ADOPTION OF FOUR CROPS CULTIVATION PATTERN BY THE FARMERS

A Thesis

By

Pallab Goswami

**MASTER OF SCIENCE
IN
AGRICULTURAL EXTENSION**

Department of Agricultural Extension

Hajee Mohammad Danesh Science and Technology University

Dinajpur

December, 2016

ADOPTION OF FOUR CROPS CULTIVATION PATTERN BY THE FARMERS

A Thesis
By

Pallab Goswami
Student No. 1505227
Session: 2015-16
Semester: July-December/2016

Submitted to the
Department of Agricultural Extension
In partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
IN
AGRICULTURAL EXTENSION

Department of Agricultural Extension
Hajee Mohammad Danesh Science and Technology University
Dinajpur

December, 2016

ADOPTION OF FOUR CROPS CULTIVATION PATTERN BY THE FARMERS

A Thesis
By

Pallab Goswami
Student No. 1505227
Session: 2015-16
Semester: July-December/2016

Approved as to style and content by

_____   _____

Kbd. Professor Dr. Saiful Huda   **Professor Dr. Md. Abu Sayed Mondol**
Supervisor   Co-Supervisor

_____

Kbd. Professor Dr. Saiful Huda
Chairman
Examination Committee
and
Chairman, Department of Agricultural Extension
Hajee Mohammad Danesh Science and Technology University
Dinajpur

December, 2016

ACKNOWLEDGEMENTS

ADOPTION OF FOUR CROPS CULTIVATION PATTERN BY THE FARMERS

ABSTRACT

The main purpose of the study was to determine the extent of adoption of four crops cultivation pattern by the farmers and to explore the relationships between nine selected characteristics of the farmers' with their adoption of four crops cultivation pattern. The factors influenced the farmers in the adoption of four crops cultivation pattern have also been identified. Data were collected from a sample of 104 farmers (out of 400) selected by simple random sampling procedure from Baragoan and Nargun union under Thakurgaon Sadar upazila of Thakurgaon district. A pretested and structured interview schedule was used to collect data from the respondents during 15 September to 15 October, 2016. The highest proportion (75.0 percent) of the farmers had medium adoption of four crops cultivation pattern, while 23.1 and 1.9 percent of them had high and low adoption of four crops cultivation pattern respectively. The major factor influenced the farmers were "four crop cultivation is profitable'', followed by "four crop cultivation is very important for food security''. Correlation analyses indicated that among nine selected characteristics education, annual income, training received, organizational participation, extension media contact and agricultural knowledge had positive significant relationships with their adoption of four crops cultivation pattern. However, age, family size, and farm size of the farmers had no significant relationships with their adoption of four crops cultivation pattern.

TABLE OF CONTENTS

Chapter	Contents	Page

TABLE OF CONTENTS (Contd.)

Chapter	Contents	Page
3	**METHODOLOGY**	**18**
3.1	Locale of the Study	18
3.2	Population and Sample	21
3.3	Research Instrument	21
3.4	Measurement of Variables	21
3.4.1	Measurement of independent variables	21
3.4.1.1	Age	21
3.4.1.2	Education	21
3.4.1.3	Family size	21
3.4.1.4	Farm size	22
3.4.1.5	Annual income	22
3.4.1.6	Training received	22
3.4.1.7	Organizational participation	23
3.4.1.8	Extension media contact	23
3.4.1.9	Knowledge on four crops cultivation pattern	23
3.4.2	Measurement of dependent variable	24
3.5	Factors influencing adoption of four crops cultivation pattern	24
3.6	Hypothesis of the Study	25
3.6.1	Research hypothesis	25
3.6.2	Null hypothesis	25
3.7	Data Collection	25
3.8	Compilation of Data	26
3.9	Statistical Analysis	26
4	**RESULTS AND DISCUSSION**	**27**
4.1	Selected characteristics of the farmers	27
4.1.1	Age	27
4.1.2	Education	29
4.1.3	Family size	29
4.1.4	Farm size	29
4.1.5	Annual income	30
4.1.6	Training received	30
4.1.7	Organizational participation	30
4.1.8	Extension media contact	31
4.1.9	Agricultural knowledge	31
4.2	Adoption of four crops cultivation pattern by the Farmers	31

TABLE OF CONTENTS (Contd.)

Chapter	Contents	Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 General Background

Bangladesh is predominantly an agricultural country comprising 147,610 square kilometres (56,990 sq mi) and extends 820 kilometres (510 mi) north to south and 600 kilometres (370 mi) east to west with an estimated population is 162.72 million (Countrymeters, 2016). The population density of Bangladesh is 1077 persons per square kilometer and per capita income is about US dollar 1466 (BBS, 2016).

Bangladesh is highly dependent on its rural economy as 80 percent people live in rural areas (BBS, 2016). Agriculture remains the major pillars of the Bangladesh national economy. It plays a vital role in ensuring food security, rising standard of living and increase export earnings. Agriculture and environment has a close relationship and interact with each other. The output prices from agriculture have been found to contribute 23.50 percent to the GDP in which 13.44 percent comes from crops, 1.90 percent from forestry, 2.93 percent from livestock and 5.23 percent from fisheries (BBS, 2014).

Four crops cultivation pattern is the judicious utilization of time and space to increase the total crop output per unit area. This cropping pattern, evolved and introduced by RDRS Bangladesh, a non-government organization, has been helping the farmers in getting four crops annually on the same land contributing substantially to increase crop intensity and food production. It is a very good practice to increase total crop yield balancing the nutritional requirements, higher monetary return, greater resource utilization and to fulfill the diversified needs of the farmers.

Food insecurity and unemployment of farm workers in September-October can be mitigated by up-scaling the production of short duration aman rice (Var. BU Dhan 1, BRRI Dhan 56, BINA Dhan 7) as it can be harvested by October. It is evident and popularized in some areas of northern Bangladesh through the preliminary research and development works done with the financial assistance of Krishi Gobeshona Foundation (KGF) from May 2009 - April 2011. Similar changes in other parts of northern region will not only ensure food security but also enhance system productivity as it facilitates timely planting of winter potato or wheat after the rice harvest (Haque, 2010). However, this practice requires further testing and validation under specific micro-environments.

Timely planting of potato or wheat in winter season further creates opportunity to establish short duration mungbean (BARImung 6, BUmung 4) and short duration aus rice (var. Pariza) in sequence, as it requires nearly 60 and 70 days field duration, respectively (RDRS, 2010). As short duration aman rice and aus rice utilizes mostly rain water, it offsets the the detrimental effect of excessive withdrawal of ground water as being practiced in boro cultivation in traditional cropping systems.

High intensive four crops in sequence aman (early) - potato or mustard-mungbean -aus (early) was tested against farmers cropping pattern aman (late)-potato-boro (late) in northern region of Bangladesh to increase cropping intensity and productivity with minimum resource use and creation of employment during joblessness time. While in central part, boro - aus (early) - aman (early) was tested against farmers cropping pattern boro - fallow - aman to increase cropping intensity and productivity in rice based cropping system.

Economic analysis showed that the alternate cropping patterns are more economical than the crops grown in the existing cropping pattern. Among the four crops grown in sequence, potato contributed the highest economic return although it required highest investment in crop cultivation. Gross return in potato of alternate cropping pattern (Tk. 300188 ha^{-1}) was found almost double than potato in farmers cropping pattern (Tk. 145661 ha^{-1}) mostly because of higher market price of early potato than late harvested potato of farmers cropping pattern (Rashid and Haque, 2016).

Similarly, greater benefit in aman rice of the alternate cropping pattern was associated with higher early market price than late harvested rice in the traditional cropping pattern. To some extent, better grain quality of early rice of alternate cropping system also enhanced the market price. From whole system research, gross return Tk. 499027 ha-1 was obtained in alternate cropping pattern against Tk. 25550 ha-1 which is 75.92 percent higher than that of farmers cropping pattern. Further, the alternate cropping pattern with four crops produced 73.43 percent higher system yield and 11.96 percent food energy over yield and food energy produced by three crops of farmers cropping pattern.

Considering cost-benefit ratio, potato (3.96) of alternate cropping pattern is more economical than potato (2.21) of farmers cropping pattern. Based on the whole cropping pattern, cost-benefit ratio was 2.93 in the alternate cropping pattern and 1.72 in the traditional cropping pattern. Comparison of the cost-benefit ratio of potato (2.21) in the traditional cropping pattern to that of the mustard (2.54) in the alternate cropping pattern suggests the possibility of extending mustard in four crops in sequence. Therefore, a lot of scope exists for adopting

mustard in place of potato to minimize the risk of overproduction of potato in northern districts. Moreover, further yield improvement in mustard may create additional impact to farmers as unit price of mustard is much higher than that of potato (Rashid and Haque, 2016).

1.2 Statement of the Problem

In Bangladesh, more than 80 percent people depend on agriculture directly or indirectly. Agricultural land of our country decreases day by day, but population increases geometrically. At present the high time to set up our mind to develop our agriculture for increasing crop production and ensure food security. Food insecurity and unemployment is common in northern Bangladesh once in September-October and again in April-May because of growing of long duration aman rice (Swarna and BR11). Food security and labor employment can be done in that two periods by adopting short duration rice (BUdhan 1, BINA Dhan 7, BRRI dhan 56) in aman and short duration mungbean (BU mung 4, BARI mung 6) in kharif season.

Besides, growing of boro after potato is becoming popular in sandy loam soil of northern region. Cultivation of boro rice in upland ecosystem is very much input intensive especially huge amount of ground water withdrawal is required throughout the growing season. Alternately Pariza, a short duration rice and short duration mungbean can easily be grown after harvesting of potato with minimal or without withdrawing ground water for irrigation.

Thus inclusion and up-scaling of short duration crops varieties (rice and mungbean) in the cultivation pattern would increase cropping intensity, system productivity and employment opportunity in northern Bangladesh with minimum use of valuable resources including ground water and chemical fertilizers. So, cultivation of four crops is very essential to get more output from a same land. With a view to have an understanding on the extent of adoption of four crops cultivation pattern by the farmers, the researcher undertook a research study entitled "Adoption four crops cultivation pattern of by the farmers." The purpose of the study is to determine the extent of adoption of four crop cultivation and also to ascertain the relationships of the selected characteristics of the farmers practicing four crops cultivation pattern with their adoption of four crops cultivation pattern. The present investigation is concerned with the adoption of four crops cultivation pattern which is a major concern in agricultural extension.

This will be done by seeking answer to the following questions:

1. What are the characteristics of the farmers?

2. What are the extents of adoption of four crops cultivation pattern by the farmers?

3. What are the relationships of the selected characteristics of the farmers with their adoption of four crops cultivation pattern?

4. What are the factors that influence the farmers in adopting four crops cultivation pattern?

1.3 Justification of the study

In Bangladesh, the deficit of food grains is a chronic problem as the pressure of population is massive. So, to ensure adequate food supply, it is necessary to give thrust to increase food production using four crop cultivation practices. Agricultural intensification minimizing food shortage and maximizing self-sufficiency in food production is possible only when adoption of four crop cultivation practices and their application skills create positive impact on the behavior of ultimate users. However, very few researches have so far been conducted in Bangladesh in the social and psychological aspects of agricultural crop production. More than 70 percent people of Bangladesh lives in rural areas and their main livelihood is agriculture. It is, therefore, necessary to undertake a research study to ascertain 'adoption of four cultivation pattern by the farmers '.

1.4 Specific Objectives of the Study

1. To determine some selected characteristics of the farmers practicing four crops cultivation pattern. The characteristics were

i. Age	vi. Training received
ii. Education	vii. Organizational participation
iii. Family size	viii. Extension media contact
iv. Farm size	ix. Agricultural knowledge
v. Annual income	

2. To determine the extent of adoption of four crops cultivation pattern by the farmers

3. To determine the factors influenced by the farmers in adopting four crops cultivation pattern; and

4. To determine the relationship between the selected characteristics of the farmers and their extent of adoption of four crops cultivation pattern.

4

1.5 Assumptions

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode, 1945). In this study, the following assumptions were taken into consideration while undertaking this study.

1. The respondents selected for this study were competent enough to provide proper responses to the questions included in the interview schedule.
2. The views and opinions furnished by the respondents were the representative views and opinion of all the farmers of that area.
3. The responses furnished by the respondents were valid and reliable.
4. The data collected by the researcher was free from bias.
5. The researcher acting as the interviewer was well adjusted to the society and environment of the study area. Hence, the data collected from the respondents were free from bias.
6. The findings of the study will have general applications to other parts of the country with similar personal, socio-economic and cultural conditions of the study area.
7. Data were normally and independently distributed.
8. The sampling procedures followed for this study, the analysis of data and interpretations etc. were free from all biases.

1.6 Limitations of the Study

Considering the time, money and other necessary resources available to the researcher and to make the study manageable and meaningful it became necessary to impose certain limitations. The limitations were as follows:

1. The characteristics of the farmers were many and varied. Only nine characteristics were selected for investigation.
2. The study was confined mainly to farmers' adoption of four crops cultivation pattern.
3. Population for the present study was kept confined within the heads of farm families in the study area, because they were the major and high user of four crops.
4. The extent of adoption of four crops cultivation pattern by the farmers was measured on the basis of their response and scores assigned to the selected statements.
5. In attempting to accomplish the objectives listed above, the researcher depended on information furnished by the respondents.

6. 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, skill and humour.

1.7 Definition of Important Terms

For clarity of understanding a number of key terms used through the study are defined below:

Adoption is the implementation of a decision to continue the use of an innovation.

Extent of adoption is the degree to which the farmer has actually adopted a practice (Ray, 1991).

Cropping pattern is the pattern of crops for given a piece of land or cropping pattern means the proportion of area under various crops at a point of time in a unit area or it indicated the yearly sequence and spatial arrangements of crops and follows in an area. Land resources being limited emphasis have to be placed for increasing production from unit area of land n a year.

Cropping Intensity of the respondents was expressed in percentage. It was measured in ratio between total cropped areas to net cropped area.

Four crops cultivation pattern is the pattern of crops which gives the farmers four crops annually on the same land in a year contributing substantially to increase crop intensity and food production. It is a very good practice to increase total crop yield balancing the nutritional requirements, higher monetary return, greater resource utilization and to fulfill the diversified needs of the farmers.

Education referred to the ability of the respondents to read and write or having formal education received up to a certain standard. Education was measured on the basis of class a farmer had passed from formal education institution.

Family size refers to the total number of members including the respondent himself, his wife, children and other dependent members who live and eat together in a single family.

Farm size referred to the cultivated area either owned by the farmer or obtained from other on borga system, the area being estimated in terms of full benefit and half benefit to the farmer respectively. The self-cultivated owned land and cultivated area taken as lease or mortgage from others was recognized as full benefit.

6

Annual income refers to the total earnings by the members of the respondents from agricultural and non-agricultural sources during a year. In fact, it was gross income and expressed in taka.

Training experiences of a farmer was defined as the number of days s/he had so far received training. It was used to refer to the completion of an activity by the farmer which was offered by the government, semi-govt. or non-government organizations to improve the knowledge & skills of farmers and changing attitude of a farmer for doing a specific job properly.

Organizational participation of farmers refers to his direct contact with various organizations within a specific period of time. An individual could take part in various activities of organization as member, secretary, Chairmen/ President etc. All these forms of participation were considered to operationalize the variable.

Extension media contact referred to one's becoming accessible to the influence of extension contact through different extension teaching methods or refers to the individual exposure to or contact with information sources.

Agricultural knowledge is the extent of basic understanding of the farmers in different aspects of agricultural subject matters i.e. crops, livestock, fisheries, agro forestry, soil, seed, fertilizer, insects and diseases of four crops, high yielding variety etc. It includes the basic understanding of the use of different agricultural inputs and practices.

CHAPTER 2

REVIEW OF LITERATURE

The present study deals with the adoption of four crops cultivation pattern. The purpose of the study is to review previous studies, opinions and observation of experts having relevance to this research. Reviewed materials included publications, journals, reports, magazines etc. The researcher therefore, made exhaustive effort to review the previous research works directly or indirectly related to the present study by different research in home and abroad. Findings of past studies indicate certain relationships between the adoption of four crops cultivation pattern and related individual characteristics of the farmers who cultivated four crops.

2.1 Concept of Diffusion, Adoption, Adoption Process and Innovation-Decision Process

Diffusion

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of social system (Rogers, 2003).

Adoption

According to Rogers (2003) "Adoption is a decision to make full use of an innovation as the best course of action available". When an individual takes up a new idea as the best course of action and practices it, the phenomenon is known as adoption (Ray, 2006).

Adoption process

Rogers and Shoemaker (1971) stated the adoption process as: the traditional view of the innovation-decision process, called "adoption process" was postulated by a committee of rural sociologists in 1955 as consisting of five stages:

a. **Awareness stage**

   The individual learns of the existence of the new idea but lacks detailed information about it

b. **Interest stage**

   The individual develops interest in the innovation and seeks additional information about it.

c. **Evaluation stage**

   The individual makes mental application of the new idea to his present and anticipated future situation and decides whether or not try it.

d. Trail stage

The individual actually applies the new idea on a small scale in order to determine its utility in its own situation.

e. Adoption stage

The individual uses the new idea continuously on a full scale.

Innovation-Decision process

Diffusion of an innovation occurs through a five–step process. This process is a type of decision-making. In later edition of the "Diffusion of Innovations" Rogers (2003) changed the terminology of the five stages to: knowledge, persuasion, decision, implementation, and confirmation. And the descriptions of five stages of the adoption process are as follows:

a. Knowledge stage

In this stage the individual is first exposed to an innovation but lacks information about the innovation. During this stage of the process the individual has not been inspired to find more information about the innovation.

b. Persuasion stage

In this stage the individual is interested in the innovation and actively seeks information/ detail about the innovation.

c. Decision stage

In this stage the individual takes the concept of the change and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation. Due to the individualistic nature of this stage Rogers notes that it is the most difficult stage to acquire empirical.

d. Implementation stage

In this stage the individual employs the innovation to a varying degree depending on the situation. During this stage the individual determines the usefulness of the innovation and may search for further information about it.

e. Confirmation stage

In this stage the individual finalizes his/her decision to continue using the innovation. This stage is both intrapersonal (may cause cognitive dissonance) and interpersonal, confirmation the group has made the right decision.

2.2 Review of General Context of Adoption

Mou (2015) found that half (50.00 percent) of the farmers had low adoption while 40.20 percent had medium adoption and 9.80 percent had high adoption of improved practices in vegetable cultivation.

Hasan (2015) found that more than half of the respondents (56.1 percent) had medium adoption where 15.9 percent had low adoption and only 24.3 percent had high adoption of modern practices for rice cultivation. There was 3.7 percent respondents were in no adoption of selected modern practices for rice cultivation.

Kabir (2015) reveal that 44.4 percent respondents had medium adoption where 24.1 percent had low adoption and 31.5 percent had high adoption of commonly used IPM practices in rice cultivation.

Rao and Singh (2014) observed that majority (65.33 percent) of the farmers had medium adoption while 10.0 percent had low adoption, and 24.67 percent had high adoption of recommended pineapple cultivation practices.

Deshmukh and Bariya (2014) found that majority (65.83 percent) of the farmers had medium adoption while 19.17 percent had low adoption and 15.00 percent had high adoption of recommended *Kharif* groundnut practices.

Afroz (2013) found that highest 40.48 percent of the respondents had low adoption of wheat cultivation, while 34.92 percent had medium adoption and the rest 24.60 percent had high adoption of wheat cultivation.

Chouhan and Singh (2013) reported that majority (74.16 percent) of the farmers had medium adoption while 12.50 percent had low adoption and 13.34 percent had high adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) revealed that 73.00 percent of the farmers had medium adoption while 10 percent had low adoption and 17.0 percent had high adoption of recommended mango cultivation practices.

Kumbhare and Singh (2011) observed that majority (53.75 percent) of the farmers had high adoption while 14.5 percent had low adoption and 31.75 percent had medium adoption of improved wheat and paddy production technology.

Baruah and Singha (2011) revealed that 58.00 percent of the farmers had medium adoption while 31.11 percent had low adoption and 24.44 percent had high adoption of recommended rice cultivation practices.

Singh and Barman (2011) found that majority (48.0 percent) of the farmers had medium adoption while 25.0 percent had low adoption and 27.0 percent had high adoption of recommended tomato and cauliflower cultivation technologies.

Singh (2010) observed that majority (58 percent) of the farmers had medium adoption while 24 percent had low adoption and 18 percent had high adoption of recommended potato cultivation practices.

Prasad and Ram (2010) found that majority (50.00 percent) of the farmers had medium adoption while 16.37 percent had low adoption and 33.63 percent had high adoption of improved wheat cultivation technologies.

Singh and Priyadarshi (2010) found that majority (59.5 percent) of the farmers had medium adoption while 28 percent had low adoption and 12.5 percent had high adoption of improved mango production practices.

2.3 Review of Relationship between Farmers' Characteristics and their Adoption.

2.3.1 Age and adoption

Hasan (2015) found that age was significant contribution on modern practices for rice cultivation.

Mou (2015) found that age did not show any significant contribution on the adoption of improved practices in vegetable cultivation of the farmers.

Kabir (2015) reveal that age was significant contribution on adoption of IPM practices in rice cultivation.

Rao and Singh (2014) observed that age of the farmers show negative and significant relationship with their adoption of pineapple cultivation practices.

Afroz (2013) found that age of the farmers showed non-significant positive relationships with the adoption of wheat cultivation.

Chouhan and Singh (2013) reported that age of the farmers show significant relationship with their adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) revealed that age of the farmers show negative relationship with their adoption of recommended mango cultivation practices.

Singh (2010) observed that age of the farmers show negative and significant relationship with their adoption of potato cultivation practices.

2.3.2 Education and adoption

Mou (2015) found that education showed significant and positive contribution to their adoption of improved practices in vegetable cultivation.

Hasan (2015) found that education was significant contribution on modern practices for rice cultivation.

Rao and Singh (2014) found that education of the farmers showed significant and positive relationship with their adoption of pineapple cultivation practices.

Afroz (2013) found that education of the farmers showed significant positive relationships with the adoption of wheat cultivation.

Chouhan and Singh (2013) revealed that education of the farmers show significant relationship with their adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) observed that education of the farmers showed significant relationship with their adoption of recommended mango cultivation practices.

Singh (2010) observed that education of the farmers showed significant and positive relationship with their adoption of potato cultivation practices.

2.3.3 Family size and adoption

Rao and Singh (2014) observed that family size of the farmers did not show any significant relationship with their adoption of pineapple cultivation practices.

Chouhan and Singh (2013) reported that family size of the farmers did not show any significant relationship with their adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) found that family size of the farmers showed negative relationship with their adoption of recommended mango cultivation practices.

Singh (2010) found that family size of the farmers showed positive relationship with their adoption of potato cultivation practices..

Singh and Priyadarshi (2010) reported that family size of the farmers showed negative significant relationship with their adoption of improved mango production practices.

2.3.4 Farm size and adoption

Mou (2015) found that farm size did not show any significant contribution on the adoption of improved practices in vegetable cultivation of the farmers.

Kabir (2015) reveal that farm size was significant contribution on adoption of IPM practices in rice cultivation.

Rao and Singh (2014) reported that farm size of the farmers showed positive and significant relationship with their adoption of pineapple cultivation practices.

Afroz (2013) found that farm size of the farmers showed non-significant positive relationships with the adoption of wheat cultivation.

Chouhan and Singh (2013) observed that farm size of the farmers show significant relationship with their adoption of improved sugarcane cultivation practices.

Singh (2010) found that farm size of the farmers showed positive relationship with their adoption of potato cultivation practices.

2.3.5 Annual income and adoption

Mou (2015) found that annual income showed significant and positive contribution to their adoption of improved practices in vegetable cultivation.

Rao and Singh (2014) found that annual income of the farmers had positive and significant relationship with their adoption of pineapple cultivation practices.

Afroz (2013) found that annual income of the farmers showed non-significant positive relationships with the adoption of wheat cultivation.

13

Chouhan and Singh (2013) observed that annual income of the farmers showed significant relationship with their adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) found that annual income of the farmers showed positive and highly significant relationship with their adoption of recommended mango cultivation practices.

Singh (2010) found that annual income of the farmers showed significant relationship with their adoption of potato cultivation practices.

Hasan (2006) reported that annual income of the growers showed significant and positive relationship with their adoption of improved practices in litchi cultivation.

2.3.6 Training received and adoption

Mou (2015) found that training experiences showed significant and positive contribution to their adoption of improved practices in vegetable cultivation.

Kabir (2015) reveal that training exposure was significant contribution on adoption of IPM practices in rice cultivation.

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

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

2.3.7 Organizational participation and adoption

Mou (2015) found that organizational participation did not show any significant contribution on the adoption of improved practices in vegetable cultivation of the farmers.

Rahman (2005) observe that the organizational participation of the farmers had no significant relationship with their adoption of modern rice varieties.

Sardar (2002) in a study on IPM practices found that organizational participation of the farmers had no significant relationship with their adoption of IPM practices.

Hussein (2001) in a study on the farmers' knowledge and adoption of modern sugarcane cultivation practices observe that organizational participation of the growers had significant positive relationship with their adoption of modern sugarcane cultivation practices.

2.3.8 Extension media contact and adoption

Mou (2015) found that extension media contact did not show any significant contribution on the adoption of improved practices in vegetable cultivation of the farmers.

Hasan (2015) found that extension contact was significant contribution on modern practices for rice cultivation.

Rao and Singh (2014) found that extension contact of the farmers showed positive and significant relationship with their adoption of pineapple cultivation practices.

Afroz (2013) found that Extension media contact of the farmers showed significant positive relationships with the adoption of wheat cultivation.

Chouhan and Singh (2013) revealed that extension contact of the farmers showed significant relationship with their adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) found that extension contact of the farmers showed positive and highly significant relationship with their adoption of recommended mango cultivation practices.

Singh and Barman (2011) observed that extension contact of the farmers showed significant relationship with their adoption of tomato and cauliflower cultivation technologies.

Singh (2010) revealed that extension contact of the farmers showed positive relationship with their adoption of potato cultivation practices.

2.3.9 Agricultural Knowledge and adoption

Mou (2015) found that vegetable cultivation knowledge did not show any significant contribution on the adoption of improved practices in vegetable cultivation of the farmers.

Kabir (2015) reveal that knowledge on pesticide application was significant contribution on adoption of IPM practices in rice cultivation.

Afroz (2013) found that agricultural knowledge of the farmers showed significant positive relationships with the adoption of wheat cultivation.

Chouhan and Singh (2013) reported that knowledge of the farmers showed significant relationship with their adoption of improved sugarcane cultivation practices.

Mehta and Sonawane (2012) found that knowledge of the farmers show positive and highly significant relationship with their adoption of recommended mango cultivation practices.

Singh and Barman (2011) observed that knowledge of the farmers showed significant relationship with their adoption of tomato and cauliflower cultivation technologies.

Singh (2010) revealed that knowledge of the farmers showed positive and significant relationship with their adoption of potato cultivation practices.

2.4. Conceptual Framework of the study

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly consists at least two important elements i.e. "dependent variable" and "independent variable". A dependent variable is a factor that appears, disappears or varies as the researcher introduces, removes or varies the independent variables.

The conceptual framework of Rosenberg and Hovland (1960) was kept in mind while making structural arrangements for the dependent and independent variables. This study is concerned with the adoption of four crops cultivation pattern by the farmers. Thus the adoption of four crops cultivation pattern was the dependent variable and nine (9) selected characteristics of the farmers were the considered as the independent variables. Adoption of four crops cultivation pattern of an individual may be influenced and affected through interacting forces of many independent variables. It is not possible to deal with all independent variables in a single study.

Therefore, it was necessary to limit the independent variables, which included age, education, family size, farm size, annual income, training received, organizational participation, extension media contact and agricultural knowledge. Factors may also influence the adoption of four crops cultivation pattern.

In the light of foregoing discussion, a conceptual framework has been developed for this study, which is diagrammatically shown in the Figure 2.1.

16

Independent variables	Dependent variable

1. Age
2. Education
3. Family size
4. Farm size
5. Annual income
6. Training received
7. Organizational participation
8. Extension media contact
9. Agricultural knowledge

Adoption of four crops cultivation pattern

Factors influencing adoption of four crops cultivation pattern

Increase farmers crop production
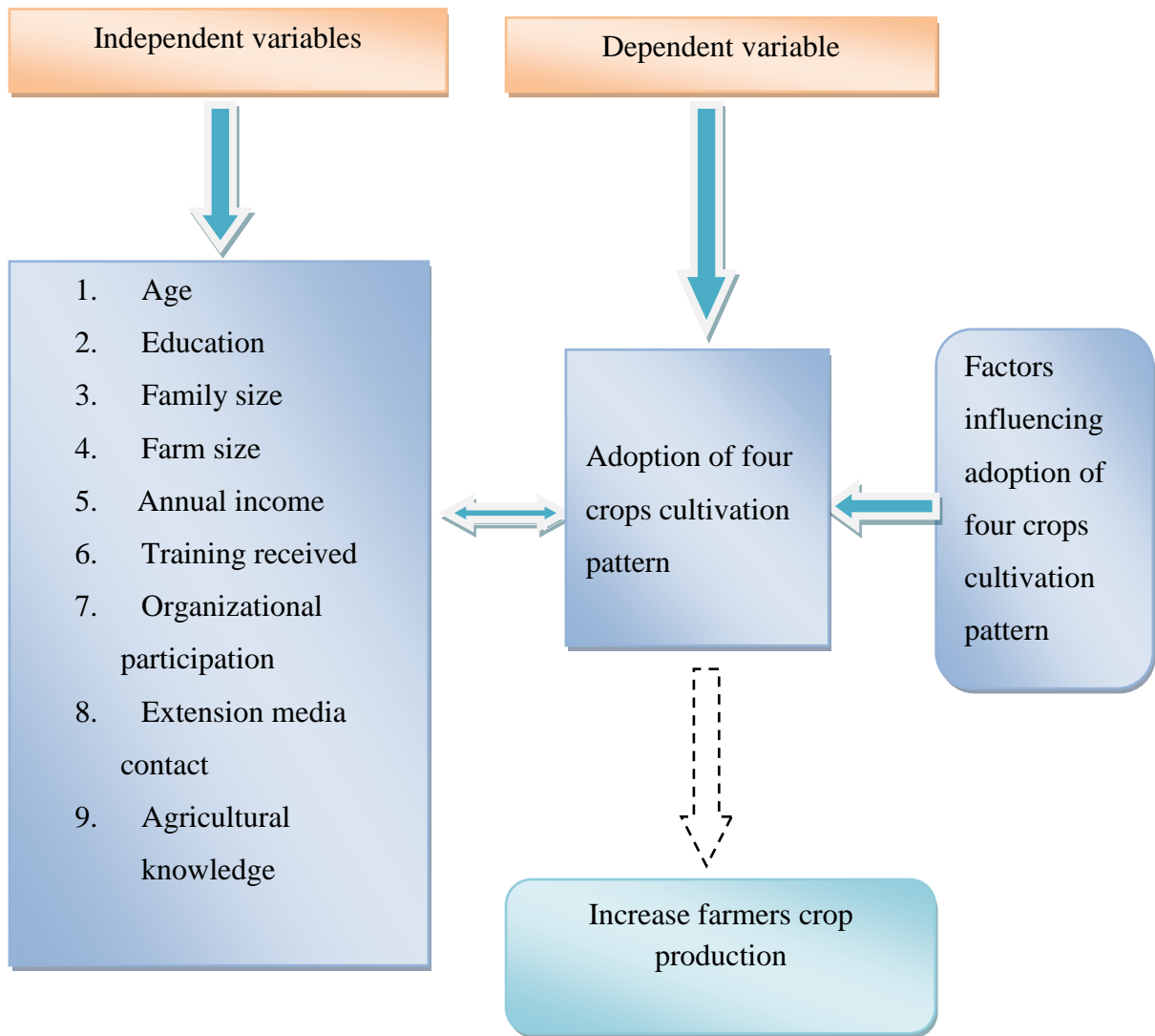
Indicates parameters under investigation

Indicates parameters not considered for investigation

Figure 2.1 Conceptual framework of the study

CHAPTER 3

METHODOLOGY

Methodology deserves a very careful consideration in any scientific research. Importance of methodology in considering any research cannot be neglected. Methodology should be such as would enable the researcher to collect decisions. Keeping this point in view, the researcher took utmost care for using proper method in all aspects of this investigation. This Chapter contains the methods and procedures in the present study in accordance with the objectives.

3.1 Locale of the Study

The study was conducted in two union of Thakurgaon Sadar upazila namely Baragoan and Nargun under Thakurgaon district. There are 22 unions of Thakurgaon Sadar upazila, among which major occupation of the farmers agricultural and few people are service holders and businessmen. The farmers of Baragoan and Nargun union are cultivating four crops that are supervised by a Non-Government Organizations named Agri and Research Foundation (ARF) and support by RDRS. The geographical location of the study area is at 26.0208^0 north latitudes and 88.4667^0 east longitudes. A map of Thakurgaon district including its upazilas is given in Figure 3.1 and Figure 3.2 respectively.

3.2 Population and Sample

The farmers who are getting support from RDRS of Baragoan and Nargun union of Thakurgaon Sadar upazila was the population of the study. An updated list of 400 farmers was collected from RDRS office record who followed four crops cultivation pattern. Out of them a sample of 104 farmers (26 percent) was selected by random sampling method. Simultaneously a reserve list of 10 farmers was made in order to use in case of non-availability of sampled farmers. The detailed distribution of population and sample are shown in Table 3.1.

Table 3.1 Union wise distribution of the population and sample

Name of the union	Number of farmers			
	Population	Sample	Percent	Reserve list
Baragoan	200	52	26	5
Nargun	200	52	26	5
Total	400	104	26	10
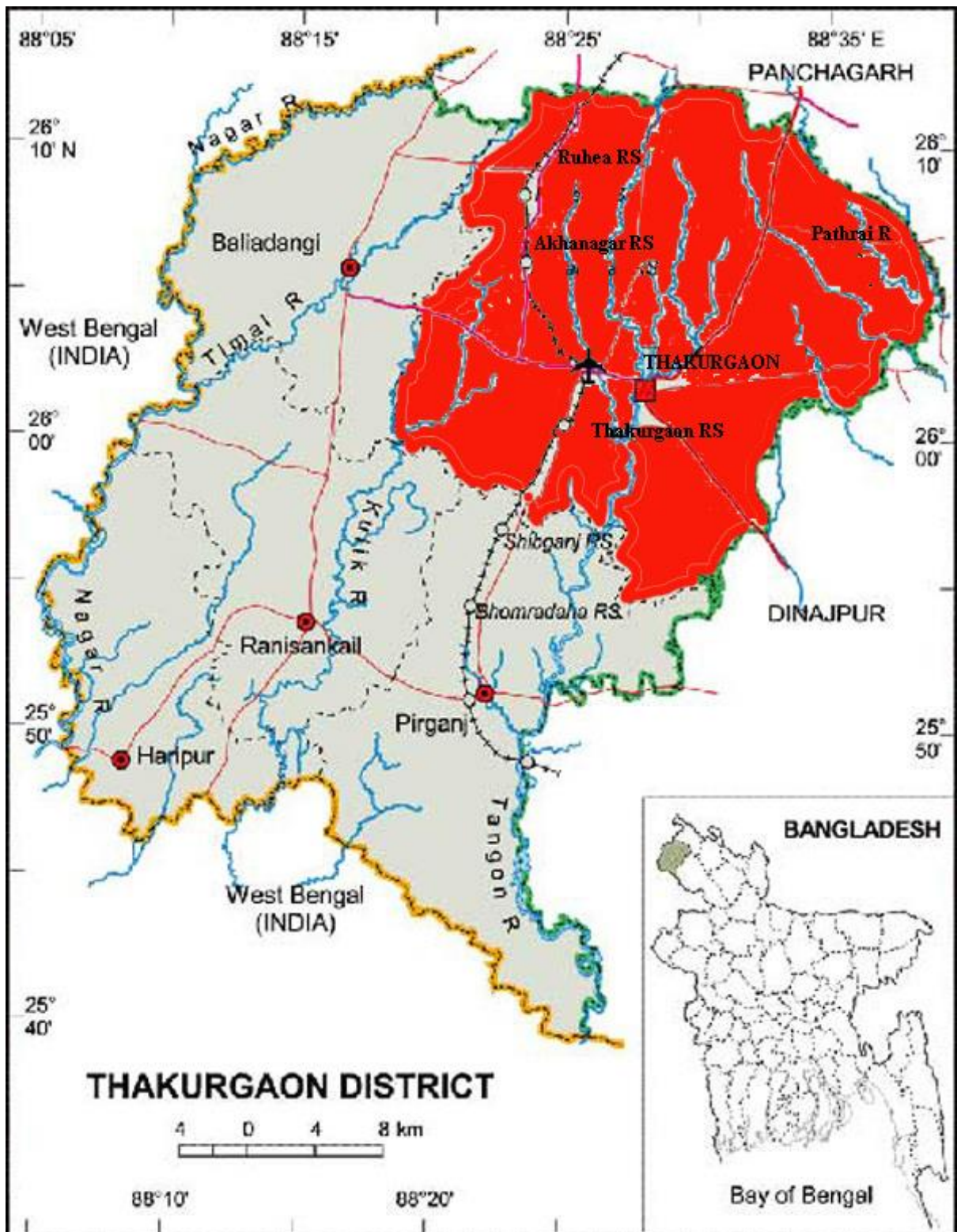
Figure 3.1 Map of Thakurgaon District Showing Thakurgaon Sadar Upazila
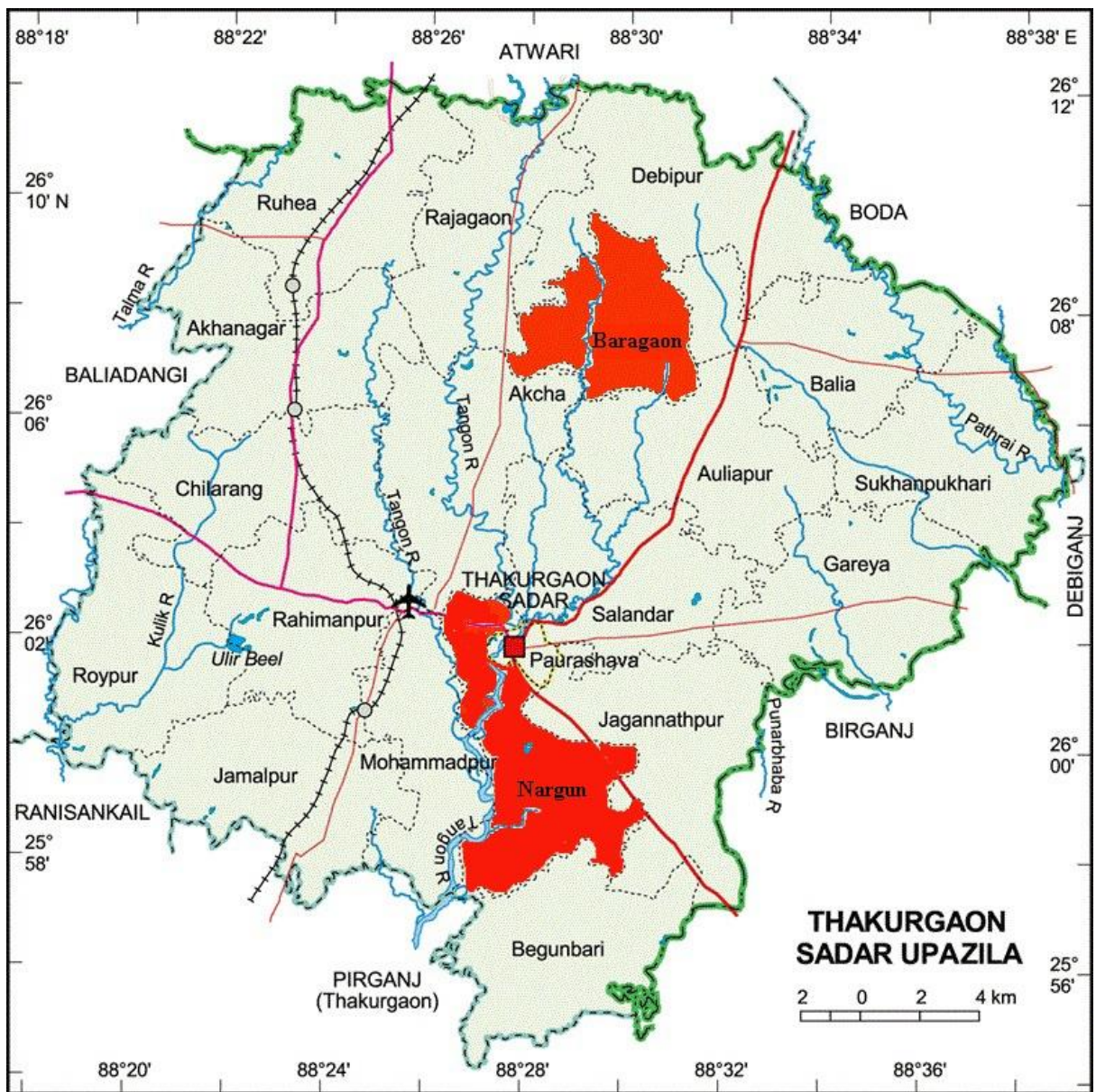
Figure 3.2 Map of Thakurgaon Sadar Upazila Showing Study Area

3.3 Research Instrument

In order to collect relevant data for the study, a structured interview schedule was prepared keeping the objectives in mind. The questions and statements contained in the schedule were simple, direct and easily understandable by the respondents. The schedule contained closed form of questions. A draft interview schedule was prepared in advance before using the same for collection of data. The draft schedule was pre-tested with 10 beneficiaries selected from the study area. This pre-test facilitated the researcher to identify faulty questions in the draft schedule and necessary corrections, addition and adjustment was made afterwards in the schedule on the basis of the pre-test results.

3.4 Measurement of Variables

3.4.1 Measurement of independent variables

The nine characteristics of the respondents namely age, education, family size, farm size, annual income, training received, organizational participation, extension media contact and agricultural knowledge constituted the independent variables of this study. The measurement procedure of these characteristics discussed below.

3.4.1.1 Age

Age of the respondent was measured in terms of years from his/her birthday to the time of interview which will be found on the basis of response. A unit score was assigned for each year of one's age. The variable appears in the item No. 1 in the interview schedule (Appendix-A).

3.3.1.2 Education

Education was measured as the ability of an individual farmer to read and write or formal education received up to a certain standard. Educational qualification of the respondents was measured in terms of one's year of schooling. One score was given for passing each level in an educational institution (Mondol, 2009). For example, if a respondent passed the final examination of class V his level of educational score was taken as five (5). If a respondent did not know how to read and write, his educational score was given as '0'. A score of 0.5 was given to that respondent who could sign his name only. The variable appears in the item No. 2 in the interview schedule (Appendix-A).

3.3.1.3 Family size

The family size was measured by the total number of members in the family of a respondent. The family members included the respondent himself, his wife, children and other dependent

members who lived and ate together. A unit score was assigned for each member of the family. If a respondent had five members in his/her family, then family size score was given as 5 (Khan, 2004). The variable appears in the item No. 3 in the interview schedule (Appendix-A).

3.4.1.4 Farm size

The farm size was measured by the area of the raised land in which the household of the respondent had its entire dwelling unit including homestead area under cultivation (Sarker, 2004). It was expressed in hectare. The total areas of land thus obtained have been considered as farm size of the respondent. The variable appears in the item No. 4 in the interview schedule (Appendix-A). It was measured using the following formula:

Farm size= $a+ b+\frac{1}{2}(c+d)+ e+ f+ g$

Where,

       a= Homestead (including garden and fallow land)

       b= Own land under own cultivation

       c= Land given to others on *borga*

       d= Land taken from others on *borga*

       e= Land taken from others on lease

       f= Pond area

       g= Others (if any)

3.4.1.5 Annual income

Annual income of a respondent was measured on the basis of total yearly earning from agriculture and non-agriculture sources (service, business, daily labor, Rickshaw/Auto-Rickshaw driving etc.) by the respondent himself and other family members. The value of all the agricultural products encompassing crops (rice, wheat, maize), vegetables, fruits, poultry, fish culture, domestic animals etc. were taken into consideration. For calculation of income score, one (1) was assigned for each one thousand taka of income. The variable appears in the item No. 5 in the interview schedule (Appendix-A).

3.4.1.6 Training received

Training received was determined by the total number of days of training received by the farmers from any organization during the last four years. If a respondent took three days training on agriculture from GOs, NGOs or any other organization, then his training exposure

score was 3 and so on. The variable appears in the item No. 6 in the interview schedule (Appendix-A).

3.4.1.7 Organizational participation

Organizational participation scores of a respondent was computed on the basis of his/her participation in different organizations operating in the study area. The researcher considered 8 such organizations and assigned a score of 0, 1, 2 and 3 for 'no participation', 'as a member', 'as a general secretary' and 'as a chairmen/ president' respectively. Thus, the Organizational participation score could range from 0 to 24 where 0 indicating no participation and 24 indicating highest participation in organizations. The variable appears in the item No. 7 in the interview schedule (Appendix-A).

3.4.1.8 Extension media contact

The extension media contact score was computed for each respondent on the basis of her extent of contact with 10 selected extension media among which four of them belong to individual media, three of them under group media and three of them under mass media contact category. For measuring the extension media contact score was assigned for the extension media 4, 3, 2 and 1 for the extent of contact 'regularly', 'often' 'rarely, and 'not at all' respectively. The variable appears in the item No. 8 in the interview schedule (Appendix-A).

3.4.1.9 Agricultural Knowledge

To measure agricultural knowledge of a respondent 10-items scale was constructed in the interview schedule. Each respondent was asked to answer all the 10 questions. Out of assigned scores against each question, the summation of obtained scores against 10 questions represented the agricultural knowledge of a respondent. Agricultural knowledge was measured by the total knowledge score about agriculture. The total assigned score was 26. But, the score of each question was not equal, it was determined according to the extent of difficulty. Full score was assigned for each correct answer and zero (0) for the wrong answer. However, for correct responses to all questions, a respondent could get a total score of 26 and for wrong responses to all questions he could get 0 (zero). Thus agricultural Knowledge of the respondents could range from 0-26, where 0 indicates very poor agricultural knowledge and 26 indicates very high agricultural knowledge.

3.4.2 Measurement of dependent variable

In this study Adoption of four crops cultivation pattern by the Farmers was the independent variable. The measurement procedure of the independent variable discussed below:

Adoption of four crops cultivation pattern by the Farmers

It was measured by the following formula of a particular year (Islam, 2007) :

$$\text{Adoption of four crops cultivation pattern} = \frac{\text{Land under four crops cultivation}}{\text{Potential area for four crops cultivation}} \times 100$$

Adoption of four crops cultivation pattern by the Farmers was measured for four years (2012, 2013, 2014, 2015). Finally adoption of four crops cultivation pattern was measured by average of four years as follows:

$$\text{Adoption of four crops cultivation pattern} = \frac{\text{Adoption of four crops cultivation pattern for 4 years}}{4}$$

Thus adoption of four crops cultivation pattern by the farmers ranged from 0 to100. Where '0' indicates no. adoption of four crops cultivation pattern and '100' indicates very high adoption four crops cultivation pattern.

3.5 Factors influencing adoption of four crops cultivation pattern

Fourteen factors were selected for the study which influences adoption of four crops cultivation pattern. The respondents were asked to response on four alternatives responses as 'not at all' , 'low', 'medium' and 'high' for each of fourteen selected problems. Scores were assigned to those alternative responses as 0, 1, 2 and 3 respectively. Thus, the possible factor influencing score of the respondents could range from 0 to 42, where 0 indicating no factor influencing while 42 indicating high factor influencing in four crops cultivation by the farmers. To ascertain the comparison among the factors, Factor Influencing Index (FII) was computed by using the following formula:

$$FII = Fh \times 3 + Fm \times 2 + Fl \times 1 + Fn \times 0$$

Where,

FII = Factor Influencing Index

Fh = Number of respondents influenced 'high'

Fm = Number of respondents influenced 'medium'

Fl= Number of respondents influenced 'low'

Fn = Number of respondents influenced 'not at all'

Thus FII for a particular factor could range from '0' to '312', while '0' indicating no factor influenced and '312' indicating highest factor influenced. FII for all the factors were determined. Finally a rank order was made on the basis of FII.

3.6 Hypothesis of the Study

According to Kerlinger (1973) a hypothesis is a conjectural statement of the relation between two or more variables. Hypothesis are always in declarative sentence form and they are related, either generally or specifically from variables to variables. In broad sense hypotheses are divided into two categories: (a) Research hypothesis and (b) Null hypothesis.

3.6.1 Research hypothesis

Based on review of literature and development of conceptual framework, the following research hypothesis was formulated: 'There were significant relationships between the selected nine characteristics (i.e. age, education, family size, farm size, annual income, training received, organizational participation, extension media contact and agricultural knowledge) of the participant farmers and their adoption of the four crops cultivation pattern. However, when a researcher tries to perform statistical tests, then it becomes necessary to formulate null hypothesis.

3.6.2 Null hypothesis

Null hypothesis: 'There was no significant relationship between the selected nine characteristics (i.e. age, education, family size, farm size, annual income, training received, organizational participation, extension media contact and agricultural knowledge) of the farmers and their adoption of four crops cultivation pattern'.

3.7 Data Collection

Data were collected during the period from 15 September to 15 October, 2016 by using the pretested questionnaire. The researchers were first established rapport with the respondents and clearly explain the objectives of the study by using local language as far as possible. As a result, the respondents were furnished proper responses to the questions and statements without any hesitation.

3.8 Compilation of Data

At the end of data collection, the collected data were coded, compiled, tabulated and analyzed. The local units were converted into standard units. The qualitative data were transferred into quantitative data by appropriate scoring technique (s). The responses of the respondents that were recorded in the interview schedule was transferred into a master sheet for analysis of the data.

3.9 Statistical Analysis

The SPSS computer program was used for analyzing the data. Various descriptive statistical measures such as frequency, number, percentage, mean, standard deviation and rank order was used for categorization and describing the variables. Pearson's Product Moment Correlation Coefficient (r) was used for testing the relationships between the concerned variables. At least 5 percent (P=0.05) level of probability was used as a basis for rejection of the null-hypotheses throughout the study.

CHAPTER 4

RESULTS AND DISCUSSION

In this Chapter the findings of the study and their interpretations have been conveniently presented. These are presented in four sub-sections according to the objectives of the study. The first sub-section deals with the selected characteristics of the farmers, while the second sub-section deals with the extent of adoption of four crops cultivation pattern by the farmers. In third section deals with discussion on factor influencing the farmers in adoption of four crops cultivation pattern and fourth sub-section, relationships between the selected characteristics of the farmers' with the extent of adoption of four crops cultivation pattern by the farmers.

4.1 Selected Characteristics of the Farmers

A variety of attributes that aggregate in human life influenced on their activity directly and indirectly. For this reason, it can be assumed that different characteristics of farmers may influence the adoption of four crops cultivation pattern and hence nine selected characteristics (i.e. age, education, family size, farm size, annual income, training received, organizational participation, extension media contact and agricultural knowledge) were considered as independent variables in this regard. The characteristics of the farmers were classified into suitable categories for description and interpretation in relation to the adoption of four crops cultivation pattern.

4.1.1 Age

The observed age of the farmers ranged from 23 to 65 years with a mean of 38.21 year and standard deviation of 9.72. On the basis of their age, they were classified into three categories as young (18-35), middle (36-50) and old (>50) are presented in Table 4.1.

Exactly half (50.0 percent) of the farmers were young aged compared to 38.5 percent of them being middle aged and 11.5 percent old. More than four-fifths (88.5 percent) of the farmers were young to middle aged. It is expected that young and middle aged farmers were more dynamic, energetic and passionate. They were the pioneer to adopt new ideas and technologies. This means that four copping cultivation system in the study area is being managed by comparatively younger farmers.

Table 4.1 Main features and categorization of the farmers (N=104)

Characteristics	Scoring method	Range		Categories	Respondents		Mean	SD
		Possible	Observed		No.	Percent		
Age	No. of year	Unknown	23-65	Young (18-35)	52	50.0	38.21	9.72
				Middle (36-50)	40	38.5		
				Old (>50)	12	11.5		
Education	Year of schooling	Unknown	0.5-16	Can sign only (0.5)	18	17.3	7.79	4.36
				Primary level (1-5)	17	16.3		
				Secondary level (6-10)	50	48.1		
				Above secondary level (>10)	19	18.3		
Family size	No. of members	Unknown	2-8	Small (≤ 4)	28	26.9	4.26	1.24
				Medium (5-6)	71	68.3		
				Large (>6)	5	4.8		
Farm size	Hectare	Unknown	0.2-3.24	Small (0.21-1.0)	67	64.4	0.98	0.73
				Medium (1.01-3.0)	32	30.8		
				Large (>3.0)	5	4.8		
Annual income	('000' Tk.)	Unknown	40.0-500.0	Low (≤55)	8	7.7	174.42	119.09
				Medium (55.01-295)	79	76.0		
				High (>295)	17	16.3		
Training received	Days	Unknown	0-90	No (0)	4	3.8	7.36	11.76
				Low (≤3)	28	26.9		
				Medium (4-7)	45	43.3		
				High (>7)	27	26.0		
Organizational participation	Score	0-24	1-6	Low (≤8)	51	49.0	1.83	1.07
				Medium (9-17)	48	46.2		
				High (>17)	5	4.8		
Extension media contact	Score	0-30	2-24	Low (≤10)	17	16.3	12.08	4.17
				Medium (11-20)	73	70.2		
				High (>20)	14	13.5		
Agricultural Knowledge	Score	0-26	4-20	Low (≤ 8)	30	28.8	11.21	3.57
				Medium (9-17)	57	54.8		
				High (>17)	17	16.3		

4.1.2 Education

The education score of the farmers ranged from 0.5 to 16 with the mean value of 7.79 and standard deviation 4.36. Based on their education scores, the farmers were classified into four categories namely "can sign only" (0.5), "primary level" (1-5), "secondary level" (6-10) and "above secondary level" (above 10). The distribution of the farmers according to their education is shown in Table 4.1.

The highest proportion (48.1percent) of the farmers had education up to secondary level compared to 18.3 percent having above secondary level education. About 17.3 percent of them can sign only while only 16.3 percent of the farmers were primary level educated. Thus, the overwhelming majority (66.4 percent) of the farmers had education ranging from secondary to above secondary level. Education helps individuals to become rational, conscious and to get useful information to solve their daily working problems through different sources of information. It might help to improve their knowledge on four crops cultivation pattern. The study revealed that there were no illiterate farmers in the study area. But the literacy rate of our country is about 62.3 percent (BBS, 2016). This is due to different GOs and NGOs activities which effected to increase the literacy rate in study area.

4.1.3 Family size

The family size of the farmers ranged from 2 to 8 having mean value of 4.26 and standard deviation of 1.246. On the basis of their family size, they were classified into three categories as "small" (≤4), "medium" (5-6) and "large" (>6) are presented in Table 4.1.

Data presented in Table 4.1 indicate that overwhelming of the farmers 68.3 percent have medium sized family. On the other hand 26.9 percent had small family and only 4.8 percent had large family. The national average family size in Bangladesh is 4.85 (BBS, 2014) which was above the mean value of the present study (4.26). Family is a fundamental social unit or social groupings. The members of which are united by bonds of kinship. The importance of the family in determining the character and structure of the society is tremendous. Family background directly or indirectly influences a person's behavior, social position and outlook of life.

4.1.4 Farm size

The farm size of the farmers ranged from 0.2 to 3.24 and the mean was 0.98 with standard deviation of 0.73. According to the farm size of the farmers, they were classified into three categories as "Small" (0.21-1), "Medium" (1.01-3) and "Large "(>3). The distribution of the farmers according to their farm size is shown in Table 4.1.

Data showed that about three-fourths (64.4 percent) of the farmers were under small farm size category followed by 30.8 percent and only 4.8 percent under medium and large farm size category respectively. Farm size of the people is being decreased day by day due to land fragmentation through generation to generation. In order to have a reasonable standard of living these farmers must be able to have high yield of crops per hectare and increase their cultivation intensity. For this reason, the farmers need adequate knowledge and skill in increasing cultivation intensity by adopting four crops cultivation pattern.

4.1.5 Annual income

Annual income of the farmers ranged from 40.0 to 500.0, the mean being 174.42 thousand tk. and standard deviation 119.09. On the basis of their family income scores, the farmers were divided into three categories: "low" (≤55) "medium" (55.01-295) and "high" (>295). The distribution of the farmers according to their family income is shown in Table 4.1.

The majority (76.0 percent) of the farmers had medium income compared to 16.3 percent of them having high income and only 7.7 percent had low income. Thus, the huge majority (92.3 percent) of the farmers had medium to high income.

4.1.6 Training received

The observed training received scores of the respondents ranged from 0 to90 with an average of 7.36and a standard deviation of 11.76. On the basis of their observed training received scores, the farmers were classified into four categories: "no" (0), "low" (≤3), "medium" (4-7) and "high" (>7). The distribution of the farmers according to their training received is shown in Table 4.1

Data contained in Table 4.1 showed that 3.8 percent of the farmers had no training received compared to 26.9, 43.3 and 26.0 percent having low, medium and high training received respectively. Training increases knowledge and skills of the farmers in a specific subject matter area especially on new four crops cultivation system. Individuals who gain high training exposure are likely to be more competent in performing in different activities. But the fact that farmers who received low training, needs attention of the authorities of extension services (GOs and NGOs) in the country. Providing adequate training on appropriate subject matter is likely to increase the knowledge and attitude of the farmers.

4.1.7 Organizational participation

Organizational participation score of the respondents ranged from 1 to 6 against the possible range of 0 to 24 with a mean of 1.83 and standard deviation of 1.07 (Table 4.1). From the participation level, the respondents were divided into three categories. The findings revealed

that about half (49.0 percent) of the respondents had low participation in organization, 46.2 percent medium, and only 4.8 percent had high organizational participation. Thus, overwhelming majority (95.2 percent) of the farmers had low to medium organizational participation.

4.1.8 Extension media contact

 The observed extension media contact scores of the respondents ranged from 2 to 24 against the possible range of 0 to 30. The average was 12.08 and the standard deviation was 4.17. Based on their extension media contact scores, the respondents were classified into three categories: "low" (≤10), "medium" (11-20) and "high" (>20). The distribution of the respondents according to their extension contact is shown in Table 4.1.

Data contained in Table. 4.1 indicated that the highest proportion (70.2 percent) of the farmers had medium extension contact as compared to 16.3 and 13.5 percent having low and high extension contact respectively. Thus, overwhelming majority (86.5 percent) of the farmers had low to medium extension contact. Extension contact is a very effective and powerful source of receiving information about various new technologies and cultivation practices. The status of no or having low and medium contacts might have significant impacts on the knowledge and attitude of the farmers.

4.1.9 Agricultural knowledge

Agricultural knowledge scores could theoretically range from 0 to 26. But their observed knowledge scores ranged from 4 to 20, the mean being 11.21 and standard deviation 3.57. Based on the scores, the farmers were classified into three categories as: "poor'' (≤8), "medium" (9-17) and "high'' (>17). The distribution of the farmers according to their knowledge is shown in Table 4.1.

Slightly more than half (54.8 percent) farmers' possessed medium knowledge, 28.8 percent of the farmers' possessed poor knowledge and only 16.3 percent of the farmers had high knowledge. Thus, a major proportion (71.1 percent) of the farmers had medium to high knowledge on various aspects of agricultural system.

4.2. Adoption of four crops cultivation pattern by the Farmers

The observed adoption of four crops cultivation pattern by the farmers scores ranged from 29.17 to 100.00 against the possible range of 0 to 100 with an average of 58.49 and standard deviation of 13.23. On the basis of their four crops cultivation pattern scores, the farmers were classified into three categories as: "low adoption" (0-33.33), "medium adoption" (33.34 -66.67) and "high adoption" (> 66.67) (Islam, 2007).

The four crops cultivation pattern of the farmers according to their extent of adoption four crops cultivation pattern scores is shown in Table 4.2.

Table 4.2 Adoption of four crops cultivation pattern by the farmers

Categories	Farmers		Observed range	Possible range	Mean	SD
	Number	Percent				
Low adoption (0-33.33)	2	1.9				
Medium adoption (33.34-66.67)	78	75.0	29.17-100	0-100	58.49	13.23
High adoption (> 66.67)	24	23.1				
Total	104	100.00				

The Table 4.2 shows that highest proportion (75.0 percent) of the farmers had medium adoption of four crops cultivation pattern, while 23.1 and 1.9 percent of them had high and low adoption of four crops cultivation pattern respectively. It means that majority (98.1) of the respondents belonged to medium to high adoption of four crops cultivation pattern. and Afroz (2013) Hossen (2013) Islam (2007) and Sadekuzzaman (2007) also found similar findings in their respective research.

4.3 Factors influencing adoption of four crops cultivation pattern

The observed factors influencing scores of the farmers ranged from 15 to 34 against the possible factors influencing scores were 0 to 42 with an average of 26.09 and the standard deviation 3.99. On the basis of factors influencing scores, the growers were distributed into three categories as low, medium and high (Table 4.4).

Data contained in the Table 4.4 reveals that the highest proportion (69.2 percent) of the farmers had medium factors influencing as compared to 15.4 percent low and 15.4 percent had high factors influencing regarding the adoption of four crops cultivation pattern.

The findings of the study indicated that overwhelming majority (84.6 percent) of the respondents had medium to high factors influenced in four crops cultivation pattern. This may helps to increase the rate of adoption of four crops cultivation pattern.

Table 4.3 Distribution of the farmers according to their factor influence

Categories	Farmers		Observed range	Possible range	Mean	SD
	Number	Percent				
Low (≤22)	16	15.4				
Medium (23-30)	72	69.2	15-34	0-42	26.09	3.99
High (> 30)	16	15.4				
Total	104	100.00				

4.3.1 Rank order of factors influencing the farmers for adoption of four crop cultivation pattern

The farmers were asked to mention the specific factors concerned by them in four crops. The factors influence identified by the farmers is listed below according to their importance (Table 4.5).

Table 4.4 Rank order of factor influencing farmer's adoption of four crops cultivation pattern

Description of factors	Number of respondents influenced with extent of adoption				FII**	Rank Order
	Not at all	Low	Medium	High		
Four crop cultivation is profitable	0	7	61	36	237	1
Four crop cultivation is very important for food security	0	6	72	26	228	2
Increase employment opportunity	0	23	55	26	221	4
Four crop cultivation aims at improving the productivity of the farmers	0	17	67	20	211	6.5
Use of fallow land	3	31	47	23	194	11
Agricultural production (crop) has considerably increased	0	19	64	21	210	8
My family has a reputation to adopt four crops cultivation pattern	6	19	44	35	212	5
My neighbors frequently visit my house and advice me to adopt four crops cultivation pattern	1	24	53	26	208	9
Fulfill nutritional demand	0	21	59	24	211	6.5
Suggestions from extension personnel	5	16	39	44	226	3
Helps to remove poverty	2	24	61	17	197	10
Government subsidies are available when faced with the loss of crops	53	37	11	13	98	14
Timely receipt of NGO loans	26	20	51	7	143	13
Provides food for cattle	6	44	48	6	158	12

**FII= Factors Influencing Index

The total Factors Influencing Index (FII) ranged from 98 to 237 with possible range of 0 to 312 (Table 4.4). Data presented above showed that the extent of adoption of four crops cultivation pattern was mostly influenced by four crop cultivation is profitable followed by four crop cultivation is very important for food security and suggestions from extension personnel. Four crops cultivation gives farmer more benefit and they cultivate short duration crops that meet their demand. Government subsidies are available when faced with the loss of crops, timely receipt of NGO loans and provides food for cattle had ranked last three positions.

4.4 Relationship between the Selected Characteristics of the Farmers and their Adoption of Four Crops Cultivation Pattern

Coefficient of correlation was computed in order to explore the relationship between the selected characteristics of the farmers and their adoption of four crops cultivation pattern. The selected characteristics constituted the independent variables and adoption of four crops cultivation pattern by the farmers constituted the dependent variable.

In this section relationship between nine selected characteristics (independent variables) of the farmers viz. age, education, family size, farm size, annual income, training received, organizational participation, extension media contact, agricultural knowledge and dependent variable (i.e. adoption of four crops cultivation pattern) are described. Person's Product Moment Co-efficient of Correlation (r) has been used to test the hypothesis concerning the relationship between the variables. Five percent level of significance was used as the basis for rejection of any hypothesis. The summary of the results of the correlation co-efficient indicates the relationships between the selected characteristics of the respondent and their adoption of four crops cultivation pattern (Table 4.5).

4.4.1 Age and adoption of four crops cultivation pattern

The relationship between age of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis:

"There was no significant relationship between age of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, a negligible positive relationship was found to exist between the two concerned variables. Secondly, the computed value of 'r' (0.166) was found which was not significant

34

with 102 degrees of freedom at 0.05 level of significance (Table 4.3). Based on the above findings, the concerned null hypothesis was accepted.

Table 4.5 Relationship between dependent variable and independent variables

Dependent variable	Selected Characteristics	Computed r-value with 102 d.f.
Adoption of four crops cultivation pattern by the farmers	Age	0.166
	Education	0.235*
	Family size	0.085
	Farm size	0.026
	Annual income	0.256**
	Training received	0.196*
	Organizational participation	0.225*
	Extension media contact	0.340**
	Agricultural knowledge	0.332**

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

The findings demonstrate that age of the farmers had no significant relationship with their adoption of four crops cultivation pattern. Similar findings were also observed by Mou (2015), Muttaleb (1995), Hossain (2003), Hasan (2006).

4.4.2 Education and adoption of four crops cultivation pattern

The relationship between level of education of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis:

"There was no significant relationship between level of education of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend. Secondly, the computed value of r (0.235) was found which was statistically significant with 102 degrees of freedom at 0.05 level of significance (Table 4.3). On the basis of the above findings, the null hypothesis was rejected and therefore it was concluded that education of the farmers had a significant positive relationship with their adoption of four crops cultivation pattern. The relationship between

the variable indicate that the more the education of the farmers the more the adoption of four crops cultivation pattern.

The existing relationship between the variables is justified because, education is considered to be a vital factor for development of insights of an individual, which help to develop mental and psychological ability of a person. Similar findings were also observed by Mou (2015), Hasan (2015), Singh (2010), and Rao and Singh (2014).

4.4.3 Family size and adoption of four crops cultivation pattern

The relationship between family size of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no significant relationship between level family size of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend between the concerned variables. Secondly, the computed value of r (.085) was found which was not statistically significant with 102 degrees of freedom at 0.05 level of significance (Table 4.3).Based on the above findings, the concerned null hypothesis was accepted and hence, the researcher concluded that family size had no significant relationship with the adoption of four crops cultivation pattern. Hossain (2009) and Anisuzzaman (2003) also found similar result in their study.

4.4.4 Farm size and adoption of four crops cultivation pattern

The relationship between farmer's farm size and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no significant relationship between level farm size of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend between the concerned variables. Secondly, the computed value of r (0.026) was found which was not statistically significant with 102 degrees of freedom at 0.05 level of significance (Table 4.3).

Based on the above findings, the concerned null hypothesis was accepted and hence, the researcher concluded that farm size had no significant relationship with the adoption of four crops cultivation pattern. Mou (2015) and Hossain (2004) also found similar findings in his study.

4.4.5 Annual income and adoption of four crops cultivation pattern

The relationship between annual income of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no significant relationship between level annual income of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend. Secondly, the computed value of r (0.256) wasfound which was statistically significant with 102 degrees of freedom at 0.01 level of significance (Table 4.3).

On the basis of the above findings, the null hypothesis was rejected and therefore it was concluded that annual income of the farmers had a significant positive relationship with their adoption of four crops cultivation pattern. Similar findings were also observed by Mou (2015), Mehta and Sonawane (2012), Chouhan and Singh (2013), Rao and Singh (2014) and Deshmukh and Bariya (2014).

4.4.6 Training received and adoption of four crops cultivation pattern

The relationship between training received of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no significant relationship between training received of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend. Secondly, the computed value of r (0.196) was found which was statistically significant with 102 degrees of freedom at 0.05 level of significance (Table 4.3). On the basis of the above findings, the null hypothesis was rejected and therefore it was concluded that training received of the farmers had a significant positive relationship with their adoption of four crops cultivation pattern. It means that adoption of four crops cultivation pattern as increased with the increase of training received. The reason might be that after completion of a successful training, farmers are expected to be aware of the benefits of four crops cultivation pattern and also have enough knowledge about the cultivation process of different crops. Mou (2015), Kabir (2015), Rahman (2010) and Rahman (2001) also found similar findings in their studies.

4.4.7 Organizational participation and adoption of four crops cultivation pattern

The relationship between organizational participation of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no relationship between organizational participation of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend. Secondly, the computed value of r (0.225) was found which was statistically significant with 102 degrees of freedom at 0.05 level of significance (Table 4.3). On the basis of the above findings, the null hypothesis was rejected and therefore it was concluded that organizational participation of the farmers had a significant positive relationship with their adoption of four crops cultivation pattern. It means that farmers with highly organizational participation were more likely to have more adoption. Haque (1984), Mohammad (1974), Karim (1973) also found the similar results in their studies.

4.4.8 Extension media contact and adoption of four crops cultivation pattern

The relationship between extension media contact of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no significant relationship between level extension media contact of the farmers and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend. Secondly, the computed value of r (0.340) was found which was statistically significant with 102 degrees of freedom at 0.01 level of significance (Table 4.3). On the basis of the above findings, the null hypothesis was rejected and therefore it was concluded that extension media contact of the farmers had a significant positive relationship with their adoption of four crops cultivation pattern. That is if the extension media contact is higher, the adoption of four crops cultivation pattern would also be higher. The finding is quite logical because extension contact makes the farmers innovative and strengthens their basic knowledge. So, high media contact farmers are supposed to be highly eager to adopt four crops cultivation. Similar findings were also observed by Hasan (2015), Singh (2010), Singh and Barma (2011), Rao and Singh (2014) and Deshmukh and Bariya (2014).

4.4.9 Agricultural knowledge and adoption of four crops cultivation pattern

The relationship between agricultural knowledge of the farmers and their adoption of four crops cultivation pattern was examined by testing the following null hypothesis: "There was no significant relationship between agricultural knowledge and their adoption of four crops cultivation pattern". The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

Firstly, relationship showed a positive trend. Secondly, the computed value of r (0. 0.332) was found which was statistically significant with 102 degrees of freedom at 0.01 level of significance (Table 4.3).On the basis of the above findings, the null hypothesis was rejected and therefore it was concluded that agricultural knowledge of the farmers had a significant positive relationship with their adoption of four crops cultivation pattern. It means that adoption of four crops cultivation pattern as increased with the increase of agricultural knowledge. The reason might be that with the increase of agricultural knowledge become aware of the benefits of four crops cultivation pattern. Similar findings were also observed by Kabir (2015), Singh (2010), Singh and Barma (2011), and Chouhan and Singh (2013).

CHAPTER 5

SUMMARY, CONCLUSIONSAND RECOMMENDATIONS

5.1 Summary of the Findings

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

5.1.1 Selected characteristics of the farmers'

Age of the farmers ranged from 23 to 65 years and the exactly half (50.0 percent) of the farmers were young aged compared to 38.5 percent of them being middle aged and 11.5 percent old. More than fourth-fifths (88.5 percent) of the farmers were young to middle aged. The **education** score of the farmers ranged from 0.5-16 and the highest proportion (48.1percent) of the farmers had education up to secondary level compared to 18.3 percent having above secondary level education. About 17.3percent of them can sign only while only 16.3 percent of the farmers were primary level educated. Thus, the overwhelming majority (66.4 percent) of the farmers had education ranging from secondary to above secondary level. The **family size** of the farmers ranged from 2-8 and overwhelming of the farmers (68.3 percent) have medium sized family. On the other hand 26.9 percent had small family and only 4.8 percent had large family. The **farm size** of the farmers ranged from 0.2 to 3.24 and above half (64.4percent) of the farmers were under small farm size category followed by 30.8 percent and only 4.8 percent under medium and large farm size category respectively. **Annual income** of the farmers ranged from 40 to 500 and The majority (76.0 percent) of the farmers had medium income compared to 16.3 percent of them having high income and only 7.7 percent had low income. Thus, the huge majority (92.3 percent) of the farmers had medium to high income. **Training received** scores of the respondents ranged from 0-90 and3.8 percent of the farmers had not raining received compared to 26.9, 43.3 and26.0 percent having low, medium and high training received respectively. **Organizational participation** score of the respondents ranged from 1 to 6 and that 49.0 percent of the respondents had low participation in organization, 46.2 percent medium, and only 4.8 percent had high participation in organization. **Extension media contact** scores of the respondents ranged from 2 to 24 and the highest proportion (70.2 percent) of the farmers had medium extension contact as compared to 16.3 and 13.5 percent having low and high extension contact respectively. Thus, overwhelming majority (83.7 percent) of the farmers had medium to high extension contact. **Agricultural knowledge** scores could theoretically range from 0 to 26 and about 54.8 percent farmers' possessed medium knowledge, 28.8 percent of the

farmers' possessed poor knowledge and only 16.3 percent of the farmers had high knowledge. Thus, a major proportion (81.2 percent) of the farmers had medium to high knowledge on various aspects of four cultivation cultivation system.

5.1.2 Adoption of four crops cultivation pattern by the farmers

Adoption of four crops cultivation pattern by the Farmers scores ranged from 29.17 to 100.00 and highest proportion (75.0 percent) of the farmers had medium adoption of four crops cultivation pattern, while 23.1 and 1.9 percent of them had high and low adoption of four crops cultivation pattern respectively.

5.1.3 Factors influencing adoption of four crops cultivation pattern

The factors influencing scores of the farmers ranged from 15 to 34 and the highest proportion (69.2 percent) of the farmers had medium factors influencing as compared to 15.4 percent low and 15.4 percent had high factors influencing regarding the adoption of four crops cultivation pattern.

The total Factors Influencing Index (FII) of total 14 factors ranged from 98 to 237 with possible range of 0 to 308. The top three factors was four crop cultivation is Profitable (FII=237), four crop cultivation is very important for food security (FII=228), suggestions from Extension personnel (FII=226) those were influence to adoption of four crops cultivation pattern.

Government subsidies are available when faced with the loss of crops (FII=98), timely receipt of NGO loans (FII=143) and provides food for cattle (FII=158) had ranked last three position.

5.1.4 Relationship between the selected characteristics of the farmers and their adoption of four crops cultivation pattern

Coefficient of correlation was computed in order to explore the relationship between the selected characteristics of the farmers and their adoption of four crops cultivation pattern.

Correlation analyses indicated that among nine selected characteristics education, annual income, training received, organizational participation, extension media contact and knowledge on four crops cultivation pattern had positive significant relationships with their adoption of four crops cultivation pattern. However, age, family size, and farm size of the farmers had no significant relationships with their adoption of four crops cultivation pattern.

5.2 Conclusions

Based on the above findings the following conclusions were drawn:

1. Majority (75.0 percent) of the farmers had medium adoption of four crops cultivation pattern. The result might be due to that adoption of four crops cultivation pattern by the farmers is not up to the mark for getting the potential benefits from four crops cultivation.

2. Overwhelming majority (86.5 percent) of the farmers had low to medium extension media contact, while there had a positive significant relationship between extension media contact and adoption four crops cultivation pattern. Therefore, it might be concluded that, low extension media contact farmers adopted less four crops cultivation and the farmers with high extension media contact showed high adoption of four crops cultivation pattern.

3. Major proportion (71.1 percent) of the farmers had medium to high agricultural knowledge and there had a positive significant relationship between agricultural knowledge and adoption of four crops cultivation pattern. Therefore, it may be concluded that, farmers who had higher agricultural knowledge were adopted four crops cultivation more easily in the study area.

4. Among the nine selected characteristics of the farmers, six (6) namely education, annual income, training received, organizational participation, extension media contact and knowledge on four crops cultivation pattern showed positive and significant relationships with their adoption of four crops cultivation pattern. It may, therefore be concluded that the above characteristics of the farmers significantly contribute to increase the extent of adoption of four crops cultivation pattern. While age, family size, and farm size of the farmers had no significant relationship in adoption of four crops cultivation pattern. This indicates that adoption of four crops cultivation pattern and above characteristics of the farmers are independent to each other.

5. The highest proportion (69.2 percent) of the farmers had medium factors influencing four crops cultivation pattern. This might be concluded farmers are influenced by several factors during adoption of four crops cultivation pattern which are to be taken into consideration in the study area.

5.3 Recommendations

5.3.1 Recommendations for policy implications

1. Four crops cultivation pattern can increase the productivity (crops) of the farmers. But in the present study the extent of adoption of four crops cultivation pattern among the farmers was medium. It is, therefore, recommended that effective steps should be taken to motivate the farmers in accepting four crops cultivation pattern.

2. Family annual income had significant positive relationship with adoption of four crops cultivation pattern. Therefore, it may be recommended that concerned authority should supply more credit to the farmers so that they can invest more in adopting four crops cultivation pattern.

3. Training received of the farmers had positive significant relationship with their adoption of four crops cultivation pattern. Therefore, it may be recommended that concern authority should take necessary motivational program like training on four crops cultivation pattern so that the farmers could increase their knowledge on four crops cultivation pattern.

4. Organizational participation had significant positive relationship with adoption of four crops cultivation pattern. Therefore, it may be recommended that concern authority should take necessary action so that the farmers could increase their organizational participation.

5. Extension media contact had significant positive relationship with adoption of four crops cultivation pattern. Therefore, it may be recommended that concern authority should take necessary action so that the farmers could increase their extension media contact.

6. Agricultural knowledge of the farmers had positive significant relationship with their adoption of four crops cultivation pattern. Therefore, it may be recommended that concern authority should take necessary motivational program like training and motivational program on four crops cultivation pattern so that the farmers could increase their knowledge on four crops cultivation pattern.

5.3.2 Recommendation for future research

The following recommendations are made for future research:

1. To arrive at generalizations as to the adoption of four crops cultivation behavior of the farmers in the country and to draw up policy measures for the whole of the nation, similar research efforts are needed at other locations.

2. This study investigated the effects of nine personal and selected characteristics of the farmers on their extent of adoption of four crops cultivation pattern. It is, therefore, recommended that further study should be conducted involving other related profile of the farmers.

3. The study was conducted to find out the adoption of four crops cultivation pattern. Further research should be taken to find out the cropping pattern, mixed cultivation, and crop rotation.

4. Adoption is the measurement of implementation by the farmers as well as vital indicator of agricultural development. It is a continuous process due to change of social system, change of technologies, change of human behavior, change of cultivation patterns, change of adoption patterns etc. So, it is suggested that there should be continuous adoption research in various aspects for agricultural development

REFERENCES

Afroz, M. R. 2013. Adoption of Wheat Cultivation by the Farmers of Selected Village of Kajipur Upazilla under Sirajganj District. M.S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Anisuzzaman, M. 2003. Use of communication Media by the farmers in the Adoption of Improved Rice Production Technology. M. S. (Ag. Ex. Ed.) Thesis, Bangladesh Agricultural University, Mymensingh.

Baruah, M. J. and A. K. Singha. 2011. Farmers' Adoption Behaviour in Rice Technology: An Analysis of Adoption Behaviour of Farmers in Rice Technology under Different Farming Systems in Assam. *Journal of Human Ecology*, 35(3): 167-172 (2011).

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

BBS. 2016. Yearbook of Agricultural Statistics of Bangladesh. Bangladesh Bureau of Statistics, Statistical division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Chouhan, S. and S. K. R. Singh. 2013. Adoption Dynamics of Improved Sugarcane Cultivation in Madhya Pradesh. *Indian Research Journal of Extension Education.* 13 (2): 26-30.

Countrymeters, 2016. A online portal to estimate the population in world. Retrieved from:http://countrymeters.info/en/Bangladesh.

Deshmukh, G. and M. Bariya. 2014. Adoption of Recommended Practices of *Kharif* Groundnut Growers in Saurashtra Zone of Gujarat. *Indian Research Journal of Extension Education*. 14 (3): 47-50.

Goode, C.V. 1945. *Dictionary of Education.* McGraw-hill Book Company, Inc., New York.

Haque. 2010. Impact of rice-wheat/potato-mungbean cropping system on farmers' employment opportunity, food security and livelihood in selected monga prone areas in northern districts of Bangladesh. Annual Report submitted to Krishi Gobeshona Foundation, BARC campus, Farmgate, Dhaka.

Haque, M. S. 1984. A Study on the Adoption of Improved Practices in Cultivation in some Selected Areas of Jessore District. MS (Ag. Ext. Ed.) Thesis, Bangladesh Agricultural University, Mymensingh.

Hasan, G. M. 2006. Adoption of Improved Practices in Litchi Cultivation by the Litchi Growers in Dinajpur Sadar Upazila. M. S. Thesis (Ag. Ext. Ed.), BAU, Mymensingh.

Hasan, M. 2015. Adoption of Modern Practices in Rice Cultivation by The Farmers of Modhukhali Upazila under Faridpur District. M.S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Hossain, M. A. 2004. Adoption of Modern Boro Rice Cultivation Technologies by the Farmers of Homna Upazila in Comilla District. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University. Mymensingh.

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

Hossain, M. 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.

Hossen, M. M. 2013. Adoption of Intercropping with Jackfruit by the Farmers of Bhaluka Upazilla under Mymenshing District. M.S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Hussein, M. A. M. 2001. Farmers Knowledge and Adoption of Modern Sugarcane Cultivation Practices. M.S. Thesis, Department of Agricultural Extension Education, BAU, Mymensingh.

Islam, H. M. S. 2007. Adoption of Mixed Cropping in Rabi Season by The Farmers of Madaripur Sadar Upazila. M. S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Islam, M. S. 2002. Adoption of Modem Agricultural Technologies by the Farmers of Sandip. M.S. Thesis. Department of Agricultural Extension Education Bangladesh Agricultural University. Mymensingh.

Kabir, M. M. 2015. Adoption of Integrated Pest Management (IPM) Practices in Rice Cultivation by the Farmers of Shahjadpur Upazilla under Sirajganj District. M.S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Karim, A. S. M. Z. 1973. Adoption of Fertilizers by the Transplanted Aman Rice Growers in Kewatkhali Union of Mymebnsingh District. MS (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education and Teachers Training, Bangladesh Agricultural University, Mymensingh.

Kerlinger, F. N. 1973. Foundations of Behavioural Research, Educational and Psychological Inquiry. Rinehart and Winston Inc., Halt, New York, U.S.A.

Khan, M. A. H. 2004. Attitude of Farmers towards Groundnut Cultivation in a Selected Area of Daulatpur Upazila of Khulna District. *M. S. (Ag. Ext. Ed.) Thesis*. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Kumbhare, N. V. and K. Singh. 2011. Adoption Behaviour and Constraints in Wheat and Paddy Production Technologies. *Indian Research Journal of Extension Education*. 11 (3):41-44.

Mehta, B. M. and M. Sonawane. 2012. Entrepreneurial Behaviour of Mango Growers of Valsad District of Gujarat State. *Indian Research Journal of Extension Education*. 12 (1):30-34.

Mohammad, A. 1974. A Study on the Farmers Adoption of Insect Control Measures and Related Aspects. M.Sc. Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Mondol, M.A.S. 2009. Use of Communication Channel by the Farmers in Receiving Farm Information. Ph.D. Thesis, Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Mou, M. M. 2015. Adoption of Improved Vegetable Cultivation Practices by the Farmers in Selected Areas of Shajahanpur Upazila Under Bogra District. M. S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Muttaleb, A. 1995. Relationship of Selected Characteristics of Potato Growers with their Adoption of Improved Potato Technologies. M. S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Prasad, A. and D. Ram. 2010. Adoption of Improved Wheat Cultivation Technologies in Unnao District of Uttar Pradesh. *Indian Research Journal of Extension Education*. 10 (2):40-45.

Rahman, M.S. 2001. Knowledge. Attitude and Adoption of the Farmers Regarding Aalok 6201 Hybrid Rice in Sadar Upazila of Mymensingh District. M.S. (Ag. Ext. Ed.) Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University. Mymensingh.

Rahman, M. M 2010. Variables contribution to farmers' attitude towards IPM practices in rice cultivation in Godagari, Rajshahi. *Journal of Life Earth Sci*., Vol. 5: 11-15.

Rahman. 2005. Environmental   Impacts of   Modern   Agricultural Technology. Diffusion in   Bangladesh: an   analysis   of farmers'   perceptions and   their determinations. J. Envir. Man.68 (2): 183- 191.

Rao, D. U. M. and M. K. Singh. 2014. Adoption of Pineapple Cultivation Practices by the Farmers in Manipur State. *Indian Research Journal of Extension Education.*, 14 (1): 111-116.

Rashid, M. M. and M. M. Haque. 2016. Good Practices, New Cropping Pattern Gives Four Crops Annually. Annual Reports, RDRS, Bangladesh.

Ray, G. L. 2006. *Extension Communication and Management*.6th Revised and Enlarged Edition. New Delhi: Kalyani Publishers.

RDRS, 2010. Pariza Ensuring food security through additional rice harvest. Rangpur Dinajpur Rural Service, Bangladesh.

Rogers, E. M. 2003. *Diffusion of Innovations*. 4th Edition. New York: The Free Press.

Rogers, E. M. and F. F. Shoemaker F. 1971. Communation of Innovations. 2nd Edition: New York: The Free Press.

Rosenberg, M. and Hovland, C.I. 1960. Research on Communication and Attitude, Coated in Triandi,(1971). Attitude and Attitude Change. Jhon Wiley Publishers, New York, U.S.A.

Sadekuzzaman, M. 2007. Adoption of Intercropping in Sugarcaneby the Farmers. M.S. Thesis (Agricultural Extension and Information System), SAU, Dhaka.

Sardar, M. H. U. 2002. Adoption of IPM Practices by the Farmers under PETRRA Project of RDRS. M. S. (Ag. Ext Ed.) Thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Sarker, M. M. R. 2004. Effectiveness of Agricultural Information Disseminated to Farmers Through Agricultural Radio Programme. M.S. Thesis (Ag. Ext. Ed.), BAU, Mymensingh.

Singh, P. K. and K. K. Barman. 2011. Adoption Behaviour of Vegetable Growers Towards Improved Technologies. *Indian Research Journal of Extension Education.*, 11 (1): 62-65.

Singh, V. K. and A. Priyadarshi. 2010. Extent of Adoption of Improved Practices of Mango Production by Mango Growers in Muzaffarnagar District of Uttar Pradesh. *Indian Research Journal of Extension Education.*, 10 (3): 107-113.

Department of Agricultural Extension
Hajee Mohammad Danesh Science and Technology University
Dinajpur

An Interview Schedule for a Research Study on the
Adoption of FourCrops Cultivation Patternby the Farmers

Date: - - - - - - - - - - - - - - -Serial No.

Name of Respondent -   Father's Name - - - - - - - - - - - - - - -

Village: -   Union: -

(Please answer the following questions)

1. Age: How old are you? ☐ Years

2. Education: Mention of your educational qualification.

- a) Do not read and write ☐
- b) Can sign name only ☐
- c) Read up to class ……………
- d) …………………class passed

3. Family size: Mention of your family members including you.

a) Male =   b) Female=   Total=

4.Farm size: Indicate the area of land in your possession.

Sl. No.	Nature of holding	Area		
		Local Unit		Hectare
		Bigha	Decimal	
a.	Homestead (including garden and fallow land)			
b.	Own land under own cultivation			
c.	Land given to others on borga			
d.	Land taken from others on borga			
e.	Land taken from others on lease			
f.	Pond area			
g.	Others (if any)			
	Total [a+b+$\frac{1}{2}$ (c+d)+ e+f+g]=			

5. Annual income: Give particulars about your family income of last year from different sources.

Sl. No	Source of income	Production	Market price	Total (TK.)
1.	Crops (Rice, Wheat, Maize)			
2.	Vegetables			
3.	Fruits			
4.	Dairy and Poultry			
5.	Fish culture			
6.	Service			
7.	Business			
8.	Day labour			
9.	Rickshaw/Auto- Rickshaw driving			
10.	Others (if any)			
			Total =	

6. Training received: Have you received any training during the last four years?

Yes ☐   No ☐

If yes, please furnish the following information

Sl. No.	Name of Organization(s)	Topics	Duration (Days)
1.			
2.			
3.			

7. Organizational participation: Indicate your involvement in the following organizations.

SL. No.	Name of organization	No Participation	Types of participation		
			As a member	General Secretary	Chairmen/ President
1.	School/ Madrasa committee				
2.	Mosque /Mondir committee				
3.	Village development committee				
4.	Youth club				
5.	Bazar committee				
6.	Cooperative association				
7.	Union parishad				
8.	Others (if any)				

8. Extension media contact: Indicate the extent of your contact with following extension media in last year.

Name of extension media		Frequency of contact			
		Regularly	Often	Rarely	Not at all
Individual contact	Neighbors and friends	5-6 times/ year	3-4 times/ year	1-2 times/ year	
	Sub Assistant Agriculture Officer	5-6 times/ months	3-4 times/months	1-2 times/ months	
	Agricultural Extension Officer	Do	Do	Do	
	NGO personnel	5-6 times/ weeks	3-4 times/ weeks	1-2 times/ weeks	
Group contact	Result demonstration	2-3 times/ year	2 times/ year	1 times/ year	
	Group discussion	5-6 times/ months	3-4 times/ months	1-2 times/ months	
	Farmer's field day	1 times/ year	1 times/ 2 year	1 times/ 3 year	
Mass media contact	Listening radio program	5-7 times/ weeks	3-4 times/ weeks	1-2 times/ weeks	
	Watching TV program	Do	Do	Do	
	Reading agricultural article from daily newspaper	Do	Do	Do	

9. Agricultural Knowledge: Answer the following questions.

Sl. No.	Questions	Marks	Obtained marks
1.	What do you mean by four cropscultivationpattern?	3	
2.	What is the benefit of four cropscultivationpattern?	3	
3.	How would you improve of your soil fertility?	3	
4.	Mention four short duration crops variety for four cropscultivationpattern.	2	
5.	Mention one crop sequence in four cropscultivationpattern.	3	
6.	How do you manage fertilizer?	3	
7.	Mention two insects names.	2	
8.	Mention two disease names.	2	
9.	Mention two insecticides names.	2	
10.	How do you maintain sowing and harvesting time?	3	
	Total=	26	

10. Adoption of fourcropscultivation patternby the Farmers: Mention your land under four crops cultivation with potential area of the past four years.

Year	Potential area (ha)	Land under four crops cultivation
2012		
2013		
2014		
2015		

11. Factors influencing adoption of four crops cultivation pattern: Indicate the extent ofinfluence that you face in four crops cultivationpattern.

Sl. No.	Factors	Extent of influence			
		Not at all	Low	Medium	High
1.	Four crop cultivation is profitable				
2.	Four crop cultivation is very important for food security				
3.	Increase employment opportunity				
4.	Four crop cultivation aims at improving the productivity of the farmers				
5.	Use of fallow land				
6.	Agricultural production (crop) has considerably increased				
7.	My family has a reputation to adopt four crops cultivationpattern				
8.	My neighbors frequently visit my house and advice me to adopt four crops cultivationpattern				
9.	Fulfill nutritional demand				
10.	Suggestions from extension personnel				
11.	Helps to remove poverty				
12.	Government subsidies are available when faced with the loss of crops				
13.	Timely receipt of NGO loans				
14.	Provides food for cattle				

Thank you for your cooperation and giving me your time

….…………………………….
Signature of the Enumerator

APPENDIX-B

Correlation Matrix between Dependent and Independent Variables

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	Y
X_1	1									
X_2	-0.070	1								
X_3	0.165	-0.202^*	1							
X_4	-0.002	0.313^{**}	0.222^*	1						
X_5	0.047	0.315^{**}	0.159	0.668^{**}	1					
X_6	-0.054	0.367^{**}	0.031	0.211^*	0.043	1				
X_7	0.131	0.148	0.121	0.177	0.252^*	0.088	1			
X_8	0.038	0.232^*	0.093	0.249^*	0.188	0.186	0.088	1		
X_9	0.016	0.251^*	0.057	0.299^{**}	0.186	0.309^{**}	0.186	0.536^{**}	1	
Y	0.166	0.235^*	0.085	0.026	0.256^{**}	0.196^*	0.309^{**}	0.340^{**}	0.332^{**}	1

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0.05 level.

X_1 = Age X_6 = Training received

X_2 = Education X_7 = Organizational participation

X_3 = Family size X_8 = Extension media contact

X_4 = Farm size X_9 = Agricultural knowledge

X_5 = Annual income   Y = Adoption of four crops cultivation pattern

                                                 by the farmers