ROLE OF FARMER FIELD SCHOOLS IN DIFFUSION OF INTEGRATED PEST MANAGEMENT PRACTICES IN RICE CULTIVATION AS PERCEIVED BY THE FARMERS

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CERTIFICATE

This is to certify that the thesis entitled ***"ROLE OF FARMER FIELD SCHOOLS IN DIFFUSION OF INTEGRATED PEST MANAGEMENT PRACTICES IN RICE CULTIVATION AS PERCEIVED BY THE FARMERS''*** *submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***Master of Science*** *in* ***Agricultural Extension and Information System****, symbolizes the result of a piece of bona fide research work carried out by* ***Kazi Muktadir Hasan****, Registration No. 09-03627 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

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The Author

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ABBREVIATIONS AND ACRONYMS

BAU	=	Bangladesh Agricultural University
BBS	=	Bangladesh Bureau of Statistics
DAE	=	Department of Agricultural Extension
DANIDA	=	Danish International Development Agency
FAO	=	Food and Agriculture Organization
FFS	=	Farmers' Field School
HYV	=	High Yielding Variety
ICP	=	Inter Country Programme
IPM	=	Integrated Pest Management
MOA	=	Ministry of Agriculture
NGO	=	Non-Government Organization
SD	=	Standard Deviation
SPPS	=	Strengthening Plant Protection Services
SPSS	=	Statistical Package for Social Science
SAAO	=	Sub-Assistant Agriculture Officer
SAU	=	Sher-e-Bangla Agricultural University
UNDP	=	United Nations Development Programme

ROLE OF FARMER FIELD SCHOOLS IN DIFFUSION OF INTEGRATED PEST MANAGEMENT PRACTICES IN RICE CULTIVATION AS PERCEIVED BY THE FARMERS

ABSTRACT

The aim of FFS is to build farmers' capacity to analyses their production systems, identify problems, test possible solutions and eventually adopt the practices most suitable to their farming system. The purpose of this study was to determine the role of FFS in diffusion of IPM practices in rice cultivation and explore the contribution of the selected characteristics of the FFS farmers. The selected characteristics were age, education, family size, farm size, annual net income from agricultural sources, organizational participation, innovativeness, knowledge on IPM, cosmopoliteness and adoption of IPM practices. Data were gathered from randomly selected 86 FFS farmers of nine villages of Chinispur and Nuralapurur union of sadar upazilla under Narsingdi district by using interview schedule. For harmonious representation from each village, 86 FFS farmers were selected by using a standard formula. Respondents were selected by using stratified random sampling method. Stepwise Multiple Regression was used to examine the contribution of the selected characteristics of the FFS farmers. The findings revealed that majority of the respondents (51.10 %) perceived medium role of FFS while (34.90 %) had low and (14.0 %) perceived high role of FFS in diffusion of IPM practices. Hence, more than half (65.10 %) of FFS farmers had medium to high role of FFS in diffusion of IPM practices. Stepwise Multiple Regression exposed that education, adoption of IPM practices, knowledge on IPM and organizational participation had significant contribution on role of FFS in diffusion of IPM practices. The R^2 value indicates the four independent variables collectively contribute (32.0 %) of the total variation on the role of FFS in diffusion of IPM practices. It may be concluded that role of FFS will be increased with the increase of educational level of the respondents.

CHAPTER I
INTRODUCTION

1.1 General Background

Rice (*Oryza sativa*) is one of the major crops of the world. Rice is semi aquatic annual grass plant and is the most important cereal crops in the developing world (Khush, 1987). About ninety percent of rice is grown and consumed by the people in Asia (Anon., 1997). More than half of the people of the world eat rice (David, 1989) but its production is less than demand. By 2025 the world population is likely to be 7.2 to 8.1 billion. By this period about 650 million rice eaters would be added. To feed the increased rice eater a great challenge would be faced by the rice growing countries (Dawe, 2003). Bangladesh is a densely populated country and threatened by floods and storms which make it one of the poorest countries of the world. In Bangladesh about 75% of the total cropped area is occupied by rice of which 80% is under irrigation. On an average per person rice provides 70-76% of total caloric supply and 66% of protein intakes (Anon., 2004a). Rice sector contributes one half of the agricultural GDP and one sixth of the national income in Bangladesh (Hossain, 2002). Thus, rice plays a vital role in the livelihood of the people.

There are several constraints on the way of increasing rice production. One of the main constraints is the pest and disease. The annual yield loss due to insect pest alone is 16% for rice and 25% for vegetables. Therefore, for increasing crop production, it is important to reduce the crop loss caused by pest and disease (Anon., 2005). IPM is a broad ecological approach to control pests. It includes various control measures such as biological control, cultural control, mechanical control, chemical control and use of pest tolerant or resistant crop varieties. Principles of IPM suggest to use insecticides as a last measure to control pest population. At the time of economic threshold level, chemical pesticide is used (Hossain, 2006). In Bangladesh, chemical control has been the principal method of pest control.

Although pesticide may provide temporary relief from pest problem but it creates long term dependency on pesticides which is not desirable. To avoid such consequence and to increase rice production alterative of chemicals for pest management is needed. Integrated pest management is the best alternative strategy (Banbeis, 2005). Before introduction of the IPM farmers used pesticides, insecticides, fungicides to control pest insect and diseases. The multinational companies used the charming phrase, 'pests are the guests of fool'. Farmers did not want to be foolish. So they used indiscriminately insecticides and fungicides to control pests of rice. Their good attempt resulted a great harm in consequence air, water and soil pollution occurred. Under this circumstance IPM was introduced as an environment friendly approach of disease and pest control. In the present day usage, IPM is not limited to dealing with pesticides and pest management. In fact, IPM is a holistic approach to crop production based on sound ecological understanding and in this sense, IPM could even be termed as an ICM (Integrated Crop Management).

The following elements are being used as components of IPM system.

- **Biological control:** natural enemies and pathogenic micro-organisms
- **Cultural control :** agronomic practices
- **Pest resistant crop varieties:** BRRI dhan 34 is resistant to Brown Plant Hopper (BPH)
- **Mechanical control:** for example hand picking, flooding to minimize the incidence of insect pest.
- **Chemical control:** It is used based on economic thresholds as a last method but priority is given to botanical and bio-pesticides whenever possible.

In Bangladesh, IPM activities started in 1981 with the introduction of the first phase of FAO's Inter Country Programmed (ICP) on rice IPM. From 1989 to 1995 ICP played a strong catalytic role in promoting the IPM concept and introduced Farmer Field School for training farmers. A number of persons from NGOs were also given training in IPM.

As a result of the success of this programme and on the basis of the need for IPM in Bangladesh, a number of IPM projects executed by the Government departments and NGOs have come into existence in Bangladesh.

Based on the success of FAO's Inter Country Programme (ICP) a project – Strengthening Plant Protection Services (SPPS) Project started functioning in 1997. SPPS project implemented by the Department of Agricultural Extension with DANIDA assistance. The project is popularly known as the Integrated Pest Management (IPM) project.

The project has completed 14 Training of Trainers (TOT's) course where a total of 626 DAE staff and 75 NGO staff have been trained in practical IPM as facilitator (trainers). In each of the 137 upazilas of 47 districts four of these trained DAE staff constitute the upazila IPM team and they provide training to farmers through Farmer's Field School (FFS) (Moa, 2003).

Ramaswamy (1997) conducted an experiment on IPM practices and reported that 4050 farmers from 81 IPM schools spent taka 816/ha on pesticides during one crop season before receiving IPM training. The same number of farmers, after receiving IPM training from IPM school could control pests with no use of chemical pesticides. They reported that the naturally available parasitoids and predators suppressed the pest population. This was possible for adopting cultivation practices and controlling of pest by mechanical means and without spending money. By using IPM knowledge they spent taka 110/ha on pesticides and thus 87 percent reduction in pesticides use was achieved.

Ramaswamy (1997) conducted a study on IPM practices in vegetable of 9 FFSs of IPM for the summer 1995 season. He reported that by practicing IPM 225 farmers from 9 IPM Field Schools, were able to reduce the use of pesticides by 69 percent in terms of money per hectare.

A new concept of farmers' training called the "Farmers Field School" (FFS) was developed in 1980s by the Food and Agricultural Organization (FAO) in Indonesia (Pointus, *et al.*, 2002).

In our country the first Farmers Field Schools was organized in the early 1990s, assisted by the FAO inter country programme for IPM in rice cultivation (Islam and Bijalmakers, 2007). The Farmers Field School is a group based learning process that has been used by a number of governments, NGOs and international agencies to promote IPM practices. The FFS brings together concept and method from agro ecology, experimental education and community development. FFS was developed for the promotion of IPM practices and promised to be effective tool to extend knowledge of farmers. It has been shown that FFS helps to increase farmer's knowledge (Godtland, *et al.* 2004). FFS can be effective in reducing the excessive use of chemical pesticides. After initial positive experiences several other donors (UNDP, CARE Bangladesh and DANIDA) started projects for spreading IPM to thousands of farmers through IPM Farmers Field School. Bangladesh now has a huge capacity to implement FFS especially by the Department of Agricultural Extension (DAE). DAE is currently running a five years program to organize 8000 FFS for Integrated Pest Management. FAO also provides financial and technical support for the diffusion of Integrated Pest Management practices for crop cultivation (Islam and Bijalmakers, 2007).

The FFS training program utilizes participatory methods "to help farmers develop their analytical skills, critical thinking, and creativity, and help them learn to make better decisions" (Kenmore, 1997). Such an approach, in which the trainer is more of a facilitator, rather than an instructor, reflects a paradigm shift in extension work (Roling and van de Fliert, 1994).

Agricultural Extension Component is using FFS as an extension approach which helps in:

- Providing an environment in which farmers acquire the knowledge and skills to improve their production and income through application of informed crop management decisions.
- Improving farmers' problem solving abilities and their resilience and adaptability to changes in their environment.

- Allowing farmers to discover the benefits of working in groups and encourage group activities and group formation.
- Empowering farmers to become “experts” on their own farms (Roy, 2013)

According to Department of Agricultural Extension (DAE) the role of FFS are mention below

- **Training to the farmers**: As an extension approach, the FFS concept does not require that all farmers attend FFS training. Rather, only a select number of farmers within a village or local farmers’ group are trained in these informal schools. However, in order to disseminate new knowledge more rapidly within the community, selected farmers receive additional training to become farmer-trainers, and are expected to organize field school replications within the community, with some support from public sources. Furthermore, all FFS members are encouraged to share their knowledge and experiences with other farmers within their local village and community organizations. FFS provides training on seed technology, how to control insect and disease from crop field are also discuss in FFS training session. Training helps the FFS member about fertilizer management, soil management and crop management.

-**Participatory learning:** FFS is based on the concepts and principles of people centered learning, and was developed as an alternative to the conventional top-down test and verification (T&V) extension approach. It uses innovative and participatory methods to create a learning environment, including learning networks, in which the land users have the opportunity to learn for themselves about particular crop production problems, and ways to address them, through their own observation, discussion and participation in practical learning-by-doing field exercises. The approach is now being used to enable farmers to investigate and overcome a wider range of problems, including soil productivity improvement, conservation agriculture, control of surface runoff, harvesting and improved irrigation. Participatory learning helps the FFS members to identify beneficial and harmful insect, determination of fertilizer doses for rice,

determination of time and method of top dressing of urea, selection of quality seeds, involved in learning by doing about IPM and participation in learning about ICM.

-**Problem identification**: FFS programs teach farmers how to experiment and problem-solve independently, with the expectation that they will thus require fewer extension services and will be able to adapt the technologies to their own specific environmental and cultural needs. FFS members can identify their problems such as lack of insect /disease resistant rice varieties, lack of quality rice seed, unavailability of fertilizer, unavailability of organic farming practice and many other problems. FFS members can solve their problem by discussion with members.

-Developing human capacity: The aim of FFS is to build farmers' capacity to analyses their production systems, identify problems, test possible solutions and eventually adopt the practices most suitable to their farming system. The knowledge acquired during the learning process enables farmers to adapt their existing technologies to be more productive, profitable, and responsive to changing conditions, or to test and adopt new technologies.

-Growing healthy crops: FFS provides training on growing healthy crop by using resistant varieties, better seed selection processes and efficient nutrient, water and weed management. Conserving beneficial insects like predators and parasites. Observing fields weekly to determine management actions necessary to produce a profitable crop.

-Field observation: FFS is described as a Platform and "School without walls" for improving decision making capacity of farming communities by regular field observation and stimulating local innovation for sustainable agriculture. It is a participatory extension approach of learning, technology development and dissemination based on adult learning principles such as experimental learning whereby the farmers are given favorable environment of being experts and decision makers in their own farms.

-Working in groups: FFS consists of a group of people with common interests. The group may be mixed with men and women together, or separated depending on culture and topic (Gallagher, 2003). Typically FFS consists of 25-30 farmers meeting weakly with facilitators throughout the cropping season. After the completion of FFS training session, the farmers continue to meet and share information with minimum contact with extension personnel.

Previous studies evaluating the impact of FFS at the farm-level report significant impacts of program participation on farm-level yields and profits, and a decline in pesticide use. For example, studies by (Nanta,1996) in Thailand and (Ekneligoda,1996) in Sri Lanka claim that pesticide applications decreased with more IPM knowledge and FFS training, while rice yields increased by as much as 25%. A similar study by (Ramaswamy *et al.*, 1992) for Bangladesh notes that FFS-schooled farmers had 8-13% higher rice yields than their non-FFS counterparts. Similarly high impacts on farm profits are also reported by studies conducted in Vietnam, Ghana, Cote d'Ivoire and Burkina Faso (cited in Kenmore 1997). Increases of profits of 40% in Sri Lanka, 30% in Thailand, and 10-25% in China are cited in (FAO, 2000). Very few empirical research was conducted on FFS. Mass people do not know the benefits of FFS. So, on the above consideration the researcher of this study felt necessity to conduct the research on "Role of Farmer Field Schools in Diffusion of Integrated Pest management Practices in Rice Cultivation as Perceived by the Farmers.

1.2 Statement of the Problem

Agriculture and environment has a close relationship. We are dependent on the environment as well as agriculture and its increased production. In agricultural field, we use different pesticides. It has been found in different countries of the world that in addition to beneficial effects, the improved agricultural practices have tremendous influence on environmental pollution and Bangladesh is not exception to this (Sattar, 1994).

The rapid increase in the use of pesticides in agriculture in recent years creates bad impact on environment. First pesticide use can have adverse health effect for farm workers and others exposed to pesticides. Second, it might contaminate ground and surface water, harming down-stream users of the pesticide leached to the water sources have also been blamed for causing regular outbreaks of epidemic disease in fishes (Ziauddin, 1991).

Since the farmers have not enough knowledge about the types of adverse effect of the pesticides they are using them in a large scale injudiciously. Such application of pesticides has been damaging our valuable natural resources such as land, fishes, beneficial insects, beneficial soil microorganisms and some beneficial plants. This is why the soil organic matter has been reduced. The use of sulfur pesticides increase the acidity of the soil. Farmers often don't use pesticides in accurate doses and thus resistance of insects grows to the insecticides in the pest population. This resistance creates serious harm of the crops. To control these resistant pests a higher dose of insecticides are needed and thereby cost of production increase and damages environmental balance as well as. So, it is essential to reduce the excess use of pesticide through popularizing practices of IPM.

IPM practices is an excellent strategy for pest control. To reduce environmental hazard, economic inputs and increase crop production as well as increase farmer's life style. From that view point, the present study has been undertaken to answer the following research questions:

1. What are the role of FFS in diffusion of IPM practices?
2. What characteristics of the FFS farmers do possess in their respective IPM practices?
3. Is there any contribution between selected characteristics of FFS farmers with the role of FFS in diffusion of IPM practices?

1.3 Specific Objectives

In order to find proper direction of the present study, the following specific objectives were formulated:

1) To assess the role of Farmer Field Schools (FFS) in diffusion of IPM practices in rice cultivation

2) To describe some selected characteristics of the Farmer Field Schools (FFS) farmers. The characteristics are –

i. Age
ii. Education
iii. Family size
iv. Farm size
v. Annual net income from agricultural sources
vi. Organizational participation
vii. Innovativeness
viii. Knowledge on IPM
ix. Cosmopoliteness
x. Adoption of IPM practices

3) To explore the contribution of selected characteristics of the FFS farmers to their role of Farmers Field School (FFS) in diffusion of IPM practices

1.4 Justification of the Study

The main focus of the study was to assess the role of FFS in diffusion of Integrated Pest Management practices by the FFS farmers in rice cultivation. Men depend on environment and agriculture. IPM is less hazardous to the environment and economically benefited considered to be suitable innovation for the farmers to control the pests. However, farmers of Bangladesh has lack of adequate knowledge on IPM. Most of the farmers use chemical fertilizer and pesticides indiscriminately. Lack of consciousness on environmental issues, they are destroying our natural resources. As a result we are facing scarcity of drinking water, destruction of natural enemies, deterioration of soil quality, increase health hazard and also loss of biodiversity.

IPM refers to integrate the use of two or more control tactics, reducing the reliance on chemicals in an attempt to –

-conserve the environment and keep biodiversity

-protect beneficial insects, frogs, fisheries etc

-reduce production costs

-protect food against residual effect of pesticides

IPM educates the farmers to utilize the readily available source of tolerant genetic resource, modern cultivation practices, mechanical means of control, biological measures of control, organic, green manuring and bio-fertilizer to the pollution and improve the environment. There is an urgent need to understand the potential and limits of IPM so that appropriate development choices can be made.

Most of the farmers of Bangladesh are poor. They could hardly spare the money for expensive toxic pesticides. IPM helps farmers to utilize the readily available source of biological control agents. For enhancing the dissemination of IPM knowledge to the end users both scientists and extension personnel should work hand to hand. Research generate new technologies appropriate for beneficiaries' use, which extension people make available to the beneficiaries. This can be done through IPM training. However, before designing IPM training it is necessary to take clear cut idea about the present status of IPM practices by the farmers.

FFS provides training on seed technology, how to control insect and disease from crop field are also discuss in FFS training session. FFS programs teach farmers how to experiment and problem-solve independently. The aim of FFS is to build farmers' capacity to analyses their production systems, identify problems, test possible solutions and eventually adopt the practices most suitable to their farming system. FFS described as a Platform and "School without walls" for improving decision making capacity of farming communities by regular field observation and stimulating local innovation for sustainable agriculture.

There have been many studies conducted relating to knowledge and attitude of farmers on various aspects of IPM.

But very little research has been reported home and abroad to determine the role of FFS in diffusion of IPM practices by the farmers. Thus, this is an urgent need to undertake a study on this prospective field. The investigator believes that the findings are likely to the helpful to develop a sound policy for the national agricultural research and extension system of the country.

1.5 Assumptions

An assumption has been defined as the supposition that an apparent fact or principle is true in the light of the available evidence (Goode, 1945). The research was carried out keeping the following assumptions in mind:

a) FFS farmers included in the sample were capable of furnishing proper responses to the questions include in the interview schedule.

b) Views and opinions furnished by the FFS respondents were the representative views and opinions of the whole population of the study.

c) The responses furnished by the FFS respondents were reliable and they truly expressed their opinions on role of FFS in diffusion of IPM practices.

d) The data collected by the researcher were free from bias.

e) The researcher who acted as the interviewer was well adjusted to the social and cultural environment of the study area. Hence, the respondents furnished their correct opinions without any hesitation.

f) The items included in the questionnaire to ascertain the practices of IPM were adequate to reflect the practices of IPM conducted by the FFS members.

g) The respondents had almost similar background and seemed to be homogenous to a great extent.

h) The information sought by the researcher revealed the real situation to satisfy the objectives of the study.

i) The findings were useful in choosing the clients as well as for planning execution and evaluation the extension programme.

1.6 Scope and Limitations of the Study

The present study was under taken to have an understanding the role of FFS in diffusion of IPM practices and to explore the contribution with selected characteristics of the farmers. The FFS provides an environment in which farmers acquire the knowledge and skills regarding sound soil and crop management. In this way farmers become learners, creative, decision makers and experts in their own fields. Being involved in FFS programme, farmers could gain more knowledge compared to other than FFS farmers. This research will be helpful to farmers to take steps in controlling the pests as well as in managing soil and crop through the environment friendly means. This research will also be helpful to the other than FFS farmers to get involved in the FFS to gain knowledge about soil and crop management technologies as well as sustainable crop production. Besides, the implementation of this research work will be helpful to extension personnel and policy makers whether the more number of FFSs should be established throughout the country in order to educate the farming community about soil and crop management in a sustainable means.

Considering the time, money and other necessary resources available to the researcher and to make the research manageable and meaningful it become necessary to improve certain limitation. The limitation of the study are noted as below:

1. The study was conducted at Sadar upazilla of Narsingdi District.
2. Among the many characteristics only ten characteristics were selected. This was done to complete the study within limited resources and time.
3. The researcher was dependent on the data furnished by the FFS farmers.
4. The respondents selected for data collection were kept limited within the FFS farmers.
5. Recalling their memories FFS farmers furnished all the data required were considered to be valid and reliable.

6. The findings of the study will have general application to other parts of the country with similar socio-economic and cultural condition of the study area. This will be helpful for the students, extension workers of another area for formulating policies particularly for extension services.
7. Data were collected from both male and female FFS farmers. This means, for the measurement of role of FFS both male and female farmers were taken into consideration. The study was restricted within the farmers who had at least some cultivable land.

1.7 Definition of the Key Terms Used

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

Age: Age is the life span of an individual. However for this study it was referred to the period of his/her birth to the time of interview.

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

Family size of FFS farmers: Family size referred to the total number of members including the respondent FFS farmers himself/herself, spouse, children and other dependents, who live and eat together in a family unit.

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

Annual net income from agricultural sources: FFS farmers have many sources of income. In this study only annual net income from agricultural sources was taken into consideration. It referred to the total annual earning of all the family members of a respondent from agricultural sources during a year. It was expressed in Taka.

Organizational participation: Organizational participation of FFS farmers referred to his /her participation in various organizations existed in the community as ordinary member, executive committee member or president/secretary within a specified period of time.

Innovativeness: Innovativeness of FFS farmers was referred to the degree of his/her adoption of innovation relatively earlier than other FFS members his/her community.

Cosmopoliteness: Cosmopoliteness of FFS farmers referred to the degree to which his/her orientation is external out of his/ his own social system.

Knowledge on IPM: Knowledge on IPM of FFS farmers was referred to the extent of knowing about IPM practices.

Adoption of IPM: In this study adoption of IPM was operationally used as the actual use of the different strategies of pest management by the FFS farmers.

FFS farmers: FFS farmers referred to a group of farmers who enrolled with Farmers' Field School and acquired knowledge about IPM practices.

IPM practices: IPM practices in respect of cultivation of any crop refers to those practices which are advocated by competent authority. This practices if use are helpful for improving the yield and/or quality of crop.

Integrated Pest Management (IPM): IPM is the selection, integration and implementation of pest control based on predicted economic, ecological and sociological consequences.

Problem: It means any different situation which requires some actions to minimize the gap between "what ought to be" and "what is". The term problem refers to different difficulties faced by the farmers at the time of practicing use of Integrated Pest Management in rice cultivation.

CHAPTAR II
REVIEW OF LITERATUR

This Chapter deals with a brief review of previous research studies relating to IPM practices. Pertinent literature representing this study was not readily available. However, the researcher tried his level best to collect necessary information through searching relevant studies, journals and periodicals, bulleting's etc. that enhanced the researcher's knowledge for better and clear understanding of the present study. The review of researches directly or indirectly related to the present study was presented in three major sections as follows:

Section 1: Reviews related to farmers field school (FFS) concept

Section 2: Other Empirical Studies of FFS in Different Countries

Section 3: Review of relationships between selected characteristics of the respondents and IPM practices.

Section 4: The Development of Conceptual Framework of the Study

2.1 Farmer Field School (FFS) Concept

David (2007) examined the knowledge and skills that farmers acquire in the farmer field school (FFS) in Cameroon, what they transmit to non-participants, and the social impacts of this training approach. A formal survey conducted in 2005, showed that FFS provided the 64 farmer-graduates with new skills and knowledge on cocoa integrated crop and pest management ICPM, and FFS graduates generally demonstrated superior knowledge on cocoa ICPM compared to 90 none-FFS farmers (26 of whom were even knowledge recipients of the graduates).

Mancini *et al.* (2007) reported that Farmer field schools (FFSs) were conducted in southern India to reduce pesticide input and enhance sustainability of cotton production systems. This study was carried out to determine the additional benefits of FFSs in the social and economic arena, using the sustainable livelihoods (SL) concept to frame the evaluation.

Farmers who had participated in the integrated pest management (IPM) FFSs perceived a range of impacts much beyond the adoption of IPM practices.

Islam *et al.* (2002) conducted a comparative study between DAE Trainer Farmers Field School (DT-FFS) and Farmer-Trainer Farmers Field School (FT-FFS) in Bangladesh. The results showed that the highest proportions (65-95%) of farmers had medium IPM skill levels. About 26 per cent of DT-FFS farmers had high skill levels as compared to 1.82% of FT-FFS farmers.

Oduori (2002) stated that the overall objectives of FFS are to bring farmers together to carry out collective and collaborative inquiry with the purpose of initiating community action and solving community problems. Sones and

Braun and Graham (2000) stated FFS are platforms and "schools without walls" for improving decision- making capacity of farming communities and stimulating local innovation for sustainable agriculture. FFS offers community-based, non-formal education to groups of 20-25 farmers through self- discovery and participatory learning principles. Some authors advocate for group sizes of 25-50 (Matata and Okech, 1998). The learning process is based on agro ecological principles covering a cropping cycle. The school brings together farmers who live in the same village/catchment and thus, are sharing the same ecological settings and socioeconomic and political situation.

2.2 Other Empirical Studies of FFS in Different Countries

Van den Berg and Jiggings (2007) conducted a survey to prepare a background paper on the state of the art of published and unpublished studies of the impact of FFSs on IPM in Asia. They reported that i) the evaluation of the FFS model combines Integrated Pest Management (IPM), new technology and farmer education makes it difficult to develop methodologies to study the impact of both of these activities overtime ii) most impact studies of FFS have concentrated on measuring immediate impacts, most notably the effects of insecticide use on crop yields. However, this type of methodology is weak for estimating medium- and long-term impacts such as developing social capital to build producer organizations iii) the immediate impact of FFS on farmers producing rice in

Asian countries is the reduction in pesticide use while the achievement of FFS on other continents "remains to be established" iv) FFS programs in Asian countries have only covered one to five percent of all farm households.

There are currently several FFS initiatives in Kenya, Tanzania and Uganda, funded by various development agencies. Preliminary data suggest that FFS initiatives have led to high level of community empowerment and increased emergence of community based extension systems with institutional innovations such as farmers associations with community self-funded extension. FFS is a relatively expensive intervention method that has limited financial sustainability; several solutions have been perused, such as serni-auto-financed FFS. But there are few studies showing whether these types of schools are effective in comparison to regular FFS (Davis, 2006)

Gallagher (2006) responds by claiming that FFS can be a steeping-stone towards self-sustained groups in some situations. But that originally the FFS itself was not designed to be sustainable, With regard to the financial sustainability Sherwood (Personal communication) argues that the impact of FFS is likely to be bigger compared to cheaper extension methods such as training and visit or mass communication campaigns. Some studies have revealed that although there were changes in farmer practices at the local level, FFS did not appear to have impact at the broader national level. Farmer to farmer dissemination is essential in up scaling. Farmers may be gaining skills and knowledge. But they are not sharing them with their neighbors (Davis, 2006). Gallagher (2006) responds that FFS have been up- scaled in Asia and Africa. FFS should be seen as one element in up-scaling an appropriate response with in demand driven system. Up-scaling of only the FFS- method is not a goal itself.

Tripp *et al.* (2005) found that FFS farmers growing rice who adopted FFS knowledge derived from IPM practices were able to reduce the number of applications of insecticides by 81 percent. But surprisingly, farmers completing the FFS did not adopt other recommended farm practices and the study provided little evidence of farmer to farmer transmission of the principal practices of the

FFS. The authors have called for more rigorous impact assessment because of insufficient assessment of FFS programs (and their alternatives) is a significant part of the problem.

Feder and Quizon (2004) also reported similar findings and concluded that FFS graduates benefited more from the significantly higher knowledge acquisition of better pest management in Indonesia. Mwagi and Onyango (2003) conducted a similar study to found that the adoption of technology on organic and inorganic fertilizer combinations by FFS farmers was significantly higher than those non-FFS farmers. It is important that FFS graduates accrue much more additional benefits which can be difficult to quantify in monetary forms

Many have argued that due to its focus on training small groups of 25 to 30 farmers and the fact that the training takes a whole season to complete, then it cannot become an effective extension methodology to reach millions of small scale farmers with new agricultural technologies (Rola and Jamias 2002 and Feder *et al*., 2004). But Leeuwis *et al.* (1998) while comparing FFS approach to the training and visits (T&V) in Zanzibar concluded that FFS has many promising attributes which gives it much higher chances of effectiveness as an extension methodology in Sub-Saharan African than T&V. In a study to assess whether FFS graduates retain and share what they learn in Philippines, Rola and Jarmias (2002) reported that FFS graduates had generally higher knowledge scores than their non-counterparts.

This finding is in agreement with all previous literature on knowledge gains associated with the participation in FFS (Rola and Jamias 2002). FFSs seem to be an appropriate strategy to overcome constrains to IPM adoption identified in the lack of farmers' biological and ecological knowledge, because it allows farmers to develop a deeper understanding of the crop systems and a stronger confidence in the method. In the case of this study, such a confidence was expressed in the decision to take fewer but likely more targeted pesticide applications.

Solanki (2001) also reported that knowledge of FFS beneficiaries about breeding, feeding, health care and management practices of dairy animals was higher than the non-beneficiaries.

Loevinsohn *et al.* (2000) found that at farm level, the FFS graduates were making conscious changes in their farming practices and tended to employ more of agro ecosystem analysis than their non-FFS graduate counter parts. They were assessing crop health and natural enemy activity before applying insecticides in addition to applying principles of IPM to other crops. Eighty percent of what was learned on coffee management in the FFS was adopted showing farmers satisfaction with the technical options learned during the FFS sessions. However, while alternative pest control measures represented 52% of the innovations made on vegetables, they accounted for 82% of the practices farmers modified and 90% of those they abandoned. In countries across the world, FFS alumni have been successful in taking greater control over their lives. In Kenya, Farmer networks and associations have emerged as a follow- up effect of FFS and these units have been successful in breaking manipulative relationships with middle men and there by gained access more lucrative markets for sale of their produce .

2.3 Findings relating to the relationship between farmers characteristics and IPM practices

2.3.1 Age and IPM Practices

Alam (2008) found that age of the farmers had no significant but negative relationship with constraints analysis in adoption of IPM practices in rice cultivation.

Hossain (2006) conducted a study on use of Integrated Pest Management practices in rice field by the farmers in Topadhan Union under Rangpur district. He observed a non-significant relationship between age of the farmers and their use of IPM practices.

Khan (2003) and Rahman (2004) observed that there were significant and positive relationship between age of the farmers and their use of IPM Practices.

Robbany (2003) conducted a study on use of IPM practice by the farmers in rice cultivation. He found that age had no significant and positive relationship with the use of IPM practices.

Haque (2001), Gogoi and Gogoi (2001), Hossain (2002) and Kashem (2003) observed that there was no relationship between age of the farmers and their use of IPM practices.

2.3.2 Education and IPM Practices

Alam (2008) found that education of the farmers had significant negative relationship with constrains analysis in adoption of IPM practices in rice cultivation.

Hossain (2006) conducted a study on use of Integrated Pest Management practices in rice field by the farmers in Tapodhan union under Rangpur District. He found a positively significant relationship between level of education of the farmers and their use of IPM practices.

Kausar (2006) conducted a study on use of Integrated Pest Management Practices by the farmers in Crop Cultivation. He found a positively significant relationship between level of education of the farmers and their use of IPM practices.

Rabbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that education had positive and significant relationship with their use of IPM practices.

Alam and Balasubramanian (2000), Patil, Hoque and Hasan (2001), Okoro & Obibuaka, Khan and Kashem (2003), Hosain (2004) and Singh (2005) observed that there was significant and positive relationship between education of the farmers and their use of IPM practices.

Hoque (2001) found a significant negative relationship between education and positive confrontation of the FFS farmers in Practicing IPM.

Roy (1997) conducted a study on the adoption of IPM practices by the Boro rice growers in Sadar Thana of Magura district. He found that education of the Boro

rice growers had a positive and significant relationship with their adoption of IPM practices.

Singh (1991) observed that education of the farmers was not associated with the level of adoption of plant protection measures.

2.3.3 Family Size and IPM Practices

Hossain (2006) conducted a study on use of Integrated Pest Management practices in rice field by the Pest Management practices in rice field by the farmers in Tapodhan Union under Rangpur district. He reported that family size of the farmers had no significant relationship with their use of IPM practices.

Kausar (2006) conducted a study on use of IPM practices by the farmers in crop cultivation. He found a non-significant relationship between family size of the farmers and their use of IPM practices.

Robbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that family size had no relationship with their use of IPM practices.

Haque (2001) revealed that significant positive relationship between family size and problem confrontation of the FFS farmers in practicing IPM. Bhuiyan (2002) and Salam (2003) found similar result in their respective studies.

Roy (1997) conducted a study on the adoption of IPM practices by the Boro rice growers in Sadar thana of Magura District. He found that family size of Boro rice growers had no significant relationship with their adoption of IPM practices.

Mustafa *et al.* (1987) in their study found that number of family members had no significant effect on adoption of modern varieties of rice in Bangladesh.

2.3.4 Farm Size and IPM Practices

Alam (2008) found that farm size of the farmers had significant negative relationship with constraints analysis in adoption of IPM practices in rice cultivation.

Hossain (2006) conducted a study on use of IPM practices in rice field by the farmers in Tapodhan union under Rangpur district. He found that farm size of the farmers had no significant relationship with their use of IPM practices.

Kausar (2006) conducted a study on use of IPM practices by the farmers in crop cultivation. He observed a positively significant relationship between farm size of the farmers and their use of IPM practices.

Muttalab, Okoro and Obiboaka (2003) and Rahman (2004) reported that farm size had significant and positive relationship with the use of IPM practices of the farmers.

Robbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that farm size had no relationship with their use of IPM practices.

Haque (2001) revealed that significant positive relationship between farm size and problem confrontation of the FFS farmers in practicing IPM.Ali and Alam (2000), Gogoi & Gogai, Hossain (2001). Islam (2002) and Khan (2003) found a strong negative relationship between farm size and use of IPM practices of the farmers.

2.3.5 Annual Income and IPM Practices

Alam (2008) found that annual income of the farmers had significant negative relationship with constraints analysis in adoption of IPM practices in rice cultivation.

Hossain (2006) conducted a study on use of IPM practices in rice field by the farmers in Tapodhan union under Rangpur district. He found a positively significant relationship between annual family income of the farmers and their use of IPM practices.

Kausar (2006) conducted a study on use of IPM practices by the farmers in crop cultivation. He found a positively significant relationship between annual family income of the farmers and the use of IPM practices.

Robbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that annual family income of the farmers had positive and significant relationship with their use of IPM practices.

Haque and Hossain (2001), Khan and Hossain (2003), Rahman (2004), Singh (2005) found that income of the farmers was associated with the use of IPM practices.

Haque (2001) found in his study that annual family income of farmers had a positive significant effect on their problem confrontation.

Roy (1997) conducted a study on the adoption of IPM practices by the Boro Rice growers in Sadar thana of Magura district. He found that annual family income of the Boro rice growers had no significant relationship with their adoption of IPM practices.

2.3.6 Organizational Participation and IPM Practices

Hossain (2006) conducted a study on use of IPM management practices in rice field by the Farmers in Tapodhan union under Rangpur district. He found a positively significant relationship between organizational participation of the farmers and their use of IPM practices.

Kausar (2006) conducted a study on use of integrated pest management practices by the farmers in crop cultivation. He observed a non-significant relationship between organizational participation of the farmers and their use of IPM practices.

Haque, Balasubramanian and Kaul (2003), Hossain (2001), Islam (2002), Khan (2003) and Rahman (2004) reported that organizational participation of the farmers had a significant and positive relationship with their adoption of IPM practices.

Rabbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that organizational participation of the farmers' had positive and significant relationship with their use of IPM practices.

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measure and related aspects. He reported that organizational

participation of the farmers had significant and positive association with their adoption of insect control measures.

2.3.7 Innovativeness and IPM Practices

Hossain (2006) conducted a study on use of IPM practices in rice field by the farmers in Tapodhan union under Rangpur district. He found a positively significant relationship between innovativeness of the farmers and their use of IPM practices.

Kausar (2006) conducted a study on use of IPM practices by the farmers in crop cultivation. He observed a positively significant relationship between innovativeness of the farmers and their use of IPM practices.

Rabbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that innovativeness had no positive and significant relationship with their use of IPM practices.

Hossain (2001). Kashem and Islam (2002) and Rahman (2004) found a positive and significant relationship between the farmer's innovativeness and their use of modern farm practices.

Akanda (1993) found that innovativeness of the farmers had a significant negative relationship with their problem faced in BR 2 rice cultivation.

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measure and related aspects. He reported that innovativeness of related aspects. He reported that innovativeness of the farmers had positive and significant association with their adoption of insect control measure.

2.3.8. Knowledge and IPM practices

Alam (2008) found that knowledge on IPM of the farmers had significant negative relationship with constraints analysis in adiption of IPM practices in rice cultivation.

Hossain (2006) conducted a study on use of integrated pest management practices in rice field by the farmers in Tapodhan union under Rangpur district. He observed a positively significant relationship between knowledge of the farmers and their use of IPM practices.

Kausar (2006) conducted a study on use of integrated pest management practices by the farmers in crop cultivation. He found a positively significant relationship between knowledge of the farmers and their use of IPM practices.

Mia (2005) conducted a study of adoption of integrated pest management practices by the vegetable growers of Magura district. He found a positively significant relationship between knowledge of the vegetable growers and their adoption of IPM practices.

Stuart (1991) conducted a study in Los Banos, Philippines on the problem faced by the farmers in relation to the adopting of IPM practices and reported that unavailable technical knowledge had significantly association with the extent of adoption of IPM practices.

Anwar (1994), Karim (1996), Islam (2002), Salam (2003) and Rashid (2003) found similar findings in their respective studies.

Rabbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that knowledge on IPM had positive and significant relationship with their use of IPM practices.

Raha (1986) found that farmer's knowledge in irrigation of modern Boro rice had no significant relationship with their irrigation problem confrontation.

2.3.9 Cosmopoliteness and IPM practices

Alam (2008) found that cosmopoliteness of the farmers had no significant but negative relationship with constraints analysis in adoption of IPM practices in rice cultivation.

Hossain (2006) conducted a study on use of integrated pest management practicies in rice field by the farmers in Tapodhan union under Rangpur district. He observed a positively significant relationship between cosmopoliteness of the farmers and their use of IPM practices.

Kausar (2006) conducted a study on use of integrated pest management practices by the farmers in crop cultivation. He observed a positively significant relationship between cosmopoliteness of the farmers and their use of IPM practices.

Mia (2005) conducted a study on adoption of integrated pest management practices by the vegetable growers of Magura district. He found a positively significant relationship between cosmopoliteness of the vegetable growers and their adoption of IPM practices.

Rabbany (2003) conducted a study on use of IPM practices by the farmers in rice cultivation. He found that cosmopoliteness of the farmers had positively significant relationship with their use of IPM practices.

Haque (2001), Khan (2003) and Rahman (2004) reported that cosmopoliteness of the farmers significantly influenced the adoption of selected IPM practices.

Roy (1997) conducted a study on adoption of IPM practices by the Boro rice growers in Sadar Thana of Magura District. He found that cosmopoliteness of the Boro rice growers had positive and significant relationship with their adoption of IPM practices.

2.3.10 Adoption and IPM Practices

Mia (2005) conducted a study on adoption of integrated pest management practices by the vegetable growers of Magura district. His study revealed that only 20 percent vegetable growers were medium and low user of land for IPM practices respectively.

Rahman (2001) conducted an investigation of knowledge, attitude and adoption of Alok-6201 hybrid rice by the farmers of sadar upazila in Mymensingh district. The study revealed that the 75 percent of the farmers fell under medium adoption while 18 percent had high adoption and 7 percent had low adoption in Alok-6201 hybrid rice cultivation.

Chowdhury (1997) conducted an inversigation on adoption of selected BINA technologies by the farmers of Boyra union in Mymenshingh district. The study

revealed that 58 percent of the respondents had no adoption of BINA technologies and 42 percent were adopted BINA technologies.

Roy (1997) conducted a study on the adoption of IPM practices by the Boro rice growers in sadar thana of Magura district. He found that 55 percent of the Boro rice growers had medium adoption of IPM technology, while 25 percent had high adoption and only 20 percent of them had low adoption of IPM practices.

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

Khan (1993) carried out a study on adoption of insecticides and related issue in the village of Pachan Union under Madaripur district. He observed that among the respondent farmers, 7 percent had no adoption while 57 percent had low adoption and 32 percent of them had medium adoption and only 4 percent had high adoption of insecticides.

2.4 Conceptual framework of the study

The conceptual framework of Rosenbarg and Hovland (1960) was kept in mind while forming the structural arrangement for the dependent and independent variables. Role of FFS in diffusion of IPM practices in rice cultivation as dependent variable which was influenced and attached through interacting forces of many characteristics in his /her surroundings. It is impossible to deal with all characteristics in a single study. It was therefore, necessary to limit the characteristics including age, education, family size, farm size, annual net income from agricultural sources, organizational participation, innovativeness, knowledge on IPM, cosmopoliteness and adoption of IPM practices.

Availability of agricultural inputs like (seed, fertilizer) and constraints in participating FFS training progrmme could also influence the role of FFS. Development supports of different GOs/NGOs would enhance the role of FFS in diffusion of IPM practices by the farmers resulting sustainable crop production.

Consequently, livelihood of the FFS farmers' would be improved and ultimately it would cause the betterment of the farmers. However, for clear understanding a conceptual model of the study based on this discussion and review of literature, has been formulated as shown in the Figure 2.1. Based on discussion and review of literature, the conceptual framework of this study has been formulated and shown in the Fig. 2.1

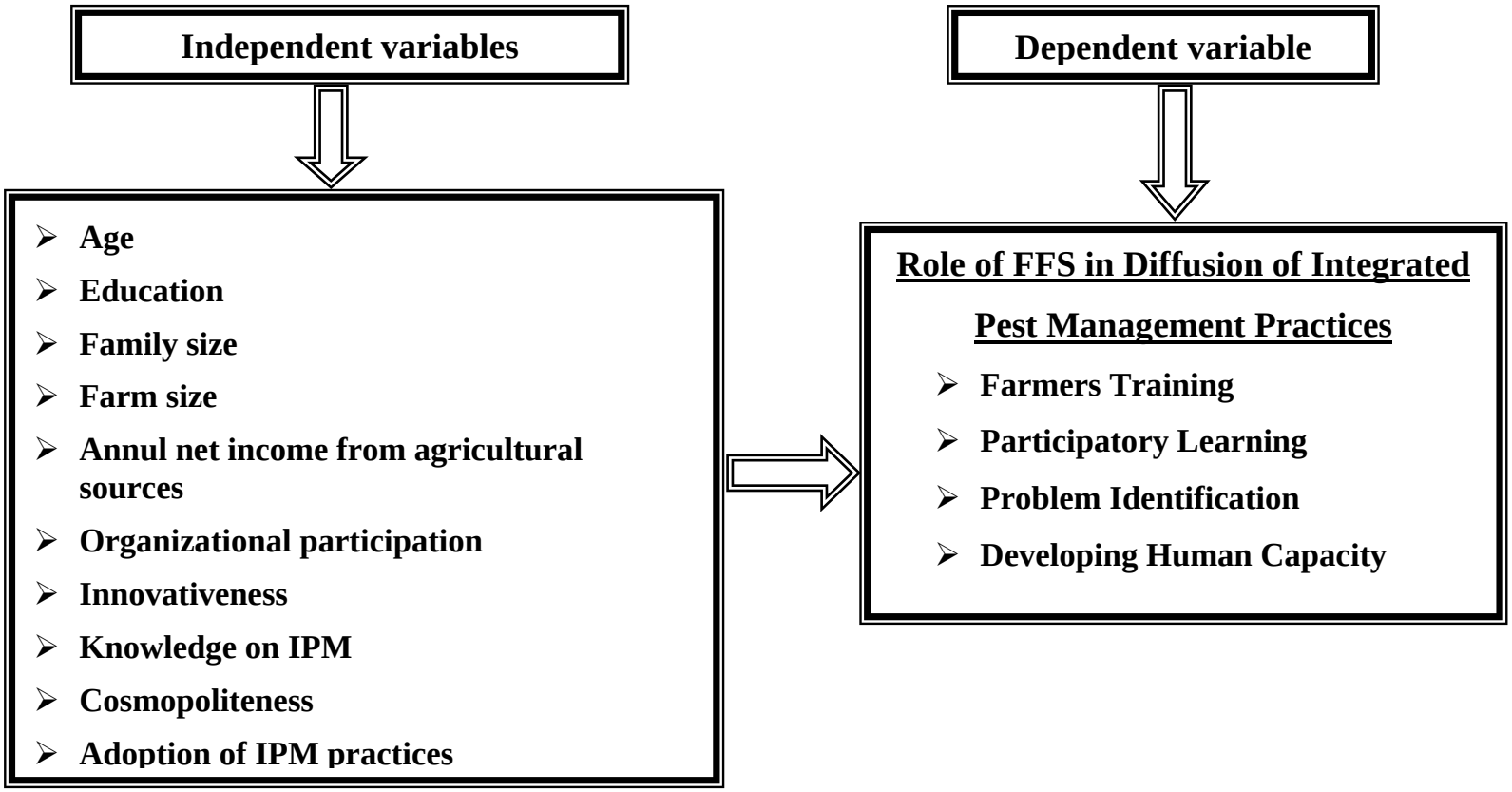

Figure 2.1 Conceptual Framework of the Study

CHAPTER III
METHODOLOGY

Methods and procedures are the key factors in conducting a research. Appropriate methodology used in research helps to collect valid and reliable decision. This Chapter delineates the locale of the study followed by source of data, research design, variables of the study, measurement of variables, categorization and statistical treatment.

3.1 Locale of the Study

The study was conducted in the Sadar Upazilla under Narsingdi District. A significant number of people of this upazilla are farmers. Among the farmers about all are rice growers. The Sadar upazilla has fourteen unions, namely Chinispur, Picharchor, Karimpur, Nuralapur, Nazarpur, Alokbali, Kathalia, Pachdona, Meherpara, Hazipur, Shilmandii, Chardishondi, Mohesasura and Paurasava. Out of fourteen Unions two unions Chinispur and Nuralapur were selected purposively. The villages of Chinispur union are Sonatola, Ghoradia,Puranpara and Dogria.The villages of Nuralapur union are Algikandapara, Shamtoli and Bolvordi. All the FFS villages of two unions were considered as study area. The selected villages had moderate to better communication facilities with upazilla and district. Figure 3.1. A map of Narsingdi district and a map of Sadar Upazila of Narsingdi showing the study area have been shown in Fig 3.2

Figure 3.1 Map showing Narsingdi district

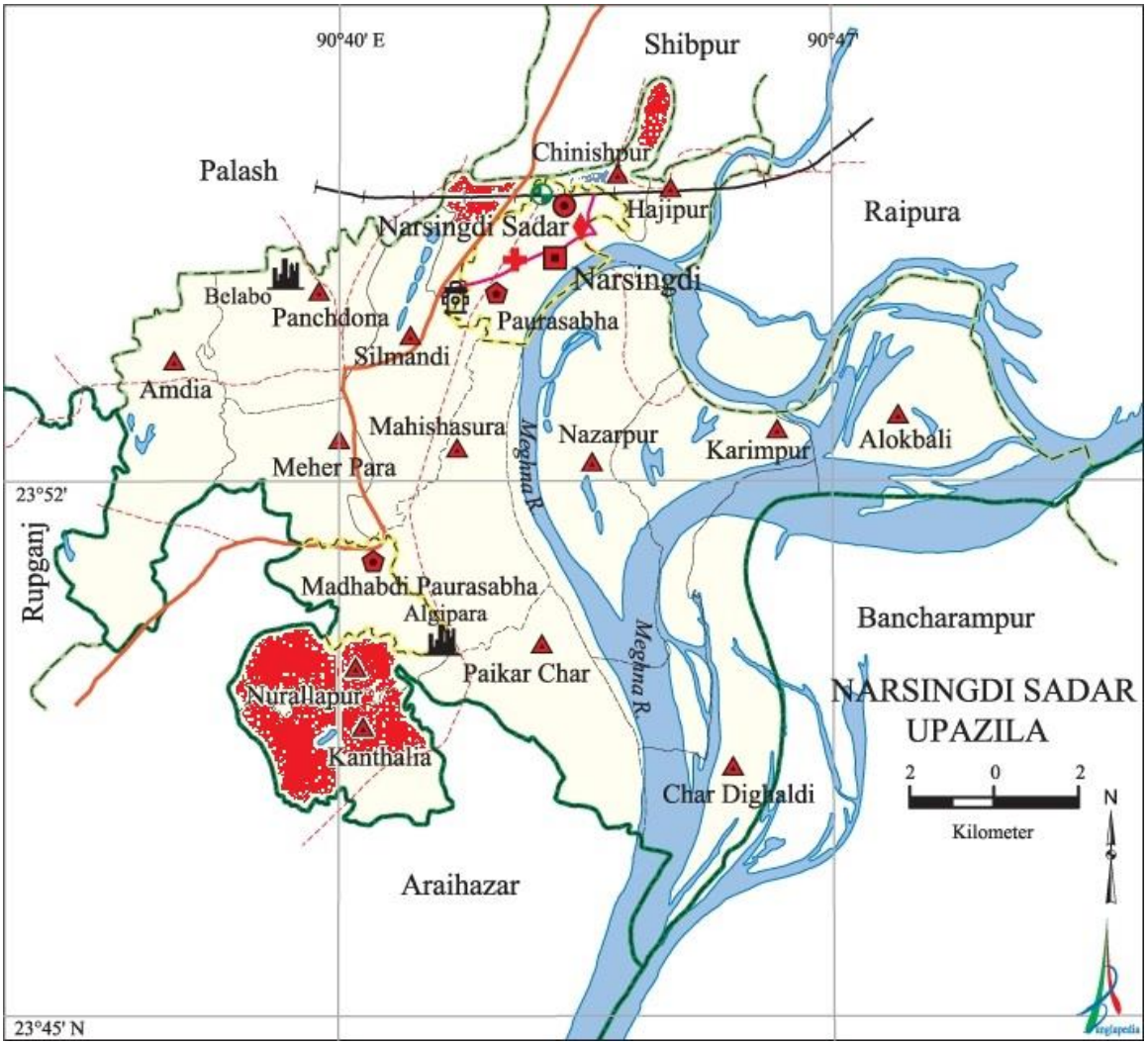

Figure 3.2 Map showing Narsingdi Sadar Upazila showing the study area

3.2 Population and Sampling Design

Six hundred and twenty five (625) FFS farmers of Sadar Upazilla under Narsingdi district were the population of the study. The selected two unions were Chinispur and Nuralapur. Respondents were randomly selected as the sample of the study by using random number table. The sampling size was determined by using a standard formula. In calculating sample size 10% marginal error was chosen from the following formula (Moral, 2011)

$$n= \frac{N}{1+Ne^2}$$

Where, n=sampling size

N= Population size

e = margin of error

Thus sample size of the study was 86. A list of FFS farmers were collected with the help of DAE Extension officer and Sub assistant agricultural officer (SAAO) of the concerned area. Out of 625 farmers, 86 were selected proportionately by using a table of Random Numbers. The distribution of selected farmers is shown in Table 3.1

Table 3.1 Distribution of population and sample of the respondents in selected FFS farmers in respective union of Sadar Upazilla

Name of union	Name of villages	No. of FFS farmers	No. of FFS farmers including in the sample	Reserve list
Chinispur	Chinispur	50	08	1
	Dogria	75	10	2
	Puranpara	75	10	1
	Ghoradia	75	10	1
	Sonatola	75	10	2
Nuralapur	Nuralapur	50	08	1
	Bolvordi	75	10	1
	Shamtoli	75	10	2
	Algikandapara	75	10	1
	Total	625	86	12

Thus 86 FFS farmers were selected as a sample. A reserve list of 12 farmers were also prepared and used only when a respondent included in the original list was not available for interview during collection of data despite several attempts.

3.3 Instrument for Collection of Data

An interview schedule was used as the research instrument in order to collect relevant information from the respondents. The schedule was carefully designed and prepared in Bengali, keeping the objectives of the study in view. The questions were arranged systematically.

3.4 Pre- testing of the Interview Schedule

The interview schedule was pre-tested with 10 farmers and then final shape was given to the interview schedule according to the experience of pre-test. The pre-testing facilitated the researcher to examine the suitability of different questions and status of the instrument in general.

The final revised version of the instrument was prepared on the basis of suggestions and comments of the appropriate authority. An English version of the interview schedule is enclosed at Appendix-I respectively.

3.5 Time and Procedure of Data Collection

Data were collected by the researcher himself during 30 October to 30 November, 2015. To get valid and pertinent information, the researcher made all possible efforts to explain the purpose of the study to the respondents. Interviews were conducted with the respondents in their homes. While starting interview with any respondent, the researcher took all possible care to establish rapport with him so that the respondent did not feel hesitant to furnish proper responses to the questions and statements in the schedule. The questions were clearly explained wherever the respondent felt any difficulty in understanding properly. Before data collection Agriculture Extension Officer (AEO) and Sub Assistant Agriculture Officer (SAAO) of the Sadar Upazilla extended necessary help and cooperation in connection with data collection.

3.6 Variables and their Measurement

In a descriptive social research the selection of variables constitute and important task. In this correction, the investigator looked into the literature to wider his understanding about the nature and scope of the variables involve in the research studies. A variable is any characteristic which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959).

A well-organized piece of research usually contains at least two important variables, *viz.,* an independent and a dependent variable. An independent variable is that factor which is manipulate by the experiment in its attempts to ascertain the relationship to an observed phenomenon. A dependent variable varies as the experiment introduce, removes or varies the independent variables (Townsend, 1953).

3.7.1 Measurement of independent variables

Ten characteristics of FFS farmers were selected as independent variables of this study. Procedure followed is measuring the independent characteristic are briefly discussed below:

3.7.1.1 Age

Age of the respondents was measured in terms of actual years from their birth to the time of interview.

3.7.1.2 Education

Education was measured as the ability of an individual respondent to read and write or the formal education received up to a certain standard. A score of one (1) was given for each year of successful schooling. If a respondent passed the S.S.C examination, his education score was given as 10, if passed the final examination of class seven (VII), his education score was given as 7. If a respondent did not know how to read and write his education score was given as '0' (zero).

3.7.1.3 Family size

Family size of a farmer was determined on the basis of the total number of members in his/her family. The family members included himself/herself, spouse, sons, daughter and other dependents. The scoring was made by the actual number of family members expressed by the respondents. For example, if a respondent had five members in his/her family, his/her score was given as 5.

3.7.1.4 Farm size

Farm size refers to the total cultivated area either owned by a farmer or obtained from others on share cropping system or taken from others as mortgage/borga where he/she used to do his/her farming operations during the period of this study. The farm size of the respondent was computed by using the following formula:

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

Where

F_s = Farm size

A_1 = Homestead area out pond and garden

A_2 = Own land under own cultivation

A_3 = Own land given to/taken from others on borga

A_4 = Own land given to/taken from others on lease

A_5 = Other (Fruit garden, pond etc.)

3.7.1.5 Annual net income from agricultural sources:

This variable was measured by the total income by a respondent and other members of his or her family from agricultural sources. Annual net income from agricultural sources was measured in "thousand" taka per year. A score of one (1) was given for each one thousand taka.

3.7.1.6 Organizational participation

Organizational participation of the respondent was measured on the basis of the nature of his participation and duration of his participation in different organizations during the time of interview. Organizational participation score was computed in the following manner for participation in each organization.

Organizational participation score = $\sum P \times D$

Where,

P= Participation score

D= Duration score

Participation score was computed in the following manner.

Nature of participation	Scores assigned
No participation	0
Participation as ordinary member	1
Participation as executive committee member	2
Participation as president or secretary	3

For measuring the duration of participation, a score of one was assigned for each year of participation in each organization.

Thus, organizational participation score of a respondent was obtained by multiplying the duration with the individual scores for ordinary member, executive committee member, and president or secretary for all the organizations.

3.7.1.7 Innovativeness

According to Rogers (1995) it is the degree of adoption a new technology to which an individual or other unit of adoption is relatively earlier than the other member of the social system. Innovativeness of a respondent was measured by computing a innovativeness score on the basis of his/her extent of use 12 selected modern agricultural practices. Scores were assigned on the basis of time dimension in the following manner.

Extent of adoption	Score assigned
Never used	0
Within 4 and above years	1
Within 3 years	2
Within 2 years	3
Within 1 year	4

Innovativeness score of a respondent was obtained by adding his/her score for all the items. Therefore, the possible innovativeness score of the respondents could range from 0 to 48 where 0 indicating no innovativeness and 48 indicating very high innovativeness.

3.7.1.8 Knowledge on IPM

Knowledge on IPM practices score of a respondent was computed on the basis his/her responses against 14 questions. IPM knowledge in rice cultivation of a respondent was measured by asking questions related to various pest management strategies contained in item number 8 of the interview schedule. It was measured in scores.

According to nature of answering, the respondent got 1or 0 (zero). For correct responses to all the 14 question, a respondent could get a total score of 14 while for wrong responses to all the 14 questions he/she could get 0 (zero). Thus, the knowledge score of the respondents could range from 0 to 14. Zero (0) indicating no knowledge and 14 indicating very high knowledge.

3.7.1.9 Cosmopoliteness

Cosmopoliteness of a respondent was measured in terms of his or her nature of outside visit (Eleven different places) external to his own social system. For this purpose, four- point rating scale was used. For measuring the cosmopoliteness, a score of one was assigned for the purpose of nonagricultural visit and two was assigned for agricultural purpose of visit. Thus, Cosmopoliteness score of a respondent was obtained by multiplying the purpose of visit with the individual scores for Regularly , Occasionally , Rarely ,Not at all of the nature of visit. For example, one individual had obtained score 10 for places of visit. If his places of visit was for nonagricultural purpose, then his cosmopoliteness score was calculated as10 x 1= 10. If his purpose of visit was agriculture, his/her cosmopoliteness score would be 10 x 2 =20.

Table 3.2 Measurement of cosmopoliteness of the respondents

Please of visit	**Nature of visit**	**Score**
1. Visit of market /familiar home outside of your own village	Regularly (≥ 7times/ month)	3
	Occasionally (4-6 times/month)	2
	Rarely (1-3 times/month)	1
	Not at all (0 time/month)	0
2. **Visit of relatives/friends**	Regularly (≥ 5 times/ month)	3
	Occasionally (3-4 times/month)	2
	Rarely (1-2 times/month)	1
	Not at all (0 time/month)	0

Please of visit	Nature of visit	Score
3. **Visit to upazilla sadar**	Regularly (≥ 5 times/ month)	3
	Occasionally (3-4 times/month)	2
	Rarely (1-2 times/month)	1
	Not at all (0 time/month)	0
4. **Visit to other upazilla sadar**	Regularly (≥ 5 times/ year)	3
	Occasionally (3-4 times/year)	2
	Rarely (1-2/year)	1
	Not at all (0 time/year)	0
5. **Visit to upazilla agricultural officer**	Regularly (≥ 4 times/ year)	3
	Occasionally (2-3times/year)	2
	Rarely (once/year)	1
	Not at all (0 time/ year)	0
6. **Visit to upazilla/district agricultural fair**	Regularly (≥ 5 times/ year)	3
	Occasionally (3-4 times/year)	2
	Rarely (1-2/year)	1
	Not at all (0 time/ year)	0
7. **Visit to IPM practice demonstration plots**	Regularly (≥ 5 times/ year)	3
	Occasionally (3-4 times/year)	2
	Rarely (1-2/year)	1
	Not at all (0 time/ year)	0

Please of visit	Nature of visit	Score
8. Attend to result demonstration plots	Regularly (≥ 3 times/ year) Occasionally (2 times/year) Rarely (once/year) Not at all (0 time/ year)	3 2 1 0
9. **Attend in meeting organized by UAO/AEO/SAAO**	Regularly (≥ 5 times/ year) Occasionally (3-4 times/year) Rarely (1-2/year) Not at all (0 time/ year)	3 2 1 0
10. **Visit to IPM related workshop**	Regularly (≥ 5 times/ year) Occasionally (3-4 times/year) Rarely (1-2/year) Not at all (0 time/ year)	3 2 1 0
11. **Meeting plant protection specialist**	Regularly (3-4 times/ month) Occasionally (2-3 times/ month) Rarely (1-2/ month) Not at all (0 time/month)	3 2 1 0

3.7.1.10 Adoption of IPM Practices

Adoption of IPM practices was measured in two dimension. First, adoption was measured on number of practices adopted and secondly on duration of adoption.

1. In case of adoption of number of practices score 10 was assigned for the adoption of one practice. If a respondent used 5 practices his / her adoption score would be 50. If he / she adopted 8 practices then his / her adoption score would be 80.

The obtained score was categorized and assigned weight in the following manner:

Percentage	Score assigned
1%-25%	1
26%-50%	2
51%-75%	3
76%-100%	4

2. In case of duration of adoption the score was assigned as follows:

Duration	Score assigned
Below 2 years	1
2- 4 years	2
Above 4 years	3

Next, the adoption score was calculated by multiplication of weights of adoption and weights of time of using technology. This was done in the following way:

Weights of adoption x Weights of time

Thus, the adoption score of the respondents could range from 0 to 12. Zero (0) indicating very low adoption and 12 indicating very high adoption.

3.7.2 Measurement of dependent variable

The present study includes the dependent variable role of FFS in diffusion of IPM practices in rice cultivation. This variable was measured on the basis of role of FFS of different kinds of IPM practices. The practice scores of the respondents was computed on the basis of the role of FFS in diffusion of Integrated Pest Management practices. Four dimension was set up for the measurement of role of FFS.

Farmers' training, participatory learning, problem identification and developing human capacity were the four dimension for the measurement of dependent variable.

3.7.2.1 Farmers' training

A five-point rating scale ranging from "excellent" to "poor" was developed to measure the extent of farmers' training. Scores were assigned on the basis of degree of betterment in the following manner.

Degree of betterment	Score assigned
Poor	0
Fair	1
Good	2
Better	3
Excellent	4

3.7.2.2 Participatory learning

A five-point rating scale ranging from "High" to "No participation" was developed to measure the extent of participatory learning. Scores were assigned on the basis of degree of participation in the following manner.

Degree of participatory learning	Score assigned
No	0
Very low	1
Low	2
Medium	3
High	4

3.7.2.3 Problem identification

A five-point rating scale ranging from "High" to "Poor" was developed to measure the extent of problem identification. Scores were assigned on the basis of degree of appropriateness in the following manner.

Degree of appropriateness	Score assigned
Poor	0
Very low	1
Low	2
Medium	3
High	4

3.7.2.4 Developing human capacity

For the measurement of developing human capacity similarly a five-point rating scale ranging from "excellent" to "poor" was developed to measure the extent of developing human capacity. Scores were assigned on the basis of degree of capacity in the following manner.

Degree of capacity	Score assigned
Poor	0
Fair	1
Good	2
Better	3
Excellent	4

However, besides having calculated the "role of FFS" score for each of the 86 respondents, adding the total score of farmer's training, participatory learning, problem identification and developing human capacity. Total 32 roles of FFS were identified. The range of role of FFS score of a respondent could vary from 0 to 128 where, 0 indicate no role and 128 indicate highest role of FFS in diffusion of IPM practices.

3.8 Statement of the Hypotheses

As defined by Goode and Hatt (1952) a hypothesis is "a proposition which can be put to test to determine its validity. It may seem contrary to, or in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test."

3.8.1 Research hypotheses

In the light of the objectives of the study and variables selected, the following research hypotheses were formulated to test them in. The research hypotheses were stated in positive form, the hypotheses were as follows:

"Each of the selected characteristics of the farmers had contribution to the role of FFS in diffusion of IPM practices."

3.8.2 Null hypotheses

In order to conduct statistical tests, the research hypotheses were converted to null form. Hence, the null hypotheses were as follows:

"Each of the selected characteristics of the farmers had no significant contribution to the role of FFS in diffusion of IPM practices."

3.9 Data Processing

3.9.1 Editing

The collected raw data were examined thoroughly to detect errors and omissions. As a matter of fact the researcher made a careful scrutiny of the completed interview schedule to make sure that necessary data were entered as complete as possible and well arranged to facilitate coding and tabulation. Very minor mistakes were detected by doing this, which were corrected promptly.

3.9.2 Coding and tabulation

Having consulted with the research supervisor and co-supervisor, the investigator prepared a detailed coding plan. In case of qualitative data, suitable scoring techniques were followed by putting proper weight age against each of the traits to transform the data into quantitative forms. These were then tabulated in accordance with the objective of the study.

3.9.3 Categorization of data

Following coding operation, the collected raw data as well as the respondents were classified into various categories to facilitate the description of the

independent and dependent variables. These categories were developed for each of the variables by considering the nature of distribution of the data and extensive literature review. The procedures for categorization have been discussed while describing the variables under consideration in chapter iv.

3.10 Statistical Analysis

The statistical measures such as range, mean, standard deviation, percentage were used for describing both the independent and dependent variables. Tables were also used in presenting data for clarity of understanding. Initially, Pearson Product Moment correlation was run to determine the relationship between the selected characteristics of the FFS farmers with the role of FFS in diffusion of IPM practices. To find out the contribution of selected characteristics of the FFS farmers with the role of FFS in diffusion of IPM practices, step-wise multiple regression was used. Five percent (0.05) level of probability was used as the basis for rejection of a null hypothesis throughout the study. Co-efficient values significant at 0.05 level is indicated by one asterisk (*), and that at 0.01 level by two asterisks (**) and at 0.001 level or above by three asterisks (***)

CHAPTER IV

FINDINGS AND DISCUSSION

In this Chapter, the findings of the study and interpretation of the results have been presented according to the objectives of the study. Necessary explanations and appropriate interpretations have also been made showing possible and logical basis of the findings. However, for convenience of the discussions, the findings are systematically presented in the following sections.

4.1 Selected Characteristics of the Farmers' (Independent variables)

In this section the findings of the farmers' selected characteristics have been discussed. The selected characteristics are i) age ii) education iii) family size iv) farm size v) annual net income from agricultural sources vi) organizational participation vii) innovativeness viii) knowledge on IPM practices ix) cosmopoliteness x) adoption of IPM practices

Measuring unit, range, mean, standard deviations of those characteristics of FFS farmers were described in this section. Table 4.1 provides a summary profile of FFS farmer’s characteristics.

Table 4.1Salient features of the farmers' selected characteristics, their role of FFS in diffusion of IPM practices

Sl. No	Selected characteristics	Scoring system	Range		Categories	Farmers (n = 86)		Mean	Standard deviation (SD)
			Possible	Observed		No.	%		
1.	Age	Actual years	-	23-58	Young (up to 35)	49	57.0	36.74	9.16
					Middle (>35-50)	26	30.2		
					Old (>50)	11	12.8		
2.	Education	Years of schooling	-	0-11	No education (0)	05	5.8	5.71	3.04
					Primary (1-5)	29	33.7		
					Secondary (6-10)	47	54.7		
					Higher secondary (>10)	05	5.8		
3.	Family size	No. of members	-	4-11	Small (up to 5)	20	23.3	6.96	1.92
					Medium (6-7)	32	37.2		
					Large (>7)	34	39.5		
4.	Farm size	Hectares	-	0.13-1.23	Marginal (0.03-0.2)	10	11.6	0.41	0.23
					Small (0.21-1.0)	71	82.6		
					Medium (1.01-3.0)	5	5.8		
5.	Annual net income from agricultural sources	In Tk. (1,000)	-	33-210	Low (up to 60)	52	60.5	62.13	34.21
					Medium (61-110)	28	32.5		
					High (>110)	6	7.0		
6.	Organizational participation	Scale score	-	2-12	Low (2-5)	41	47.7	5.86	2.87
					Medium (6-9)	34	39.5		
					High (>9)	11	12.8		
7.	Innovativeness	Scale score	0-48	10-32	Low (10-17)	32	37.2	19.36	6.32
					Medium (18-25)	40	46.5		
					High (>25)	14	16.3		
8.	Knowledge on IPM	Scale score	0-14	3-12	Low (3-6)	29	33.7	7.51	2.51
					Medium (7-10)	43	50.0		
					High (>10)	14	16.3		
9.	Cosmopoliteness	Scale score	0-66	10-34	Low (10-18)	33	38.4	21.62	6.45
					Medium (19-27)	37	43.0		
					High (>27)	16	18.6		
10.	Adoption of IPM Practices	Scale score	0-12	3-12	Low (3-6)	34	39.5	7.41	2.79
					Medium (7-9)	40	46.5		
					High (>9)	12	14.0		
11.	Role of FFS i) Farmer's training	Scale score	0-20	8-17	Low (8-11)	24	27.9	12.55	1.89
					Medium (12-14)	51	59.3		
					High (>14)	11	12.8		
ii)	Participatory learning	Scale score	0-40	23-33	Low (23-26)	22	25.6	27.60	2.05
					Medium (27-29)	50	58.1		
					High (>29)	14	16.3		
iii)	Problems identification	Scale score	0-40	16-28	Low (16-20)	34	39.5	21.20	2.35
					Medium (21-24)	44	51.2		
					High (>24)	08	9.3		
iv)	Developing human capacity	Scale score	0-28	12-22	Low (12-15)	20	23.3	17.47	2.73
					Medium (16-19)	41	47.6		
					High (>19)	25	29.1		
v)	Overall role of FFS	Scale score	0-128	71-89	Low (71-77)	30	34.9	78.84	4.37
					Medium (78-83)	44	51.1		
					High (>83)	12	14.0		

4.1.1 Age

The age score of the FFS farmers ranged from 23 to 58. The average was 36.74 and standard deviation 9.16. Based on their age score, the farmers were classified into three categories as shown in Table 4.2

Table 4.2 Distribution of the FFS farmers according to their age

Categories	Farmers		Mean	Standard deviation
	Number	%		
Young (up to 35)	49	57.0	36.74	9.16
Middle aged (>35-50)	26	30.2		
Old (above 50)	11	12.8		
Total	86	100.00		

Data furnished in the Table 4.2 indicate that the highest proportion (57.0 %) of the respondents fell in the young aged category, while 30.2 and 12.8 % belonged to middle and old aged categories respectively. Moreover, data also revealed that 87.2 % of the respondents in the study area were young to middle aged. This is because they are likely to be involved in crop cultivation who are comparatively more energetic, prompt, enthusiastic and innovative than the older people in our community. The extension services like DAE, BRAC, PROSHIKA and others use young and middle aged farmers in technology diffusion and income generating activities. Maskwat (2010) also reported similar findings and categorized in the same way.

4.1.2 Education

The education score of the respondents ranged from 0 to 11 with the average of 5.71 and standard deviation 3.04. Based on their score, the farmers were classified into four categories as shown in Table 4.3. The data indicate that majority (54.7 %) of the farmers had secondary level of education while (33.7%) and (5.8 %) of farmers had primary and higher secondary level of

education respectively. Only (5.8 %) of the farmers did not receive any education.

Table 4.3 Distribution of the FFS farmers according to their Education

Categories	Farmers		Mean	Standard deviation
	Number	%		
No education (0)	5	5.8	5.71	3.04
Primary (1-5)	29	33.7		
Secondary (6-10)	47	54.7		
Higher secondary (>10)	5	5.8		
Total	86	100		

Education helps the farmers to face the adverse condition and adjust with unfavorable condition through reading leaflets, booklets, books and other printed materials in this case. Hence, it is expected that education is one of the important factors in determining the role of FFS in diffusion of IPM practices by the farmers in rice cultivation. Comparatively educated person is relatively more responsive to the technology and new innovation. These findings are in line with Kausar (2006).

4.1.3 Family size

The family size score of the respondents ranged from 4 to 11 with an average of 6.96 and standard deviation 1.92. Data in the Table 4.4 indicate that about one third of the respondents (39.5 %) fell into large family category, while (37.2 and 23.3 %) had medium and small family size respectively. However, 76.7 % of the respondents had medium to large family size. The village people are not conscious about their number of children. The people in the village areas think if family is large with more children can engage in different income

generating activities. But they do not think about the future of the children. Hence, most of the village families are medium to large in size. As a result majority (39.5 %) of the respondent had large family in the study area. Kausar (2006) also reported similar findings.

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

Categories	Farmers		Mean	Standard deviation
	Number	%		
Small family (up to 5)	20	23.3	6.96	1.92
Medium family (6-7)	32	37.2		
Large family (above 7)	34	39.5		
Total	86	100.00		

4.1.4 Farm size

The farm size of the FFS farmers in the study area varied from 0.13-1.23 hectares (ha.). The average farm size was 0.41 ha with the standard deviation 0.23. Based on their farm size, the respondents were classified into three categories as shown in Table 4.5.

Table 4.5 Distribution of the FFS farmers according to their farm size

Categories	Farmers		Mean	Standard deviation
	Number	%		
Marginal farm (.01- 0.2)	10	11.6	0.41	0.23
Small farm (0.21-1.0)	71	82.6		
Medium farm (1.01-3.0)	5	5.8		
Total	86	100.00		

The Table shows that the highest proportion (82.6 %) of the respondents belonged to small farm size, compared to (11.6 % and 5.8 %) had marginal and medium farm respectively. Here, most (94.2 %) of the farmers had marginal to

small farm. In Bangladesh, population is being increased day by day. But agricultural land does not increases with the increase of population. So, individual possess limited amount of cultivable land. In the study area most of the FFS farmers had small farm. The small farmers can improve productivity in their small amount of land by adopting IPM practices. Meagy (2001), Ahmed (2002), and Ullah (2011) also reported similar findings

4.1.5 Annual net income from agricultural sources

Annual net income from agricultural sources score of the respondents ranged from 33 to 210 (in thousand) with an average of 62.13 and standard deviation 34.21. On the basis of annual net income from agricultural sources, the respondents were classified into three categories as shown in Table 4.6.

Table 4.6 Distribution of the FFS farmers according to their annual net income from agricultural sources

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low income (up to 60)	52	60.5	62.13	34.21
Medium income (61-110)	28	32.5		
High income (>110)	06	7.0		
Total	86	100.00		

Data presented in the Table 4.6 indicate that the highest proportion (60.5 %) of the respondents had low annual income, while (32.5 %) had medium income. Only (7.0 %) of the respondent had high income. As a result, the most (93 %) of the respondents in the study area had low to medium annual income. It can be mentioned that the farmers of low to medium income category were likely to participate in the FFS training program. In this research only annual net income from agricultural sources were considered. Other income sources were

not considered. The income from agricultural sources were good enough, because all the respondents were FFS farmers.

FFS farmers were conscious about their crop production compared to other farmers. Hanif (2000) reported similar findings.

4.1.6 Organizational participation

The observed organizational participation score of the respondents ranged from 2 to 12. The mean score was 5.86 with the standard deviation 2.87. Based on the organizational participation scores, the respondents were classified into three categories as shown in the Table 4.7. Data contained in the Table revealed that the highest proportion (47.7 %) of the respondents had low organizational participation as compared to (39.5 %) had medium participation and (12.8 %) had high participation. However, more than half of the respondents (52.3 %) had medium to high organizational participation.

The study revealed that all the respondents in the research area had more or less participation in different organization. It can be mentioned that FFS farmers had more scope of exchanging ideas related IPM practices than the other farmers. Hoque (2001) reported similar finding.

Table 4.7 Distribution of the FFS farmers according to their Organizational participation

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low participation (2-5)	41	47.7	5.86	2.87
Medium participation (6-9)	34	39.5		
High participation (above 9)	11	12.8		
Total	86	100.00		

4.1.7 Innovativeness

The observed innovativeness scores of the respondents ranged from 10 to 32 against the possible range of 0 to 48. The average and standard deviation were 19.36 and 6.32 respectively. Based on the innovativeness scores were classified into three categories as shown in Table 4.8. Data presented in the Table indicate that majority (46.5 %) of the respondents had medium innovativeness as compared to (37.2 and 16.3 %) had low and high innovativeness respectively. As majority (62.8 %) of the respondents had medium to high innovativeness it can be mentioned that, FFS farmers are more innovative than other farmers. FFS farmers engage on different training programme. So, FFS farmers accept new innovation than other category farmers. These findings are in line with Pal (2009).

Table 4.8 Distribution of the FFS farmers according to their Innovativeness

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	32	37.2	19.36	6.32
Medium	40	46.5		
High	14	16.3		
Total	86	100.00		

4.1.8 Knowledge on IPM

Scores of knowledge on IPM practices the respondents could range from 0 to 14 while the observed scores ranged from 3 to 12 with the average 7.51 and standard deviation of 2.51 as shown in Table 4.9. Data contained in the table indicate that the highest proportion (50.0 %) of the farmers had medium knowledge while (33.7 %) had low and (16.3 %) had high knowledge.

Knowledge on IPM is an important aspect for motivating farmers about integrated pest management activities of FFS.

So, it can be mentioned that the majority of the respondents (66.3%) had medium to high knowledge on IPM which may be conducive for better understanding the role of FFS. The knowledge acquired by the FFS members during the learning process enables farmers to adapt their existing technologies to be more productive, profitable, and responsive to changing conditions, or to test and adopt new technologies. These findings are in line with Meagy (2001), Miah (2006), Islam (2007) and Roy (2009).

Table 4.9 Distribution of the FFS farmers according to their Knowledge on IPM

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	29	33.7	7.51	2.51
Medium	43	50.0		
High	14	16.3		
Total	86	100.00		

4.1.9 Cosmopoliteness

The observed cosmopoliteness scores of the respondents ranged from 10 to 34 against the possible range of 0 to 66. The mean score was 21.62 with the standard deviation of 6.45. Based on the observed cosmopoliteness scores, the respondents were classified into three categories. Data contained in the Table 4.10 showed that (43.0 %) of the respondents had medium cosmopoliteness as compared to (38.4 %) having low and (18.6 %) had high cosmopoliteness. Data also revealed that majority (61.6 %) of the respondents were under medium to high cosmopoliteness. Higher the cosmopoliteness in different places higher the scope of gathering knowledge, exchanging information that leads to higher the level of using of IPM practices in rice cultivation. FFS farmers perform

training program on different activities. For this they have to visit many places to learn new things about IPM. So, their cosmopoliteness score is higher than other farmers. These findings are in line with Pal (2009).

Table 4.10 Distribution of the FFS farmers according to their Cosmopoliteness

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	33	38.4	21.62	6.45
Medium	37	43.0		
High	16	18.6		
Total	86	100.00		

4.1.10 Adoption of IPM Practices

Scores of adoption of IPM practices the respondents could range from 0 to 12 while the observed scores ranged from 3 to 12 with the average 7.41 and standard deviation of 2.79 as shown in Table 4.11.

Table 4.11 Distribution of the FFS farmers according to their Adoption of IPM Practices

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	34	39.5	7.41	2.79
Medium	40	46.5		
High	12	14.0		
Total	86	100.00		

Data contained in the Table indicate that the highest proportion (46.5 %) of the farmers had medium adoption while (39.5 %) had low and (14.0 %) had high

adoption. Findings show that majority of the farmers (60.5 %) possessed medium to high level of adoption on various aspects of IPM. The farmers in the study area were willing to adopt any new technology in their farming. Mia (2005) reported similar findings.

4.2 Dependent Variable

As noted earlier (Chapter 3), the role of FFS in diffusion of IPM practices was considered as the dependent variable of the study. This section will present the findings of the role of FFS in diffusion of IPM practices divided into five subsections. Such as -

i) Farmers' training
ii) Participatory learning
iii) Problem identification
iii) Developing human capacity
iv) Overall role of FFS

4.2.1 Farmers' training

Scores of training of FFS farmers the respondents could range from 0 to 20 while the observed scores ranged from 8 to 17 with the average 12.55 and standard deviation of 1.89 as shown in Table 4.12. Based on the observed training scores, the respondents were classified into three categories *viz.*, low, medium and high.

Table 4.12 Distribution of the FFS farmers according to their training

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	24	27.9	12.55	1.89
Medium	51	59.3		
High	11	12.8		
Total	86	100.00		

Data contained in table indicate that more than half (59.3 %) of the farmers had medium training while (27.9 %) had low and (12.8 %) had high training. Findings show that majority (72.1 %) of the farmers possessed medium to high level of training on various aspects of IPM. The probable reason for this may be due to in order to disseminate new technology more rapidly within the community, selected farmers receive additional training and are expected to organize field school replications within the community. FFS members are encouraged to share their knowledge and experiences with other farmers within their local village and community organizations. Training helps the FFS member about fertilizer management, soil management and crop management.

4.2.2 Participatory learning

The observed participatory learning scores of the respondents ranged from 23 to 33 against the possible range of 0 to 40. The mean score was 27.60 with the standard deviation of 2.05. Based on the observed participation scores, the respondents were classified into three categories viz., low, medium and high.

Table 4.13 Distribution of the FFS farmers according to Participatory learning

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	22	25.6	27.60	2.05
Medium	50	58.1		
High	14	16.3		
Total	86	100.00		

Data contained in the Table 4.13 showed that (25.6 %) of the respondents had low participation as compared to (58.1 %) having medium and (16.3 %) had high participation. Data also revealed that majority (74.4 %) of the respondents had medium to high participation. The probable reason for this may be due to

FFS uses innovative and participatory methods to create a learning environment in which the land users have the opportunity to learn for themselves about particular crop production. The participatory learning approach is now being used to enable farmers to investigate and overcome a wider range of problems, including soil productivity improvement, identify beneficial and harmful insect, determination of fertilizer doses for rice, selection of quality seeds, involved in learning by doing about IPM and participation in learning about ICM.

4.2.3 Problem identification

Scores of problem identification of FFS farmers the respondents could range from 0 to 40 while the observed scores ranged from 16 to 28 with the average 21.20 and standard deviation of 2.35 as shown in Table 4.14. Based on the observed problem identification scores, the respondents were classified into three categories *viz.*, low, medium and high.

Table 4.14 Distribution of the FFS farmers according to Problem identification

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	34	39.5	21.20	2.35
Medium	44	51.2		
High	8	09.3		
Total	86	100.00		

Data contained in the table indicate that about a half (51.20 %) of the farmers identified medium problem while (39.5 % and 9.30 %) identified low and high problem respectively. Findings show that majority (90.70 %) of the farmers possessed medium to low level of problem identification on various aspects of IPM. The probable reason for this may be due to FFS programs teach farmers

how to problem-solve independently. FFS members can identify their problems such as lack of insect /disease resistant rice varieties, lack of quality rice seed, unavailability of fertilizer, unavailability of organic farming practice and many other problems.

4.2.4 Developing human capacity

The observed developing human capacity scores of the respondents ranged from 12 to 22 against the possible range of 0 to 28. The mean score was 17.47 with the standard deviation of 2.73. Based on the observed developing human capacity scores, the respondents were classified into three categories *viz.*, low, medium and high. Data contained in the Table 4.15 showed that approximately a half (47.6 %) developed medium level of human capacity as compared to (23.3 % and 29.1 %) developed low and high level of human capacity respectively. Data also revealed that majority (76.7 %) of the respondents developed medium to high level of human capacity. The probable reason for this may be due to the aim of FFS is to build farmers' capacity to analyses their production systems, identify problems, test possible solutions and eventually adopt the practices most suitable to their farming system.

Table 4.15 Distribution of the FFS farmers according to developing human capacity

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	20	23.3	17.47	2.73
Medium	41	47.6		
High	25	29.1		
Total	86	100.00		

4.2.5 Overall role of FFS

Role of FFS in diffusion of IPM practices was the main thrust of the research. Observed role of FFS in diffusion of IPM scores of the farmers ranged from 71 to 89 against the possible range of 0 to 128. The average and standard deviation were 78.84 and 4.37 respectively. Based on the observed scores, the farmers were classified into three categories *viz.,* low, medium and high. Data contained in the Table 4.16 indicate that highest proportion (51.1 %) of the farmers had medium role of FFS, where (34.9 % and 14.0 %) had low and high role of FFS in diffusion of IPM practices. Data also revealed that majority (65.1 %) of the respondents possessed medium to high role of FFS in diffusion of IPM practices. Based on above findings it can be mentioned that FFS is mostly effective to the FFS farmers concerning soil and crop management that could be helpful for sustainable crop production.

Table 4.16 Distribution of the FFS farmers according to their role of FFS in diffusion of IPM practices

Categories	Farmers		Mean	Standard deviation
	Number	%		
Low	30	34.9	78.84	4.37
Medium	44	51.1		
High	12	14.0		
Total	86	100.00		

4.3 Contribution of the Selected Characteristics of the Respondents and the Role of FFS in Diffusion of IPM Practices

For this study ten characteristics of the respondent were selected and each of the characteristics was treated as independent variables. The selected characteristics include age (x_1), education (x_2), family size (x_3), farm size (x_4), annual net income from agricultural sources (x_5), organizational participation (x_6), innovativeness (x_7), knowledge on IPM (x_8) , cosmopoliteness (x_9) and

adoption of IPM practices (x_{10}). Role of FFS in diffusion of IPM practices (Y) was the only dependent variable of this study. Before exploring contribution of the selected characteristic of the farmers and the role of FFS in diffusion of IPM practices, Pearson Product Moment Correlation was run to find out the relation between the selected characteristics of the farmers and the role of FFS in diffusion of IPM practices. From this correlation test, it was found that level of education, organizational participation, innovativeness, knowledge on IPM, cosmopoliteness and adoption of IPM practices of the farmers had significant positive relationship with the role of FFS in diffusion of IPM practices in rice cultivation. Beside these six characteristics, rest four characteristics of the farmers (age, family size, farm size and annual net income from agricultural sources) had no significant relationship with the role of FFS in diffusion of IPM practices.

The result of co-efficient of correlation between the independent and dependent variables were presented in the Table 4.17 However, the results of interrelationships among different independent and dependent variables are presented in Appendix-II.

Table 4.17 Co-efficient of correlation showing relationships between the selected characteristics of the farmers and the role of FFS in diffusion of IPM practices in rice cultivation (N = 86)

Selected characteristics (independent variables)	**Correlation co-efficient (r) (Role of FFS)**
1. Age	-0.208 NS
2. Education	0.433**
3. Family size	0.029 NS
4. Farm size	-0.149 NS
5. Annual net income from agricultural sources	-0.097 NS
6. Organizational participation	0.269 *
7. Innovativeness	0.282 **
8. Knowledge on IPM	0.384 **
9. Cosmopoliteness	0.250 *
10. Adoption of IPM practices	0.393 **

NS = Not significant
* = Significant at 0.05 level
** = Significant at 0.01 level

Then full model regression analysis was run with selected 10 independent variables. But it was observed that the full model regression results were misleading due to the existence of interrelationships among the independent variables. Therefore, in order to avoid the misleading results and to determine the best explanatory variables, the method of step-wise multiple regressions was administrated and 10 independent variables were fitted together in step

wise multiple regression analysis. Table 4.18 shows the summarized results of step-wise multiple regression with 10 independent variables of the respondents' role of FFS in diffusion of IPM practices in rice cultivation. It was observed that out of 10 variable 4 independent variables namely education, adoption of IPM practices, knowledge on IPM & organizational participation were entered into the regression equation. Other six variables were not entered into the regression equation. The regression equation so obtained is presented below:

$Y = 68.715 + 0.206\ X_2 + 0.262\ X_{10} + 0.265\ X_8 + 0.217\ X_6$

Table 4.18 Summary of stepwise multiple regression analyses showing the contribution of selected characteristics of the farmers to their role of FFS in diffusion of IPM practices

Variable entered	Standardize partial 'b' coefficient	Value of t (with probability level)	R^2	Adjusted R^2	Increase in R^2	Variation explained in %
Education	0.206	2.007 (0.048)	0.187	0.177	0.177	17.7
Adoption of IPM practices	0.262	2.724 (0.008)	0.254	0.236	0.059	5.9
Knowledge on IPM	0.265	2.779 (0.007)	0.308	0.283	0.047	4.7
Organizational participation	0.217	2.342 (0.022)	0.352	0.320	0.037	3.7
Total					0.320	32.0

Multiple R = 0.593

R-square = 0.352

Adjusted R- square = 0.320

F-ratio = 10.996

Standard error of estimate = 3.60

Constant = 68.715

The multiple R and R^2 values were found 0.593 and 0.352 respectively and the corresponding F-ratio was 10.996 which were significant at 0.000 levels. For determining unique contribution on role of FFS in diffusion of IPM practices each of the four variables the increase in R^2 value was determined. These four variables combinedly explained 32.0 % of the total contribution on role of FFS. Education had the highest contribution (17.7 % of the variation) followed by adoption of IPM in rice cultivation 5.9 %, knowledge on IPM in rice cultivation 4.7 % and organizational participation on rice cultivation had 3.7 % on role of FFS in diffusion of IPM practices in rice cultivation.

Table 4.18 showed that education, adoption of IPM practices, knowledge on IPM and organizational participation had significant contribution on role of FFS in diffusion of IPM practices i.e. the farmer who had higher education, more knowledge on IPM, more adoption of IPM and organizational participation were found to have more role of FFS in diffusion of IPM practices and in this connection, some predictive importance has been briefly discussed below:

4.3.1 Education

Stepwise multiple regression revealed that education of the respondents had highest contribution (17.7 %) to the role of FFS in diffusion of IPM practices in rice cultivation. Correlation matrix also showed that education of respondents had significant positive relationship with the role of FFS. (Appendix-II and Table 4.17). Education develops mental and psychological ability of average person to understand, decide and adopt new practices and ideas. Hence, it is expected that education is one of the important factors in determining the role of FFS.

Education helps the farmers to face the adverse condition and adjust with unfavorable condition through reading leaflets, booklets, books and others printed materials in this case. Education helps the farmers to broaden their outlook and mental horizon by helping them to develop proper attitude and correct perception to decrease knowledge gap about production technology of

crops. An educated man is more responsive to the technology and new innovation. S/he can easily contact with various extension agent and make frequent contact with other information sources, which make them able to acquire adequate accurate information. S/he has enough courage to take risk. The farmers who have no education, s/he is supposed to face a great difficulty in adjusting with the unfavorable condition regarding knowledge gap for rice production. Such condition indicates the need for improving literacy level among the farmers for having the knowledge on rice production.

Education is considered as an index of acquiring knowledge in various matter. By being education a man becomes aware of various facts and phenomenon around him. This enables him to transfer knowledge about new technology such as IPM.

4.3.2 Adoption of IPM Practices

Stepwise multiple regression found that adoption of IPM practices of the respondents had second highest contribution (5.9 %) to the role of FFS in diffusion of IPM practices in rice cultivation. Correlation matrix also showed that adoption of IPM practices of the respondents had significant positive relationship with the role of FFS. (Appendix- II and Table 4.17). The contribution indicated that the farmers having more adoption of IPM practices had more the role of FFS.

FFS farmers become aware of the improved agricultural practices compare to other farmers through the various extension communication media. Farmers having no or low extension contact were expected to be low in adoption of improved agricultural practices. It is expected that, the person having more knowledge on IPM should adopt modern technology.

4.3.3 Knowledge on IPM

Stepwise multiple regression found that knowledge on IPM of the respondents had third highest contribution (4.7 %) to the role of FFS in diffusion of IPM

practices in rice cultivation. Correlation matrix also showed that knowledge on IPM of respondents had significant positive relationship with the role of FFS. (Appendix-II and Table 4.17). The contribution indicated that the farmers having more IPM knowledge had more the role of FFS.

The FFS farmers gets education through their involvement with field school which is also helpful to increase their extent of knowledge as well. FFS farmers are supposed to be get education on various dimension on agriculture which is likely to increase their knowledge on IPM. In addition, the FFS farmers gets training on IPM which ultimately help them to adopt new technology. Knowledge on IPM helps the farmers to grow rice by using environmentally friendly cultivation practices. Knowledge definitely act as a motivator towards using new practices.

4.3.4 Organizational participation

Stepwise multiple regression found that organizational participation of the respondents had lowest contribution (3.7 %) to the role of FFS in diffusion of IPM practices in rice cultivation. Correlation matrix also showed that organizational participation of the respondents had significant positive relationship with the role of FFS. (Appendix-II and Table 4.17). The contribution indicated that the farmers having more organizational participation had more the role of FFS.

Higher the participation in different organization higher is the scope of exchanging information that leads to higher the level of using of IPM practices in rice cultivation. Participation in various organization make an individual enable to come in contact with change agents and thereby increase the role of FFS. Participation with various organization creates enormous scope to mix with others which helps to increase level of using IPM practices of the FFS farmers. Higher the organizational participation of the FFS farmers received more information on farm affairs which strengthened the base of their

knowledge. Such knowledge was probably conductive to motivate the FFS farmers towards adoption of different new technologies. Organizational participation enables the FFS farmers to come in contact with people having diversified experience and problem solving capabilities. This opportunity enables them to improve their knowledge and skills that results better management activities.

CHAPTER V
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

5.1.1 Selected characteristics of the farmers (Independent variable)

The major findings of the study are summarized below:

Age

Age of the respondent farmers was found to range from 23 to 58 years. The average age was 36.74 years with the standard deviation 9.16. The highest proportion (57.0 %) of the respondents fell in the young age, while (30.2 and 12.8 %) belonged to middle and old age respectively.

Education

The education score of the respondents ranged from 0 to 11 with the average of 5.71 and standard deviation 3.04. Education level of the farmers were classified into four categories. The majority (54.7 %) of the farmers had secondary level of education while (33.7 %) farmers had primary level of education, (5.8 %) had no education and (5.8 %) higher secondary level of education.

Family size

The family size of the respondents ranged from 4 to 11 with an average of 6.96 and standard deviation 1.92. The majority of the respondents fell into large (39.5 %) family, while (37.2 and 23.3 %) had medium and small family size respectively.

Farm size

The farm size of the farmers in the study area varied from 0.13-1.23 hectares (ha.). The average farm size was 0.41 ha with the standard deviation 0.23. The highest proportion (82.6 %) of the respondents belonged to small farm size, compared to having (11.6 %) marginal, and (5.8 %) medium farm respectively.

Annual net income from agricultural sources

Annual net income from agricultural sources score of the respondents ranged from 33 to 210 (in thousands) with an average of 62.13 and standard deviation 34.21.The highest proportion (60.5 %) of the respondent to had low annual income, while (32.5 %) medium income and (7.0 %) had high income.

Organizational participation

The observed organizational participation score of the respondents ranged from 2 to 12. The mean score was 5.86 with the standard deviation 2.87. The highest proportion (47.7 %) of the respondents had low organizational participation as compared to (39.5 %) medium participation and (12.8 %) having high participation.

Innovativeness

The observed innovativeness scores of the respondents ranged from 10 to 32 against the possible range of 0 to 48. The average and standard deviation were 19.36 and 6.32 respectively. The majority (46.5 %) of the respondents had medium innovativeness as compared to (37.2 %) low and (16.3 %) high innovativeness.

Knowledge on IPM

Scores of knowledge on IPM practices the respondents could range from 0 to 14 while the observed scores ranged from 3 to 12 with the average 7.51 and standard deviation of 2.51.The highest proportion (50.0 %) of the farmers had medium knowledge while (33.7 %) had low and (16.3 %) had high knowledge.

Cosmopoliteness

The observed cosmopoliteness scores of the respondents ranged from 10 to 34 against the possible range of 0 to 66. The mean score was 21.62 with the standard deviation of 6.45. (38.4 %) of the respondents had low cosmopoliteness as compared to (43.0 %) having medium and (18.6 %) had high cosmopoliteness**.**

Adoption of IPM Practices

Scores of adoption of IPM practices the respondents could range from 0 to 12 while the observed scores ranged from 3 to 12 with the average 7.41 and standard deviation of 2.79. The highest proportion (46.5 %) of the farmers had medium adoption while (39.5 %) had low and (14.0 %) had high adoption.

5.1.2 Dependent variable

Farmers' training

Scores of training of FFS farmers the respondents could range from 0 to 20 while the observed scores ranged from 8 to 17 with the average 12.55 and standard deviation of 1.89. The highest proportion (59.3 %) of the farmers had medium training while (27.9 %) had low and (12.8 %) had high training. Findings show that majority of the farmers possessed medium level of training on various aspects of IPM.

Participatory learning

The observed participation scores of the respondents ranged from 23 to 33 against the possible range of 0 to 40. The mean score was 27.60 with the standard deviation of 2.05. 25.6 % of the respondents had low participation as compared to (58.1 %) having medium and (16.3 %) had high participation. Data also revealed that majority (74.4 %) of the respondents were under medium to high participation.

Problem identification

Scores of problem identification of FFS farmers the respondents could range from 0 to 40 while the observed scores ranged from 16 to 28 with the average 21.20 and standard deviation of 2.35. The highest proportion (51.20 %) of the farmers had medium problem faced while (39.5 %) had low and (9.30 %) had high problem faced. Findings show that majority (90.70 %) of the farmers possessed medium to low level of problem on various aspects of IPM.

Developing human capacity

The observed developing human capacity scores of the respondents ranged from 12 to 22 against the possible range of 0 to 28. The mean score was 17.47 with the standard deviation of 2.73. (23.3 %) of the respondents had low developing human capacity as compared to (47.6 %) having medium and (29.1 %) had high developing human capacity. Data also revealed that majority (76.7 %) of the respondents were under medium to high developing human capacity.

Overall role of FFS

Observed role of FFS in diffusion of IPM scores of the farmers ranged from 71 to 89 against the possible range of 0 to 128. The average and standard deviation were 78.84 and 4.37 respectively. The highest proportion (51.1 %) of the farmers had medium role of FFS where (34.9 % and 14.0 %) had low and high role of FFS in diffusion of IPM practices.

5.1.3 Contribution of the Selected Characteristics of the Respondents and the role of FFS in diffusion of IPM Practices

Out of ten variables four independent variables namely education, adoption of IPM practices, knowledge on IPM and organizational participation had significant contribution on role of FFS in diffusion of IPM Practices. These four variables combined explained (32.0 %) of the total contribution.

5.2 Conclusions

A conclusion presents the statements based on major findings of the study and these statements mostly conform to the objective of the research in the shortest form. It presents the direct answer of the research objectives or it relates to the hypothesis (Labon and Schefter, 1990).

Based on the findings and its logical interpretation the following conclusions have been drawn:

1. The findings revealed that majority of the respondents (51.10 %) perceived medium role of FFS. So there is a scope to increase the role of FFS by providing training, result demonstration, method demonstration and other extension services to increase the role of FFS.

2. Overwhelming majority (94.2 %) of the respondents were literate. Stepwise multiple regression revealed that education of the respondent had the highest contribution to the role of FFS. Correlation matrix also showed that education of respondents had significant positive relationship with the role of FFS. Highly educated respondents had more role of FFS. A literate person have in general, high innovativeness, high organizational participation, high knowledge and high cosmopoliteness. So, it may be concluded that education is an important factor for popularizing IPM practices.

3. The findings of the study revealed that half (50.0 %) of the farmers had medium knowledge on IPM practices. Stepwise multiple regression found that knowledge on IPM of the respondents had third highest contribution to the role of FFS in diffusion of IPM practices in rice cultivation. Correlation matrix also showed that knowledge on IPM of the respondents had significant positive relationship with the role of FFS. Therefore, it may be concluded that there is necessity to increase the knowledge of the farmers in diffusion of IPM practices.

4. Majority (46.5 %) of the FFS farmers had medium adoption of IPM practices. Stepwise multiple regression found that adoption of IPM practices of the respondents had second highest contribution to the role of FFS in diffusion of IPM practices in rice cultivation. Pearson Product Moment Correlation also showed that adoption of IPM practices of the respondents had significant positive relationship with the role of FFS. Therefore, it may be concluded that individual having more adoption on IPM practices, had more knowledge on IPM and thus increases the role of FFS.

5. The findings of the study revealed that the majority (52.3 %) of the respondents had medium to high participation in different organization. Stepwise multiple regression found that organizational participation of the respondents had lowest contribution to the role of FFS in diffusion of IPM practices in rice cultivation. Pearson Product Moment Correlation also showed that organizational participation of the respondents had significant positive relationship with the role of FFS. It may be concluded that higher the participation in different organization higher is the scope of exchanging information that leads to higher the level of using of IPM practices in rice cultivation.

5.3 Recommendations

The following recommendations are forwarded for consideration for the authorities concerned:

5.3.1 Recommendations for policy implications

1. Sustainable agricultural development cannot be imagined keeping the agro environment imbalanced. Nowadays the environment has been facing much disturbance in many ways. Use of agro-chemicals (*i.e.* insecticides, pesticides) is one of the threats to healthy environment. Hence the concerned agencies like DAE, NGOs and individuals need to take initiatives of IPM practices for healthy environment.

2. Contact with change agent, cosmopoliteness and organizational participation helps an individual to work in cooperation with others for solution of various problems. Organizational participation of the respondents had the lowest contribution to the role of FFS in diffusion of IPM practices in rice cultivation. It is, therefore, recommended that steps should be taken by DAE and NGOs to encourage contact with change agents of the farmers in local organizations and they should also be encouraged to set up organizations which will be helpful to the farmers to receive new ideas and facts that would make them enable to take necessary action.

3. Majority (60.5 %) of the farmers had medium to high adoption of IPM practices. DAE should carefully consider the finding. Adoption of IPM practices of the respondents had second highest contribution to the role of FFS in diffusion of IPM practices in rice cultivation. Thus IPM programmes should be strengthened and the horizon should be broaded. At the same time proper strategy and realistic work plan should be developed in order to popularize IPM practices through FFS.

4. Department of Agricultural Extension (DAE) and different NGOs should organizes more and more training, IPM fair and cultural program about IPM and established farmer organization, IPM club in the village for using IPM practices in rice cultivation.

5. In the study area, only DAE's contact was found through the root level extension workers such as Sub Assistant Agricultural Officer (SAAO). It was observed that there was extension contact, but the contact was not sufficient at the field level. It may be recommended that attempt should be taken by the private and public extension, research and development organizations for using of IPM practices in rice cultivation. DAE should supervise the activities of FFS.

6. Majority (66.3 %) of the respondents had medium to high knowledge on IPM practices. Knowledge on IPM of the respondents had third highest contribution to the role of FFS in diffusion of IPM practices in rice cultivation. Therefore it may be recommended that attempts should be taken by Department of Agricultural Extension (DAE) and other extension providers to arrange training, motivational campaign for popularizing IPM.

7. Education of the respondent had highest contribution to the role of FFS. Again education of respondents had significant positive relationship with the role of FFS. Therefore it may be recommended that attempts should be taken by DAE and NGOs to establish adult learning centre to increase educational level as well as to increase the role of FFS.

5.3.2 Recommendations for further study

A small piece of study as has been conducted can not provide all information for the proper understanding of the role of FFS in diffusion of IPM practices. On the basis of scope and limitations of the present study following suggestions are being put forward for further research:

1. The study was conducted at Sadar Upazilla of Narsingdi district. Findings of this study need verification by similar research in other parts of the country.

2. The present study was conducted taking 10 characteristics of the farmers. Further study may be conducted considering other characteristics of the farmers.

3. The present study was been conducted taking only FFS farmers. Similar study should be conducted taking all categories of the farming community.

4. In the present study age, family size, farm size and annual net income from agricultural sources no significant relationship with the role of FFS. In this connection, further verification is necessary.

BIBLIOGRAPHY

Ahmed, K. F. (2002). A Comparative Study on Adoption of IPM by the Male and Female FFS Beneficiaries in Pirgonj Upazila under Rangpur District. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Akanda, M. G. R. (1993). Problem Faced by the Farmers in Respect of cultivating Mukta (BR 2) Rice. M.S. Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Alam, A. Q. M. S. (2008). Constraints Analysis in Adoption of IPM Practices in Rice Cultivation by the Farmers of Savar Upazila under Dhaka District. M.S. Thesis, Department of Agricultural Extension & Information System, Sher-e-Bangla Agricultural University, Dhaka 1207.

Alam, M. S. (2000). Use of Improved Farming Practices in Rice Cultivation by the Farmers. M.S. Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Ali, K. A., Chowdhury, S. A., Kadar, M. A. and Goni, M. O. (2000). Factors influencing Adoption of Sugarcane Production technologies among the growers of a sugar mill zone. *Bangladesh J. of Extn. Educt.,* **1** (2): 25-30.

Anonymous, (1997). In: Influence of different Cultivation Method on Growth and Yield of Hybrid and Inbred Rice. Food and Agricultural Organization the United Nations. p-51.

Anonymous, (2004a).Workshop on Testing of Rice Knowledge Bank. The Bangladeshobserver.www.bangladeshobserveronline.com

Anonymous, (2005). An Overview of Strengthening Plant Protection Service (SPPS). A report prepared for ministry of Agriculture, Department of Agricultural Extension, Khamarbari, Dhaka.

Anwar, A. B. M. N. (1994). Study for Involving Rural Youth Activities in Three selected villages of Mymenshing District. Ph.D. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Balasubramanian, S. and Kaul, P. N. (2000). Adoption of Improved Practices by Traditional Fisherman of Bijapur District. *Indian J. of Extn. Educt.,* **26** (3 & 4): 67-69.

Banbeis (2005). In: Use of Integrated Pest Management Practices in Rice Field by the farmer in Tapodhan Union under Rangpur District. The daily independent.

Bhuiyan, M. A. S. (2002). Problem Confrontation of the Farmers in Banana cultivation in Kulianchar Upazila under Kishorgonj District. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Braun, A. and Graham, T. (2000). Integrated Nutrient Management to Attain Sustainable Productivity Increase in East African Farming Systems, Nairobi, Kenya.

Chowdhury, M. S. A. (1997). Adoption of selected BINA Technologies District. M. S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

David, C. C. (1989). The Global Rice Situation. In: Progress in irrigated rice research. Intt Rice Res. Inst. Philippines. pp. 9-24.

David, S. (2007). Learning to Think for Ourselves: Knowledge Improvement and Social Benefits among Farmer Field School Participants in Cameroon. *J. of lnt. Agric. and Extn. Educt.,* **14**(2): 35-49.

Davis, K. (2006). Farmer Field Schools: A Boom or Bust for Extension in Africa. *J. of lnt. Agric. and Extn. Educt.*, **13** (1): 91-97.

Dawe, D. (2003). In: New challenges and technological opportunities for rice based population systems for food security and poverty alleviation in Asia and the pacific. FAO. Rice conference, Rome, Italy.

Ekneligoda, I. A. (1996).“Integrated Pest Management in Asia and the Pacific: Report of APO Study Meeting 17-22 July 1995.” Country Paper : Sri Lanka, Asian Productivity Organization, Tokyo.

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

FAO. (Food and Agriculture Organization). (1999). Technical Assistance to the Integrated Pest Management Training Project: Indonesia. Report No. AG: UTF/INS/072/INS, Rome.

FAO. (Food and Agriculture Organization). (2000). Inter-Country Programme for Community IPM in Asia: Phase IV Mid Term Review. Rome.

Feder, G. and Quizon, J. B. (2004). Sending Farmers back to School. Review of Agricultural Economics, **26**(1): 45-62.

Feder, G., Murgai, R. and Quizon, J. B. (2004). The Acquisition and Diffusion of Knowledge. The Case of Pest Management Training in Farmer Field Schools, Indonesia. *J.of Agric. Econ*., **55** (2): 217-239.

Gallagher, K. (2003). Fundamental Elements of Farmer Field School. LEISA Magazine, ILEIA. **19** (1): 5-6.

Gallagher, K. (2006). Demystifying Farmer Field School Concepts. Wageningen University Press. Expansion of Farmer Field School Programmes in Eastern and Southern Africa, IFAD/FAO Final Design Paper FAO, Plant Protection Service.

Godtland, E., Murgai, R. and Ortiz, O. (2004).The Impact of Farmers Field School on Knowledge and Productivity. Economic Development and cultural change. 53(1) : 63-92.

Gogoi, S. K. and Gogoi, D. K. (2001). Adoption of Recommended Plant Protection Practices in Rice. *Indian J. of Extn. Educt.* **25** (1 & 2): 26-29

Goode, C. V. (1945). Dictionary of Education. New York: Mc Graw Hill Book Company Inc.

Goode, W. J. and Hatt, P. K. (1952). Methods in Social Research. New York: McGraw Hill Book Company Inc.

Hanif, M. A. (2000). Comparative Analysis between FFS and non-FFS Farmers Regarding Environmental Awareness (unpublished master's thesis). Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Haque, M. M. (2001). Adoption of Improved Practices in Sugarcane cultivation by Sugarcane growers of Sripur Upazila under Gazipur District. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Haque, M. S. (2003). Adoption of Improved Practices in Sugarcane Cultivation of Some Selected Area of Jessore District. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Hasan, M. Z. (2001). Adoption of Some Selected Agricultural Technologies among the farmers as perceived by the Front Hine GO and NGO Workers. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Hoque, M. K. (2001). Environmental Awareness and Problem Confrontation of the FFS Farmers in Practicing IPM. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Hossain, M. A. (2001). Adoption of Improved Farm Practices by the Transplanted Aman Rice Growers in Gouripur Union of Mymensingh District. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Hossain, M. A. (2002). Adoption Behavior of Contact Wheat Growers in Sadar Upazila of Jamalpur 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. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Hossain, M. M. (2006). Use of Integrated Pest Management Practices in Rice Field by the Farmers in Tapodhan Union under Rangpur District. M.S. Thesis. Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka-1207.

Hossain, M. N. (2004). Farmers Perception of on the Effect of Agro-chemicals on Environment. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Islam, A. M. and Bijalmakers, W. L. (2007). Changing the Strategies of Farmers Field Schools in Bangadesh. LEISA magazine.

Islam, M. M. (2007). Farmers' Use of Indigenous Technical Knowledge (ITK) in the Context of Sustainable Agricultural Development. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Islam, M. R., Biswas, J. C. and Islam, M. N. (2002). Correlates of some Selected Characteristics of FFS Farmers with Their Integrated Pest Management Skill. *Bangladesh J. of Train. And Dev.* **15**(1&2): 75-80.

Islam, S. M. N. (2007). Effect of Result Demonstration on the Adoption of Improved Practices in Rice cultivation (unpublished master's thesis). Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Karim, M. L. (1996). Relationship of Selected Characteristics of Kakrol Growers with their Problem Confrontation. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Kashem, M. A. (2002). Small Farmers Constraints to the Adoption of Modern Rice Technology. The Bangladesh Development studies XV. **10**: 18-30

Kaul, M. R. (2003). An Evaluation study of women Development Programme under Indo-German Dhauhadhar Project Palampur District Kumgra. H.P. Thesis. Haryana Agricultural University, Hissar, India.

Kausar, A. S. M. N. U. (2006). Use of IPM Practices by the Farmers in Crop Cultivation. M.S. Thesis. Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka-1207.

Kenmore, P. E. (1997). Indonesia's Integrated Pest Management: A Model for Asia. Manila, Philippines: FAO Intercountry IPC Rice Program. "A Perspective on IPM."

Khan, M. H. (1993). Adoption of Insecticides and Related Issue in villages of Pachon Union. Madaripur District. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Khan, M. H. (2003). Adoption of Insecticides and Related Issues in Village of Pachon Union, Madaripur District. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Khush, G. S. (1987). Disease and Insect resistance in rice. Intl. Rice Res. Inst., Philippines.

Labon, C. S. and Schefter, M. (1990). Succesful Lab. Reports: A Manual for Science Students. Cambridge. Cambridge University Press. p. 23.

Leeuwis, C., Roling, N. and Bruin, G. (1998). Can the Farmer Field School Replace the T&V System of Extension in Sub—Saharan Africa? Some Answers from Zanzibar. Proceedings for 15th International Symposium of the Association for Farming Systems Research—Extension, Pretoria, South Africa, 493-497.

Loevinsohn, M., Meijerink, G. and Salasya, B. (2000). Integrated Pest Management in Smallholder Farming Systems in Kenya: Evaluation of a Pilot Project. Global IPM Facility.

Mancini, F., Bruggen, A. H. C. V. and Jiggins, J. L. S. (2007). Evaluating Cotton Integrated Pest Management (IPM) Farmer Field School Outcomes using the Sustainable Livelihoods Approach in India. Experimental Agriculture, **43**(1): 97-112.

Maskwat, S. M. (2010).Opinion Leadership of IPM Farmers in Diffusion of Integrated Pest Management (IPM) in two Selected Unions of Savar Upazilla under Dhaka District. M. S. Thesis. Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka-1207.

Matata, J. B. W. and Okech, A. G. O. (1998). Promising and New Methods, Draft Report On New and Adapted Field Methods in Kenya. FARMESA.

Meagy, M. J. H. (2001). Effectiveness of Farmer Information Needs Assessment (FINA) as perceived by the farmers (unpublished master's thesis). Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Mia, M. A. T. (2005). Adoption of IPM Practices by the Vegetable Growers of Magura District. M.S. Thesis, Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Miah, M. M. (2006). Use of Integrated Pest Management Practices by the FFS Farmers in Vegetable Cultivation (unpublished master's thesis). Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

MOA, (2003). An Overview of Strengthening Plant Protection Service (SPPS) Project Phase I and Phase II. A Report prepared for the Minister of Agriculture. Department of Agriculture Extension. Khamarbari, Dhaka.

Mohammad, A. (1974). A study on the farmers' Adoption of insect Control Measures and related Aspects. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Moral, M. J. B. (2011). Localizing the poor: Spatial Poverty mapping of household in Rajshahi City. Bangladesh University Sains Malaysia. Penans, Malaysia.

Mustafa, B. B. A., Islam, M. M. and Rahman M. M. (1987). Factors affecting Adoption of Modern Varieties of Rice in Bangladesh a Discriminate Analysis. *Bangladesh J of Extn. Educt*. **7** (1).

Muttaleb, M. A. (1995). Relationship of selected characteristics of Potato Growers with their Adoption of Improved Potato Technologies. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Muttaleb, M. A. (2003). Relationsip of Selected Characteristics of potato growers with their Adoption of Improved Potato Technologies. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Mwagi, G. and Onyango, O. (2003). Effectiveness of Farmer Field School Approach on Technology Adoption, Group Cohesion and Group Empowerment with Leader Ship Skill. A Case Study of Farmer Groups in Kisii District, Kenya. A paper presented in the 21st Annual conference of the soil science society of East Africa, held at Eldoret, Kenya.

Naika, K. V. and Rao, M. K. S. (1990). A study on village Adoption Programme in Selected Villages of Mysone District, Kornataka. *Indian J of Extn. Educt.*, ***25*** (142): 13-17.

Naika, K. V. and Rao, M. K. S. (2003). A study on Village Adoption Programme in Selected villages of Mysore District, Kornataka. *Indian J. of Extn. Educt*., **25** (142): 13-17.

Nanta, P. (1996). "Integrated Pest Management in Asia and the Pacific: Report of APO Study Meeting 17-22 July 1995." Country Paper #11: Thailand, Asian Productivity Organization, Tokyo.

Oduori, G. (2002). Report on Experiences of Farmer Field Schools in Busnia District. Ministry of Agriculture and Rural Development.

Okoro, E. U. and Obibuaka, L. U. (2003). Factors Influencing the Adoption of Improved Oil Palm Management Practices among Small Holders in IMO state, Nogeria. *Bangladesh J. of Extn. Educt*., **7** (1 & 7): 45-52.

Pal, J. R. (2009).Training Needs of the Farmer on Integrated Pest Management (IPM) Practices. M.S. Thesis. Department of Agricultural Extension and Information System. Sher-e-Bangla Agricultural University, Dhaka-1207.

Patil, N. B. (2001). A study of Factors Associated with the knowledge and adoption Behavior of Farmers in Relation of Recommended Practices of BIDI Tobacco Cultivation in Nepal Area of Kanataka State. Thesis. **10** (1-4): 11-20.

Pointus, J., Dilts, R. and Bertlett, A. (2002).Ten Years of IPM Training in Asia. Farmers Field schools to community IPM. Bangkok.

Rabbany, G. (2003). Use of IPM Practices by the Farmers in Rice Cultivation. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Raha, S. K., Talukder, R. K. and Rahman, M. H. (1986). Relative profitability of cotton and its competing crops in Bangladesh. *Bangladesh J. of Agric. Econ.,* **9** (1): 74-82.

Rahman, M. M. (2004). An Investigation into the Characteristics of the Farmers Related to Adoption of Improved Farm Practices in Boro Rice Cultivation. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Ramaswamy, S. (1997).A summary of Integrated Pest Management Activities and Their Impact in Bangladesh DAE Dhaka.p.8-13.

Ramaswamy, S., Shafiquddin, K. and Latif, M. A. (1992). "A Review of IPM Activities and their Impacts using Boro Rice Season in Bangladesh." FAO Intercountry Program for IPM in Rice in South and Southeast Asia, GCP/RAS/101/NET.

Rashid, M. Z. (2003). Participation of School Dropout Rural Youth in Selected Agricultural Activities in two Villages of Mymensingh District. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Rogers, E. M. (1995). Diffusion of Innovations. 4th edn. New York: The Free Press.

Rola, A. and Jamias, S. (2002). Do Farmer Field School Graduates Retain and Share what They Learn? An Investigation in Iloilo, Philippines. *J. of Int. Agric. and Extn. Educt.,* **9**(1): 65-76.

Roling, N. and Fliert, E. V. D. (1994). "Transforming Extension for Sustainable Agriculture: The Case of Integrated Pest Management in Rice in Indonesia." Agriculture and Human Values **11**:96-108.

Rosenbarg, M. and Hovland, C. I. (1960).Research on communication and Attitude. Attitude and Attitude change John Wiley and Sons, Inc, Publisher, New York.

Roy, B. S. (2009). Farmers' Perception of the Effect of IPM for Sustainable Crop Production. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Roy, D. (2013). Effectiveness of Farmers Field School for Soil and Crop Management. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Roy, S. K. (1997). Factors Associated with the Extend of Adoption of IPM Practices in Boro Rice in Sadar Thana of Magura District. M. S. Thesis. Department of Agricultural Extension Education. BSMRAU, Gazipur.

Salam, M. A. (2003). Problem Confrontation of the farmers in Adopting Environmentally Friendly Farming Practices. M.S. Thesis. Department of Agricultural Extension Education. Bangladesh Agricultural University, Mymensingh.

Sattar, M. A. (1994). Impacts of Agro-Chemicals. In: Ali, M.H. (ed.), Proceeding of Workshop on Environmental Issues. pp. 5-23. Graduate Training Institute. Bangladesh Agricultural University, Mymensingh. pub. No. 99.

Singh, P. K. (1991). Extent of Adiption of Selected Recommended Practices by Kinnow Growers of Ferozpur and Faridkot District of Panjab. Directorate of Publication, Haryana Agricultural University, Hissar. India.

Singh, S. P. and Rajendra, S. (1990). A study on adoption of Improved Sugarcane Variety. *Indian J. of Extn. Educt*., **26** (1 & 2): 110-111.

Singh, S. P. and Rajendra, S. (2005). A study on Adoption of improved Sugarcane variety. *Indian J. of Extn. Educt*. **26** (1 & 2): 110-111.

Solanki. (2001). Comparison of Knowledge between Dairy Cooperatives Members and Non Members Regarding Advanced Dairy Production Technology. *Rajasthan J. of Extn. Educt.* **19**(12&13): 142-145.

Sones, K. R. and Duveskog, D. (2003). Farmer Field Schools: The Kenyan Experience. Report of the Farmer Field Schools Stakeholders Forum held ILRI, Nairobi, Kenya.

Stuart, L. H. (1991). Constraints in Technology Transfer: A User Perspective with a Focus in IPM. Phillipines Loa Banos. pp. 473-485.

Townsend, J. C. (1953).International student edition. Mc Graw hill book company Inc. New York.

Tripp, R., Wijeratne, M. and Piyadasa, V. H. (2005). What Should We Expect from Farmer Field Schools. A Sri Lanka Case Study. World Development. **33**(10): 1705-1720.

Ullah, S. M. A. (2011). Farmers' Perception of one House one Farm Approach (unpublished master's thesis). Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

Van, D. B. and Jiggins, J. L. S. (2007). Investing in Farmers the Impacts of Farmer Field Schools in Relation to IPM. World Development. **35**(4): 663-686.

Ziauddin, A. A. (1991). Nature, Environment and Danger to Civilization. Asia, Central Forum on Development (ACFORD).

Appendix-I

(English Version of the Interview Schedule)

DEPARTMENT OF AGRICULTURAL EXTENSION AND INFORMATION SYSTEM

SHER-E- BANGLA AGRICULTURAL UNIVERSITY

SHER-E- BANGLA NAGAR, DHAKA-1207

AN INTERVIEW SCHEDULE FOR A RESEARCH STUDY ENTITLED

"ROLE OF FARMER FIELD SCHOOLS IN DIFFUSION OF INTEGRATED PEST MANAGEMENT PRACTICES IN RICE CULTIVATION AS PERCEIVED BY THE FARMERS''

Serial No: ……

Respondent Name:……..

Village: …….

Union:……..

Upazila:…….District:…….

(Please provide the following information)

1. **Age**

How old are you? ..... Years

2. Education

What is your level of education?

a. Can't read and write ……..
b. Can sign only …….
c. Have passed ……..class

3. Family size:……members

4. Farm Size: Please furnish information on your land ownership

Sl. No	Pattern of ownership of land	Area	
		Local unit	Hectare
i.	Homestead		
ii.	Own land under own cultivation		
iii.	Land taken from others on borga		
iv.	Land given to others on borga		
v.	Land taken from others on lease		

5. Annual net income from agricultural sources

Please mention your net family income from the following sources: (in taka)

A) Agriculture

From agricultural Crops	Land allotted (Bigha/acre/ha)	Per unit production (kg)	Expenditure per crop (Tk.)	Market price (Tk)		Net income (Total price-Expenditure)
				Per unit	Total price	
Rice						
a) Aus						
b) Aman						
c) Boro						
Wheat						
Maize						
Jute						
Oil seeds						
Potato						
Pulse						
Vegetables						
Fruits						
Others						
Total						

Annual net income from agricultural sources:

B) Livestock	**Quantity**	**No. sell out**	**Expenditure per unit (Tk)**	**Market price (Tk)**		**Net income (Total price-Expenditure)**
				Per unit	**Total price**	
Cattle rearing						
Milk (Lit)						
Goat rearing						
Poultry rearing						
Egg						
Duck/duckling						
C)Fish culture						
Rui						
Katla						
Mrigel						
Telapia						
Others						
Total						

Total = Agriculture + Livestock + Fish culture

6. Organizational participation

Please mention your Organizational Participation with the following sources:

Sl. No	Organization	No participation (0)	Ordinary member (1)	Executive member (2)	President /Secretary (3)	Duration
i.	Farmers Field School Club					
ii.	IPM club					
iii.	Farmers' Co-operative society					
iv.	Mosque /Temple Committee					
v.	NGO Society					
vi.	Madrasha Committee					
vii.	School committee					
viii.	Others					

7. Innovativeness

Please indicate of use regarding the following technologies

Sl. No	Name of the technology	Never used	Degree of the innovativeness			
			Within 1 Year after hearing	Within 2 Years after hearing	Within 3 Years after hearing	4 or more Years after hearing
i.	Use of leaf color chart					
ii.	Use of seed treatment with Agroson GN, Granosen M					
iii.	Use of tractor, power tiller					
iv.	Use of light trap for insect control in the rice field					
v.	Use of hybrid rice variety					
vi.	Use of bamboo booster in the rice field					
vii.	Use of super granular urea (SGU)					
viii.	Use of perching in the field for sitting of the birds					
ix.	Collection and destroy of eggs and larvae of insects (Manual cleaning)					
x.	Use of sweeping net					
xi.	Use of sex pheromone					
xii.	Artificial pollination					

8. Knowledge on IPM: Please answer/ tick the correct answer

A. Which of the followings is the eco-friendly pest control method?
   i. IPM
   ii. Weeding
   iii. Good tillage
   iv. Chemical insecticide

B. Which insect causes white head and dead heart of rice?
   i. Stem borer
   ii. Rice bug
   iii. Rice hispa
   iv. Grasshopper

C. For what purpose you use Light trap?

   Ans:

D. What are the precautions do you need to follow while applying insecticides in your field?

   i. Wind blowing
   ii. Covering nose and mouth
   iii. Appropriateness of insecticides
   iv. All of the above.

E. Which of the followings belong to biological pest control?
   i. Mentid
   ii. Spider /Frog
   iii. Lady bird beetle
   iv. All of them

F. Select the element of organic fertilizer?
   i. Cowdung /Compost
   ii. Green manuring
   iii. Mixed fertilizer
   iv. Both i and ii

G. What is the benefit of using compost?
   i. Supply nitrogen
   ii. Supply Triple Super Phosphate
   iii. Supply Murate of Potash
   iv. Supply balance nutrition

H. Which insect can be controlled by using Sex Pheromone?
   i. Fruit fly
   ii. Caterpiller
   iii. Aphid
   iv. Lady bird beetle

I. Why do you control weed?
   i. To reduce nutrient competition
   ii. To control insect and disease
   iii. To maintain crop growing space
   iv. All of them

J. Viral diseases spread by-
   i. Stem borer
   ii. Brown plant hopper
   iii. Rice hispa
   iv. Rice bug

K. Which method do you use to control Aphid?
   i. Spreading ash
   ii. Melathion 57 EC
   iii. Growth regulators
   iv. Predator

L. Which of the followings can be used as a green manure?
   i. Dhaincha
   ii. Wheat
   iii. Joar
   iv. Rice

M. Seed treatment can be done with –
   i. Provex 200wp
   ii. Hot water (50 C)
   iii. Seed scraping
   iv. Both i and ii

N. Herbicides are used to control
   i. Fungi
   ii. Algae
   iii. Weed
   iv. Insect

9. Cosmopoliteness

Please indicate how frequently you visit the following places with a specific period:

Place of visit	Nature of visit				Purpose of visit
	Regularly	Occasionally	Rarely	Not at all	Agriculture /Non agriculture
i. Visit of market /familiar home outside of your own village	≥7 times/month	4-6 times/month	1-3 times/month	0 times/month	
ii. Visit of relatives/friends	≥5 times/month	3-4 times/month	1-2 times/month	0 times/month	
iii. Visit to upazilla sadar	≥5 times/month	3-4 times/month	1-2 times/month	0 times/month	
iv. Visit to other upazilla sadar	≥5 times/year	3-4 times/year	1-2 times/year	0 times/year	
v. Visit to upazilla agricultural officer	≥4 times/year	2-3 times/year	Once/year	0 times/year	
vi. Visit to upazilla /district agricultural fair	≥5 times/year	3-4 times/year	1-2 times/year	0 times/year	
vii. Visit to IPM practice demonstration plots	≥5 times/year	3-4 times/year	1-2 times/year	0 times/year	
viii. Attend to result demonstration plots	≥3 times/year	2 times/year	1 times/year	0 times/year	
ix. Attend in meeting organized by UAO/AEO/SAAO	≥5 times/year	3-4 times/year	1-2 times/year	0 times/year	
x. Visit to IPM related workshop	≥5 times/year	3-4 times/year	1-2 times/year	0 times/year	
xi. Meeting plant protection specialist	3-4 times/month	2-3 times/month	1-2 times/month	0 times/month	

10. Adoption of IPM Practices

Please answer the following questions

a) Do you use IPM? Yes ….. No…..

b) If yes, how many practices of IPM do you use?

c) How long do you use IPM?

i) < 1 years

ii) 1-2 years

iii) 3-4 years

iv) 5-6 years

v) Above 6 years

11. Role of FFS

a) Farmers' training

Please mention the areas of training offered by FFS with their degree of betterment

Sl. No	Topic	Degree of betterment				
		Excellent	Better	Good	Fair	Poor
i.	Seed technology					
ii.	Insect and disease control					
iii.	Fertilizer management					
iv.	Soil management					
v.	Crop management					

b) Participatory learning

Please mention the area of your participatory learning with your degree of participation

Sl. No	Participatory learning topics	Degree of participatory learning				
		High	Medium	Low	Very Low	Poor
i.	Identification of beneficial and harmful insect					
ii.	Determination of fertilizer doses for rice					
iii.	Determination of time and method of top dressing of urea					
iv.	Selection of quality seeds					
v.	Seed treatment with fungicides					
vi.	Determination of seed rate including rice					
vii.	Production of quality rice seeds					
viii.	Advise FFS members about soil fertility					
ix.	Involved in learning by doing about IPM					
x.	Participation in learning about ICM					

c) Problem identification

As a member of FFS mention the problems you could identify with degree of appropriateness

Sl. No	Problem	Degree of appropriateness				
		High	Medium	Low	Very low	Poor
i.	Lack of insect /disease resistant rice varieties					
ii.	Lack of quality rice seed					
iii.	Lack of knowledge about the beneficial and harmful insect					
iv.	Unavailability of fertilizer					
v.	Lack of providing information about crop management and soil management					
vi.	Absence of sufficient demonstration plots on IPM					
vii.	Inability to attend training regularly and timely due to long distance of FFS from home					
viii.	Lack of co-operation among the farmers					
ix.	Some farmers criticize IPM practices					
x.	Unavailability of organic farming practice					

d) Developing human capacity

Please mention in which areas FFS could develop your capacity to cultivate rice properly

Sl. No	Topic	Degree of capacity				
		Excellent	**Better**	**Good**	**Fair**	**Poor**
i.	Develop mental faculty of FFS members by providing training					
ii.	FFS members can identify their problem					
iii.	FFS members are able to make critical decision					
iv.	FFS members work on group to solve their problems					
v.	FFS members have knowledge on fertilizer management particularly for rice cultivation					
vi.	FFS members have knowledge on soil and crop management in respect of rice cultivation					
vii.	FFS members can produce and select good quality seeds					

Thanks for your kind co-operation.

Signature of interviewer

…….

Appendix -II. Correlation Matrix of the Dependent and Independent Variables (n=86)

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	Y
X_1	1.000										
X_2	-0.257*	1.000									
X_3	0.299**	-0.117	1.000								
X_4	0.189	-0.041	0.011	1.000							
X_5	0.259*	-0.130	0.047	0.635**	1.000						
X_6	-0.088	0.237*	0.165	-0.176	-0.164	1.000					
X_7	-0.060	0.339**	0.051	0.065	0.057	0.170	1.000				
X_8	-0.276*	0.322**	-0.216*	-0.037	-0.030	-0.008	0.222*	1.000			
X_9	-0.109	0.264*	-0.228*	0.048	-0.044	0.168	0.129	0.362**	1.000		
X_{10}	-0.106	0.345**	-0.028	0.211	0.185	0.020	0.277**	0.210	0.213*	1.000	
Y	-0.208^{NS}	0.433**	0.029^{NS}	-0.149^{NS}	-0.097^{NS}	0.269*	0.282**	0.384**	0.250*	0.393**	1.000

Notes: ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

X_1 = Age
X_2 = Education
X_3 = Family size
X_4 = Farm Size
X_5 = Annual net income from agricultural sources
X_6 = Organizational participation
X_7 = Innovativeness
X_8 = Knowledge on IPM
X_9 = Cosmopoliteness
X_{10} = Adoption of IPM Practices
Y = Role of FFS