizer by the boro Rice Farmers of Ishwarganj Thana. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh, Bangladesh.

Rahman, M.M. 2003. Use of Intercropping in Pineapple Cultivation in Three Selected Village. M.S. (Ag. Ext. Ed.). Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Rahman, M.M. 1986. "Correlates of Adoption of Improved Practices in Transplanted Aman Rice." *Bangladesh J. Ext. Edu*., **1**(2):71-77.

Rahman, M.S. 1974. Analysis of Factors in Relation to the Use of IR-20. M.Sc. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh.

Rahman, M.S. 2001. Knowledge, Attitude and Use of the Farmers Regarding Aalok 6201 Hybrid Rice in Sadar Upazila of Mymensingh

Reddy, P.R., M.M. Reddy and D.R. Reddy 1987. "Impact of national demonstration on knowledge level attitude and use behaviour of farmers in ranaga reddy district of andhra pradesh state." *J. Res. APAU*., **15**(1): 35-38.

Rogers, E.M. 1995. Diffusion of innovations, 4th Edn. New York: The Free Press.

Salam, M.A. 2003. Constraints Faced by the Farmers in Adopting Environmentally Friendly Farming Practices. M.S. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Sardar, M.H.U. 2002. "Use 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, Bangladesh.

Sarker, D.C. 1997. Correlates of Selected Characteristics of Potato Growers with Their Use of Improved Potato Cultivation Practices in Five Village of Comilla District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Siddaramiaiah, B.S. Ranga, V.K., Naika and Kumar R.P. 1995. "Use of Improved Sericultural Practices Among Bio and small Farmers." *Indian J. Ext. Edu*., **XXXI,** Nos, 1 to 4.

Singh, P.K. 1991. Extent of Use of selected Recommended Practices by Kinnow Growers of Ferozepur and Faridkot Districts of Punjab. Directorate of Publication, Hariyana, Agricultural University, *Thesis Abstract*. **17**(3): 209-210.

Singh, S.P. and Rajendra 1990. A Study on Use of Sugarcane Variety. *Indian J. Ext. Edu*. **26** (1&2): 110-111.

Slade, R.G. Feder and Shikaria 1988. Reforming Agricultural Extension. The Training and Visit System in India. *Quarterly J. Int. Agri*., (3 & 4): 228-246.

Suhendrata, T. 2008. The role of agricultural technology innovation in increasing rice productivity in support of food security. In Proceedings of the National Seminar on Agricultural Engineering. Yogyakarta.

Sunding, D., and Zilberman, D. 2000. The agricultural innovation process: Research and technology use in a changing agricultural sector. In B. L. Gardner & G. C. Rausser (Eds.), Handbook of Agricultural Economics (Vol. **IA**). Amsterdam: Elsevier.

Swinkeles, R.A., K.D. Shepherd, S. Franzel, J.K. Ndufa, E. Ohisson, H. Sjogren, S. Franzel, (ed.) and S.J. Scherr. 2002. Assessing the Use Potentialof Hedgerow Intercropping for improving Soil Fertility. Western Kenya. Trees on the farm: Assessing the Use Potential of Agroforestry Practices in Africa, 2002, 86-110.

Talukdar, M. M. R. 2006. Use of Selected Rice Production Practices by the Farmers of Char-Land of Gomoti River.M.S. (A.E.I.S.) Thesis, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.

Townsend, J.C. 1953. Introduction to Experimental Methods. International Student Edition, McGraw Hill Book Company Inc. New York.

Wilkinson, T. S. and Bhandarka, P. L. 1977. Methodology and Techniques of social Research, Bombay: Himalaya Publishing House. p 79.

Zegeye, T., B. Tadesse, S. Tesfaye, M.Nigussie, D. Tanner and S. Afriye. 2002. Determinants of Use of Improved Maize Technology in Major Maize Growing Regions of Ethiopia. Enhancing the Contribution of Maize of Food Security in Ethiopia. Proceeding of the National Maize Workshop of Ethipia, 12-16, November 2001. 125-136, Addis Ababa.

APPENDICES

Appendix I: A questionnaire on interview schedule for a research study

Use of Integrated Crop Management (ICM) practices by the farmers

Serial No. : …….

Name of the respondent : ……..

Address : ……..

: ……..

: ……..

Please answer the following questions. Information given by you will be kept secret and only be used for research work

1. Age: How old are you?

…… years

2. Education (Please mention your educational attainment by putting () mark against the appropriate answer.)

a) Do not know reading and writing
b) Can sign only
c) I have studied up to ……..class

3. Family labour size

Please mention the number of your family members engaged in farming activities:

a) Male member…….person
b) Female member……person
c) Total member……person
d) Family member involve in agriculture……..person

4. Annual family income (TK)

Please mention production and income of your family from different sectors in the last year

Sl. No.	Source of income	Amount of production	Price per unit(TK)	Total (Tk.)
A.	Agriculture			
	1. Rice			
	2. Jute			
	3. Wheat			
	4. Potato			
	5. Pulse			
	6. Oilseed			
	7. Spices and condiments			
	8. Vegetables			
	9. Fruits			
	10. Other crops			
	11. Fish culture			
	12. Poultry rearing			
	13. Cattle rearing			
B.	Business			
C.	Service			
D.	Labour			
E.	Others			

Total annual income =A+B+C+D+E=

5. Farm size

Please mention the area of your land possession:

Sl. No.	Types of land ownership	Land area	
		Local unit	Hectare
1.	Homestead area(including pond)		
2.	Own land under own cultivation		
3.	Land given to others as bogra		
4.	Land taken from others as bogra		
5.	Land taken from others as lease		
6.	Fallow land		
Total			

6. Training exposure

Do you attend any training on agriculture during last 5 years? Yes /no. If yes,

Then please mention the training courses you have attended so far.

Subject	**Place**	**Duration (day)**	**Organization**

7. Times spent in farming

How many hours do you spend in farm? (hours/week)

----

8. Contact with extension media

Please mention the extension contact you have attended so far

Type of media	**Name of information media**	**Extent of contact**			
		Frequently	Occasionally	Rarely	Not at all
		3	2	1	0
Personal Contact	Friends/relatives				
	Extension agents (SAAO/FMO)				
	Extension officials (AEO/AAO/UAO)				
	BADC officials/UFPO				
	NGO personnel/AHI/UMO				
	Input dealers				
	Model farmer				
Group Contact	Demonstrations				
	Field days				
	Training days				
	Group meetings				
Mass Contact	Radio				
	Television				
	Newspaper				

	Leaf lets or booklet				
	Reading agricultural books				
	Agricultural fair				
	Audio-visual aids				

9. Knowledge on ICM

Kindly answer the following question:

Sl. No.	Questions	Marks	Obtained mark
1.	Can you mention two soil management practices that conserve soil moisture?	2	
2.	How much standing water is needed for applying granular insecticide in rice field?	3	
3.	What quantity of insecticide suspension generally hold in a knapsack sprayer machine?	3	
4.	What do you mean by ICM?	2	
5.	After how many days of spraying you can harvest crops?	2	
6.	Name two mechanical control of weed management practices.	2	
7.	Mention two biological control of pest management.	2	
8.	Which plant helps to fix nitrogen from air to soil?	2	
9.	Mention the name of three crops cultivated for green manure.	3	
10.	Mention three organic sources of nutrient for plants.	3	
11.	What is IPM?	2	
Total		26	

10. Use of ICM:

Please mention the practices you followed in last year

Sl. No.	Practices	Extent of use			
		Frequently (3)	Occasionally (2)	Rarely (1)	Never (0)
1.	Crop diversification				
2.	Alternations in cropping patterns				
3.	Legume crop cultivation				
4.	Use of frog, praying bird etc.				
5.	Use of sweeping net				
6.	Manually weed management(rouging ,eradication etc,)				
7.	Use of light trap				
8.	Use of perching				
9.	Collection and destroy eggs and larvae of insects				
10.	Use of pesticide as a last measurement				
11.	Maximize the use of organic material				
12.	Destroy crop residues				
13.	Use of mulching				

Thank you for your kind cooperation.

.....

Date:..... Signature of Interviewer

Appendix II: Correlation matrix

Variables	Age	Education	Family labor size	Annual family income	Farm/land size	Training exposure	Times spent in farming/ day	Extension media contact	Knowledge on ICM	Use of ICM
Age	1	-.187(*)	0.444(**)	-0.011	0.044	0.097	-0.064	0.039	0.037	0.12
Education	-.187(*)	1	-0.039	0.04	0.17	-0.006	-0.139	0.468(**)	0.279(**)	0.358(**)
Family labor size	0.444(**)	-0.039	1	0.047	0.358(**)	0.134	-0.036	0.078	0.190(*)	0.161
Annual family income	-0.011	0.04	0.047	1	0.135	0.063	-0.019	0.035	0.075	-0.089
Farm/land size	0.044	0.17	0.358(**)	0.135	1	0.567(**)	0.012	0.454(**)	0.503(**)	0.375(**)
Training exposure	0.097	-0.006	0.134	0.063	0.567(**)	1	-0.16	0.243(*)	0.335(**)	0.203(*)
Times spent in farming/day	-0.064	0-0.139	-0.036	-0.019	0.012	-0.16	1	-0.082	-0.004	-0.042
Extension media contact	0.039	0.468(**)	0.078	0.035	0.454(**)	0.243(*)	-0.082	1	0.504(**)	0.495(**)
Knowledge on ICM	0.037	0.279(**)	0.190(*)	0.075	0.503(**)	0.335(**)	-0.004	0.504(**)	1	0.526(**)
Use of ICM	0.12	0.358(**)	0.161	-0.089	0.375(**)	0.203(*)	-0.042	0.495(**)	0.526(**)	1

[NS] Correlation is not significant

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

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