ADOPTION OF INTEGRATED PEST MANAGEMENT (IPM) PRACTICES BY THE VEGETABLE GROWERS OF MAGURA DISTRICT

A Thesis
By

Md. Abu Touhid Mia
Examination Roll No. 19744
Registration No. 19744
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DEPARTMENT OF
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Dedicated

To

My Departed Father

and

Beloved Mother

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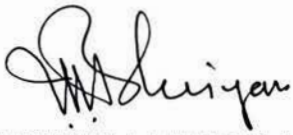
Approved by

Mohammad Hossain Bhuiyan
Supervisor
Advisory Committee

Prof. M. Zahidul Haque
Co-Supervisor
Advisory Committee



Prof. Mohammad Hossain Bhuiyan
Chairman
Examination Committee

SHER-BANGLA AGRICULTURAL UNIVERSITY
DHAKA – 1207
BANGLADESH

CERTIFICATE

This is to certify that the thesis entitled, **ADOPTION OF IPM PRACTICES BY THE VEGETABLE GROWERS OF MAGURA DISTRICT** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE** in **AGRICULTURAL EXTENSION AND INFORMATION SYSTEM** embodies the result of a piece of *bona fide* research work carried out by **MD. ABU TOUHID MIA** Roll No. 19744 Registration No. 19744 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.

Dated: 31 December, 2005
Dhaka, Bangladesh

(Prof. Mohammad Hossain Bhuiyan)
Supervisor
Advisory Committee

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The Author

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ADOPTION OF INTEGRATED PEST MANAGEMENT (IPM) PRACTICES BY THE VEGETABLE GROWERS OF MAGURA DISTRICT

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THESIS ABSTRACT

The main objectives of this study was to find out the extent of adoption of Integrated Pest Management (IPM) practices by the vegetable growers and to explore the relationships between the selected characteristics of the vegetable growers and their adoption of IPM practices. The study was conducted in two Unions under Sreepur upazila of Magura district. A list of 125 vegetable growers of Farmers' Field School (FFS) was collected from Upazila Agriculture Office. Out of 125 vegetable growers, 100 vegetable growers were randomly selected by taking 20 from each of 5 FFSs for the sample of the study. Data were collected from the respondents using an interview schedule during the whole month of June 2005. Descriptive statistics, such as mean, standard deviation, range and percentage were used to describe the variables under consideration. Spearman's correlation coefficient (r) was used to explore the relationship between the selected characteristics of the vegetable growers and their adoption of IPM practices. The data showed that only 32 percent of the vegetable growers were high user of IPM practices, while 63 percent medium and 5 percent of the vegetable growers were low user of IPM practices respectively. According to the land use for IPM practices only 20 percent of the vegetable growers were high user of land and 45 percent and 35 percent of the vegetable growers are medium and low user of land for IPM practices respectively. Among the ten selected practices "Weed management" ranked first followed by use of healthy seeds, perching in the crop field, use of light trap, practice of crop rotation, indigenous methods, hand sweep, use of pesticides, collection and destroy eggs and larvae, and "cultivation of resistant variety" ranked last. The findings also revealed that adoption of IPM practices by the vegetable growers had significant positive correlation with their level of education, family size, farm size, annual income, organizational participation, extension media contact, innovativeness, knowledge on IPM and cosmopoliteness while only age of the vegetable growers had no significant relationship with their adoption of IPM practices.

CHAPTER 1

INTRODUCTION

1.1 General Background

Agriculture is the economic backbone of Bangladesh, which contributes about one third to the country's gross domestic product (GDP). Approximately 84 percent of the country's total population is directly or indirectly dependent on agriculture for their livelihood. About 63 percent of the labour force is employed in agriculture sector of which about 57 percent is engaged in the crop sub-sector alone. The country has a total area of 147,570 square kilometers with a population of 134 million. Its average population density is about 850 per square kilometer probably the highest in the world (BBS, 2004). To feed the burgeoning population it is a dire necessity to increase crop production. With limited land area, horizontal expansion is rarely possible, but increase in crop production is still possible with vertical expansion through increasing crop yield per unit area and by reducing production losses.

One of the main constraints to increasing crop production is the pests and diseases. According to an estimate, annual yield loss due to insect pest alone is 16 percent for rice, 11 percent for wheat, 20 percent for sugarcane, 25 percent for vegetables, 15 percent of jute and 25 percent for pulse crops. (Alam and Kumar, 2005)

In Bangladesh vegetables are grown in two seasons, summer (April to October) and winter (October to March). The major vegetables are brinjal (egg plant), country bean, tomato, cabbage, cauliflower, yard long bean, cucurbits etc. As per Bangladesh Bureau of Statistics (BBS) 2004, the area under vegetable cultivation is 0.55 million hectare and production is 6.133 million metric tons. Among the vegetables, brinjal receives maximum pesticide applications even up to 80 times during its growing period.

The overall objective of the National Agricultural Policy (NAP) is to make the country self sufficient in food through increasing crop production and ensuring a sustainable food security system. To this effect the Department of Agricultural Extension (DAE) has prepared a Strategic Plan for 2002-2006. The plan has five general objectives and one of them is to increase agricultural productivity. Therefore, to increase crop production it is imperative to reduce the crop loss caused by insect pests and diseases.

In Bangladesh, chemical control has been the principal method of pest control. Although pesticides may provide temporary relief from pest problems, long-term dependency on pesticides is not desirable. It is now widely accepted that indiscriminate use of pesticides not only creates serious environmental and human health problems but also promotes development of pest resistance to insecticides, destroys beneficial insects, upsets the balance between the pests and their natural enemies, leading to the increase in the population of the target pests and even the creation of new pest problems. To avoid such consequences and at the same time to increase rice and vegetable production on a sustainable basis, a viable alternative to sole dependence on chemicals for pest management is needed. Integrated Pest Management (IPM) is the best alternative strategy.

In Bangladesh, IPM activities first started in 1979 with the introduction of first phase of FAO's Inter-Country Programme (ICP) on IPM in rice crop. The FAO's ICP played a strong catalytic role in promoting the IPM concept and approach among the government officials and donor community during 1989 to 1995. During that period the emphasis was given on rice IPM. The programme provided IPM training to build the training capacity of the Department of Agricultural Extension (DAE) and introduced Farmers' Field School (FFS) for training of farmers. A number of persons from the non-government organizations (NGOs) were also given training on IPM. At that time most of the projects worked mainly on rice IPM and those were extension led projects. Although the DAE/DANIDA SPPS (Strengthening Plant Protection Service) Project during its 1st phase worked mainly on rice IPM yet considerable work was done on vegetable IPM too.

During 1995-2002 about 8-10 IPM projects in rice and vegetables were in operation and executed by different government departments and NGOs. The FAO inter-country vegetable IPM programme conducted one (ToT) in 1997 and one in 1999. A total of 62 DAE staff and 2 NGO staff received season long training in vegetable IPM through these TOTs.

Based on the excellent performance of SPPS project during first phase, DANIDA came forward to support the second phase (September 2002 to June 2006). In the second phase, the project had 5 components namely, (1) Integrated Pest Management in rice and vegetables, (2) Pest Surveillance, Forecasting and Early Warning System, (3) Pesticide Administration and Quality Control, (4) Plant Quarantine Services, and (5) Vertebrate Pest Management. The project operates in 201 upazilas of 64 districts and it is implemented by DAE. The Integrated Pest Management component is funded by DANIDA and other components by the Government of Bangladesh. The overall objective of the 2nd phase project is to increase smallholder farm output and income on an environmentally sustainable basis.

During 2nd phase of SPPS project the major emphasis is on training. The training focuses on the dissemination of IPM technologies through proper implementation of Farmers' Field School (FFS) on IPM. It also emphasizes for the promotion of community IPM and at the same time to spread IPM knowledge widely amongst farmers in Bangladesh.

The SPPS project during 1st phase (1997-2002) conducted 14 ToTs courses on rice and vegetable IPM where a total 626 DAE staff (AEO, PPI and BS) and 75 NGO staff were trained in practical IPM as facilitators (trainers). During second phase, 2 TOTs have been conducted and provided training to 110 DAEs field level workers. These IPM trained DAE staff constitute the upazila IPM team and they provide training to farmers through FFS. The projects have made remarkable progress.

The SPPS Project has targeted to establish 8500 FFSs in rice and vegetables (5100 in rice and 3400 in vegetables). Among the vegetables, the project deals with brinjal, country bean, cabbage, cauliflower, tomato and cucurbits. The project has acceded the

target of vegetable FFS. As of October 2005, the project has established 3784 FFSs in vegetables IPM including 592 in ongoing winter vegetable season and provided training to about 94600 vegetable farmers (52% male & 48% female). In addition, approximately 800,000 farmers were given exposure to vegetable IPM activities through 3192 Field Days. Besides FFS, the SPPS project initiated work on biological control of Rice hispa and Brinjal shoot and fruit borer.

The IPM training has rendered a positive impact on the trained farmers. The trained farmers can understand that all insects in a crop field are not harmful. Beneficial insects (parasites and predators) are more abundant in the crop ecosystem than the harmful insects. The IPM training not only increase the knowledge of the farmers but also reduces their crop production cost (by reduced use of pesticides) and increase in crop yield.

1.2 Statement of the problem:

All over the world pesticides are randomly used in crop cultivation. Although it has some beneficial effects but it has been found in everywhere that it causes environmental pollution including air, soil and water. Ziauddin (1991) said that the pesticides usage have a number of bad effects. First, pesticides can have adverse health effect for farm workers and others exposed to pesticides. Second, it contaminates surface water, harming downstream users of the water sources by causing regular outbreaks of epidemic diseases in fishes.

Since the introduction of pesticides campaign, advertisement and extension works were launched to adopt this method of pest control. Due to injudicious and indiscriminate application of pesticides throughout the world, an injurious effects of pesticides along with its benefits has been observed. The beneficial insects, which are useful for the pollination of crops and maintaining ecological balance die. Moreover, the residual effects of chemicals remain in plant parts and the soil that cause various harm to animals and human body.

Ripper (1944) pointed out that pesticides would kill natural enemies of pests and results in resurgence of pest population. The high level of pesticides usage also contaminate surface and ground water and damage our natural resources such as soil, fishes, diatoms, beneficial micro-organisms, beneficial insects, plants and so on. So, it is necessary to reduce the excess use of pesticide through popularizing practice of IPM.

IPM practices are unique strategy for pest control. To minimize environmental hazard, cost of cultivation and increase agricultural production, IPM practice is important for farmers. That is why the researcher has undertaken a study: Adoption of Integrated Pest Management Practices by the Vegetable Growers of Magura district. The result of the study answer the following questions–

i. What is the present situation of pest control measures of vegetables?
ii. What percentages of vegetable growers are using IPM?
iii. What characteristics do the farmers possess in their respective IPM practices?
iv. Is there any relationship between selected characteristics of vegetable growers and their adoption of IPM practice?

Thus this study will help the government and the concerned body to take proper steps so that the IPM can be adopted by most of the growers and get the benefits from it.

1.3 Specific Objectives:

The following specific objectives were set in order to give proper direction of the study:

i. To determine and describe the selected characteristics of vegetable growers. The selected characteristics are age, level of education, family size, farm size, annual income, organizational participation, extension media contact, innovativeness, knowledge on IPM, and cosmopoliteness
ii. To determine the extent of adoption of IPM practices by the vegetable growers
iii. To explore the relationship between extent of adoption of IPM practices and selected characteristics of vegetable growers
iv. To compare the extent of adoption of different IPM practices in the study area, and
v. To determine the mean adoption of selected IPM practices in the study area.

1.4 Justification of the Study

Some agricultural activities specially the use of pesticides is detrimental to the environment. Integrated pest management is that method of crop protection which is less hazardous to the environment and economically sound.

Many studies have so far been conducted relating to knowledge and attitudes of farmers on various aspects of agriculture. There are also a number of studies conducted relating to the adoption of various modern technologies by the farmers. But very little research has been reported home and abroad to determine the use of IPM practices by the vegetable growers.

IPM educates the farmers to utilize the readily available sources of tolerant genetic resources, modern cultivation practices, mechanical means of control, biological

means of control, organic fertilizer, green manuring and bio-fertilizer to check the pollution and improve the environment. There is an urgent need to understand the potentiality and limitation of IPM to make appropriate development choices.

Farmers of Bangladesh are mostly poor. They could hardly spare money for expensive toxic pesticides. Considerable attention has been given in recent years to "Integrated Pest Management" (IPM) following increasing the sole reliance on pesticide, which is counterproductive. Today's IPM refers to integrate the use of two or more control tactics, reducing the sole reliance on chemicals in an attempt to –

1. conserve the environment and keep biodiversity
2. protect beneficial insects, frogs, fishes etc.
3. reduce production costs and
4. protect food against residual effect of pesticides

For enhancing the dissemination of IPM knowledge to the end users both scientists and extension personnel should work hand to hand. Research generates new technologies appropriate for beneficial use, which extension worker make available to the beneficiaries. This can be done through IPM training. However, before designing IPM training it is necessary to get clear-cut idea about the present status of IPM practices by the vegetable growers.

Integrated Pest Management (IPM) helps the growers to assess the environmental awareness. Under the above consideration, the present study is supposed to support the researcher and extension personnel, policy makers and farmers to establish more extensive programmes.

1.5 Assumptions

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode, 1945). The following assumptions were in the mind of the researcher during conducting the study.

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

(b) The researcher who acted as interviewer was well adjusted to the social environment of the study area. Hence the data collected by the researcher were free from bias.

(c) The responses furnished by the respondents were reliable.

(d) The items included in the questionnaire to ascertain the practices of IPM were adequate to reflect the practices of IPM.

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

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

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

1.6 Scopes and Limitations of the Study

The present study was undertaken to have an understanding of the use of IPM practices and to explore the relationship with selected characteristics of the farmers. Considering the time, money and other necessary resources available to the researcher and to make the research manageable and meaningful it become necessary to impose certain limitations. The limitations were as follows:

1. The study was conducted at Sreepur upazila under Magura district.
2. The study was restricted within the farmers who had at least some cultivable land under own cultivation.

3. For information about the study the researcher was dependent on the data furnished by the randomly selected respondents during the interview with them.
4. Characteristics of the farmers were many and varied but in the present study only 10 characteristics were selected.
5. The respondents for data collection were kept limited within the farm family who received training on IPM from DAE.
6. The researcher relied on the data furnished by the farmers from their memory during interview.

1.7 Definition of Terms

A number of key terms used throughout the study are defined below for clarity of understanding:

Age: Age of a farmer referred to the period of time in complete years from 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: Family size refers to the total number of members including the respondent himself/herself, spouse, children and other dependents, who live and eat together in a family unit.

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

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

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

Extension media contact: Extension media contact refers to an individual's exposure to or contact with different information sources and personalities being contacted for technology dissemination among the farmers.

Innovativeness: Innovativeness is the degree to which an individual is relatively earlier in adopting an innovation with respect to other members of a social system (Rogers, 1995). This was comprehended by the quickness of accepting innovation by an individual in relation to others and was measured on the basis of time dimension.

Cosmopoliteness: Cosmopoliteness refers to the degree to which an individual's orientation is external to his own social system.

Knowledge on IPM: Knowledge on IPM refers to the understanding of the respondents about different strategies of pest management.

IPM Practices: IPM practices in respect of cultivation of any crop refer to those practices which are advocated by competent authority. This practices if used are helpful for improving the yield and/or quality of crop. In this study ten IPM practices during cultivation were considered.

Integrated Pest Management (IPM): Integrated Pest Management can be defined in many ways. According to the Food and Agriculture Organization (FAO) "A pest population management system that utilizes all suitable techniques in a compatible manner to reduce pest population and maintain them at levels below those economic injury"

CHAPTER 2

REVIEW OF LITERATURE

This Chapter deals with the reviews of past researches related to this investigation. The present study is concerned with the adoption of IPM practices by the vegetable growers and its relationships with their selected characteristics. An effort was made to know the findings of past research in this respect. Accordingly, the researcher made an extensive search of past studies that could be made available. But unfortunately none of the studies were found related to the present study. However the researcher collected and presented the following review of literatures related to plant protection.

2.1 Review of Studies Related to the Adoption of Different Practices

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 Boro rice growers had medium adoption of IPM technology, while 25 percent had high and only 20 percent with low adoption.

Hossain and Karim (1971) studied the adoption of four practices of cultivation of Transplanted Aman such as use of recommended varieties of seeds, line-transplanting method, recommended doses of fertilizer, and plant protection measures in Gouripur union of Mymensingh district. Nearly 67 percent farmers adopted plant protection measures followed by recommended varieties of paddy (36 percent), line transplanting method (25 percent), and recommended doses of fertilizers(12 percent).

Rahman (1986) studied the extent of adoption of four improved practices namely, use of fertilizers, line sowing, irrigation and use of insecticide in transplanted Aman rice cultivation in two villages of Mymensingh district. The analysis revealed that 22 percent adopted all the four practices in combination against 49 percent adopted 3 practices. Again 22 percent adopted 2 practices while 5 percent adopted only one practice and 2 percent of the farmers were found to adopt none of the practices.

Dale, *et al.* (1982) in their study on effect of pesticides residues on the natural enemies of citrus mealy bug reported that phosphate and carbonyl had significantly high toxic residual effect up to 30 days permanently against majority of the natural enemies.

Ramaswamy (1997) reported that 4050 farmers from 81 IPM schools spent Taka 816/ha on pesticides during one cropping season before receiving IPM training. The same 4050 farmers, after receiving IPM field training, control their pests through IPM skills. They reported that the naturally available parasitoids and predators suppressed the pest population. This was possible for adopting cultivation practices and controlling of pests by mechanical means and without spending money. They spent Taka 110/ha on pesticides and thus 87 percent reduction in pesticides use was achieved by using IPM knowledge.

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

Naika and Rao (1990) concluded that more area was brought under plant protection chemicals after adoption of improved practices. It increased from 45.75 acres to 104.75 acres in an adopted village and 8.00 acres to 11.00 acres in non-adopted villages.

Singh and Rajendra (1990) found that out of 150 farmers, 105 farmers adopted cos 767 variety of sugarcane, while only 45 farmers did not adopt. A high level of adoption was found in nitrogen fertilizer and weeding and interculture (110 percent), followed by plant protection measures and (74.3 percent) potassic fertilizer (33.1 percent). Only 28.6 percent adopted ridge-planting practices.

Findings of the research studies regarding the extent of adoption of IPM practices as presented above indicate that the adoption of IPM practices in the rural areas of Bangladesh is not very encouraging. Till today, most of the farmers do practice traditional methods to a greater extent. This fact indicates that the extension workers have enormous scope to enhance the adoption of IPM practices among the farmers.

2.2 Findings Relating to the Relationship between Farmers Characteristics and Adoption of IPM Practices.

2.2.1 Age and adoption of IPM Practices

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

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measures and related aspects. He reported that age of the farmers had low association with their adoption of insect control measures.

Khan (1993) in his study found that age of the farmers was significantly related with their adoption of insecticides. He also found that with the increase of age of the farmers, the adoption of insecticides reduces i.e., age was negatively related with adoption.

Hoque (1993) observed that age had a negative relationship with the adoption of insecticides. Kashem (1987) observed similar relationship.

Hossain (1999) conducted at study to determine the farmers' perception of the effects of agrochemical on environment. He found that age of the farmers had no relationship with their adoption of fertilizer. Similar results were observed by Muttalab (1995).

2.2.2 Level of education and adoption of IPM practices

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.

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.

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measures and related aspects. He reported that education of the farmers had low association with their adoption of insect control measures.

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

Hoque (1993) observed that education of the cane growers had positive relationship with their practice of pest management.

Khan (1993) studied on the adoption of insecticides and related issues in the villages of Pachan union, Madaripur district. He found that education had positive relationship with the adoption of insecticides.

2.2.3 Family size and adoption of IPM practices

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 the Boro rice growers had no significant 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 family size had no relationship with their use of IPM practices.

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measures and related aspects. He reported that family size of the farmers had low association with their adoption of insect control measures.

2.2.4 Farm size and adoption of IPM practices

Rabbany (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.

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measures and related aspects. He reported that farm size of the farmers had low association with their adoption of insect control measures.

Gogoi and Gogoi (1989) found in their study that adoption of recommended plant protection practices was influenced by the size of operational land holding of the farmers.

Okoro and Obibuaka (1992) studied adoption of recommended management practices among small holders in IMO state, Nigeria. The findings of the study indicated a positive relationship between the farm size and adoption of recommended management practices.

Khan (1993) observed in his study that farm size was positively related to the adoption of insecticides.

2.2.5 Annual income and adoption of IPM practices

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 annul income of the Boro rice growers had no significant 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 annul income had positive and significant relationship with their use of IPM practices.

Mohammad (1974) undertook an investigation on the farmers' adoption of insect control measures and related aspects. He reported that annul income of the farmers had low association with their adoption of insect control measures.

Singh (1991) found that income of the farmers was associated with the level of adoption of plant protection measures. He also found that low-income farmers had greater tendency to apply less than the recommended doses and lack of knowledge was found major reasons for non-adoption.

Khan (1993) found significant relationship between annual income of the farmers and their adoption of insecticides. Similar findings obtained by Alam (1997) and Pal (1995).

2.2.6 Organizational participation and 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 had positive and significant relationship with their use of IPM practices.

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

Hossain's (1971) study revealed a positive relationship between organizational participation of the farmers with their adoption of recommended does of fertilizer and plant protection measures. Similar results were also reported by Karim (1973) and Hossain (1991).

Hoque (1993) in his study observed a positive relationship between organizational participation of the cane growers and their adoption of pest management practices.

Khan (1993) found that organizational participation of the farmers had positive relationship with their adoption of insecticides.

Islam (1993) found that organizational participation of the potato growers had positive relationship with their adoption of plant protection measures.

2.2.7 Extension media contact and adoption of IPM practices

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 extension media contact of the Boro rice growers had 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 extension media contact had positive and significant relationship with their use of IPM practices.

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

Juliana, *et al.* (1991) studied on relationship between characteristics of cotton growers and their adoption level of IPM practices. They reported that in respect of all the three categories of farmers, their extent of adoption associated positively and significantly with extension media contact.

Singh (1991) observed in his study that mass contact of the farmers had significant relationship with their level of adoption of plant protection measures.

2.2.8 Innovativeness and adoption 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.

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

Hossain (1999) found a positive significant relationship between innovativeness of the farmer's and their adoption of fertilizer and also observed no relationship with adoption of pesticides.

Islam (2002) in his study revealed that innovativeness of the farmers had significant positive relationship with their adoption of modern agricultural technology.

2.2.9 Knowledge and adoption of IPM practices

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.

Alam (1997) in his study revealed that agricultural knowledge of the farmers had positively significant with their adoption of IPM practices.

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

2.2.10 Cosmopoliteness and adoption of IPM practices

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 cosmopoliteness of the Boro rice growers had positive and significant 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 cosmopoliteness of the farmers had positive and significant relationship with their use of IPM practices.

Khan (1993) observed in his study on adoption of insecticides and related issues by the farmers, a positive relationship between cosmopoliteness of the farmers and their adoption of insecticides.

Islam (1993) found a significant relationship between cosmopoliteness of the farmers and their adoption of plant protection measures in potato cultivation.

2.3 The Conceptual Framework of the Study

In scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constituted properly contains at least two important elements i.e. "a dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variables (Townsend, 1953). An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon.

The conceptual framework of Rosenbarg and Hovland (1960) was kept in mind while framing the structural arrangement for the dependent and independent variables. Adoption of IPM practices by the vegetable growers 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 include age, level of education, family size, farm size, annual income, extension media contact, organizational participation, innovativeness, knowledge on IPM practices and cosmopoliteness. Based on these discussions and the review of literatures, the conceptual framework of this study has been formulated and shown in the Fig. 2.1.

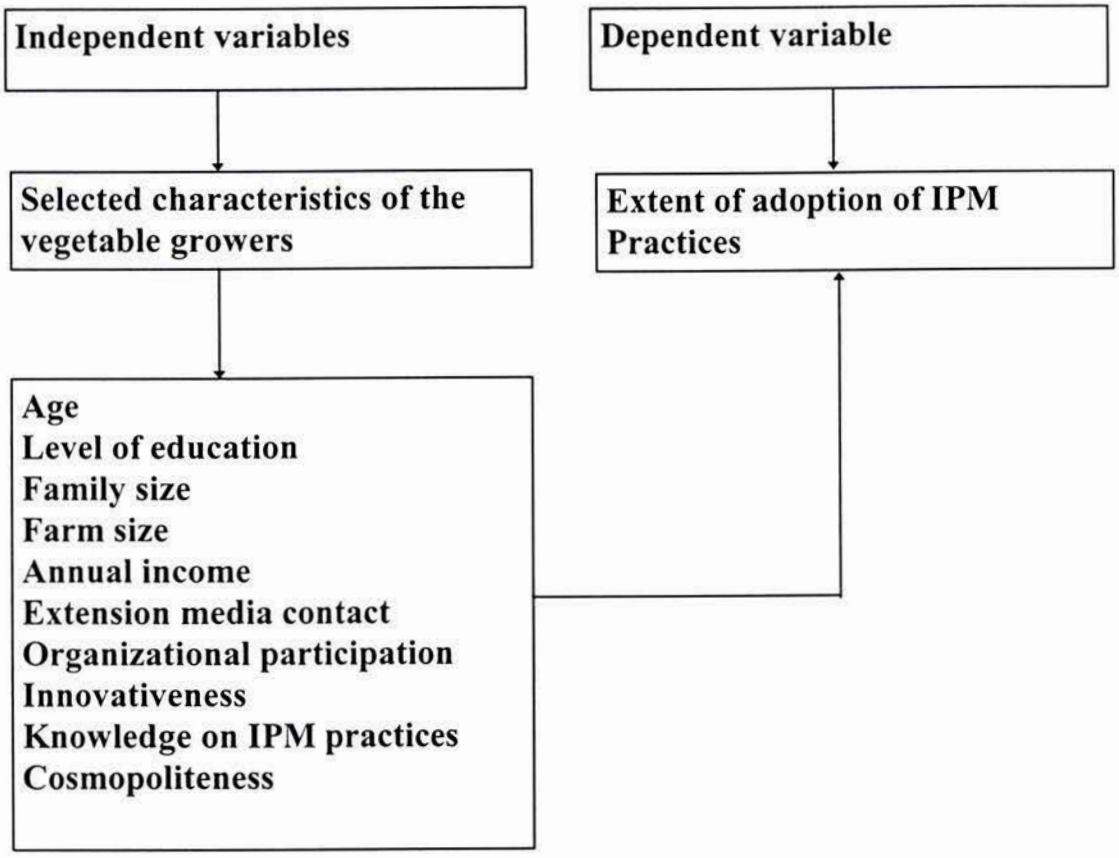

Fig. 2.1 Conceptual framework of the study

CHAPTER 3

METHODOLOGY

This chapter mainly deals with the methodology followed to collect, compile and analysis of data pertaining to the Adoption of IPM practices by the Vegetable Growers of Magura District as per objectives of the study.

3.1 Locale of the Study

The study was conducted in Sreepur upazila under Magura district which is located at the South-West part of Bangladesh. It is situated about 200 km South-West from the capital city and is well communicated. It has 2309.50 ha of high land, 6225.43 ha of medium high land, 5443.50 ha of medium low land and 414.57 ha of low land area. Total cultivable land is 15570 ha. In this upazila, Farmers' Field School (FFS) under IPM project started functioning in 14 July 2000. Sixty eight FFSs have been working in 8 unions. This upazila is divided into 27 agricultural blocks. Two unions were randomly selected out of 8. The name of the selected unions were Sopdalpur and Kadirpara. The selected unions have 3 blocks each, and Sopdalpur union consists of 15 FFSs on the other hand Kadirpara union have 7 FFSs. Five FFSs under 2 selected unions are randomly selected. Three FFSs were selected from Sopdalpur unions located in 3 adjacent villages namely Amtoil, Maldah and Kazoly. On the other hand 2 FFSs were selected from Kadirpara union located in 2 adjacent villages namely Bisnapur and Dorannagor. These selected villages have better communication facilities with upazila, district and Capital city. A map of Magura district showing the study area within the Sreepur upazila have been presented in figure 3.1

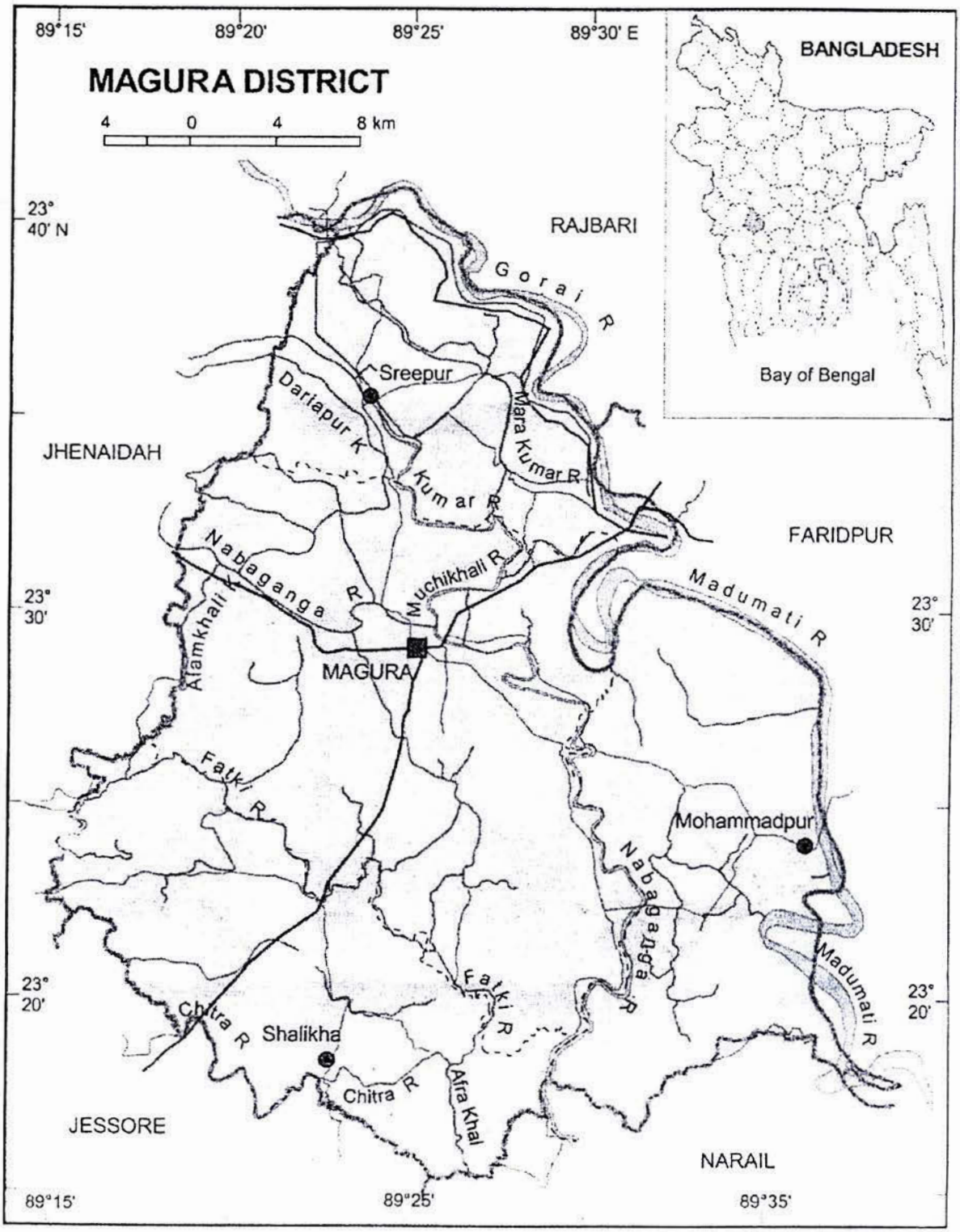

Figure 3.1 A map of Magura district showing study area

Table 3.1 Total numbers of ongoing FFSs under Sreepur upazila (2000-05)

Year	Crops	Numbers of FFS
2000	T-Aman	3
2001	T-Aman +Boro Winter vegetables	15
2002	Boro rice	6
2003	Vegetable (Summer + winter) + T-Aman +Boro	25
2004	Vegetable (Summer + winter) + T-Aman +Boro	14
2005	Boro+Summer Veg. + T-aman	5

3.2 Population and Sample design

The total number of FFS farmers (2000-2005) of respective villages under Sreepur upazila was the population of the study. In the first phase 5 FFSs were randomly selected out of 68 FFSs. A list of 125 farmers were collected from Upazila Agriculture Office and 100 farmers were selected randomly using random number taking 20 from each FFS. The village-wise distribution of population and sample of FFS farmers are shown in Table 3.2. At the same time a reserve list were prepared with a view to using those farmers if the respondents included in the organized sample are not available during collection of data.

Table 3.2 Distribution of population and sample of respondents in selected FFS in respective villages of Sreepur upazila

Name of unions	Name of villages	Name of FFS	Numbers of FFS farmers	No of FFS farmers included in the sample	Reserve list
Sopdalpur	Amtoil	Amtoil	25	20	5
	Maldah	Maldah	25	20	5
	Kazoly	Kazoly	25	20	5
Kadirpara	Bisnapur	Bisnapur	25	20	5
	Dorannagor	Dorannogor	25	20	5

3.3 Measurement of variables

Measurable characteristics of a population that may vary from element to element either in magnitude or in quality are called variable. 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 manipulated by the researcher in his/her attempt to ascertain relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or manipulates the independent variable (Townsend, 1953).

3.3.1 Measurement of independent variables

The independent variables of this study were the 10 selected characteristics of FFS farmers, namely: age, level of education, family size, farm size, annual income, organizational participation, extension media contact, innovativeness, knowledge on IPM and cosmopoliteness. The processes of measuring the independent variables are given below:

3.3.1.1 Age:

The age of respondents was measured in term of actual years from his/her birth to the time of interview. It appears in item no.1 in the interview schedule (Appendix-A).

3.3.1.2 Level of education

Level of education of a respondent was measured in term of years of schooling or classes passed by him/her, for example, if a respondent passed S.S.C. a score of 10 was taken for calculating his education score. If a respondent had education out side the school and if the level of education was measured equivalent to that of S.S.C. exam of the school, then his/her education score was taken as 10. A respondent who did not know reading or writing had education score of zero (0). Thus the level of education score could ranges from 0 to 14.

3.3.1.3 Family size

Family size of a farmer was determined on the basis of total number of members of his/her family. The family members included himself/herself, spouse, sons, daughters 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.

3.3.1.4 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/lease where s/he used to do his/her farming operations during the period of this study. The farm size of the respondent was calculated by using the following formula:

$$F_s = A_1 + A_2 + \frac{1}{2} A_3 + A_4 - A_5 + A_6$$

Where, F_s = Farm size

A_1 = Homestead area out of pond and garden.

A_2 = Own land under own cultivation

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

A_4 = Land taken from others on lease.

A_5 = Own land given to others on lease.

A_6 = Other (fruit garden, pond etc.)

3.3.1.5 Annual income

Annual income of a respondent was measured in Taka on the basis of his total yearly earning from agriculture and other sources in which the respondent was directly or indirectly involved, or one or more of his family members involved. The yields of all crops in the antecedent year were recorded. Then all the yields were converted into cash income according to prevailing market price. The price of other enterprises (i.e. poultry, dairy, fish etc.) was also added to the price. Earning of each respondent's different sources (i.e. service, business labour etc.) were also included in the income computation. Yearly earning from farming and other sources (non-farming) ware added together to obtain total income of a respondent.

3.3.1.6 Organizational participation

Organizational participation of a respondent was measured on the basis of the nature of his/her involvement in different organization during the time of interview. Organizational participation score was computed in the following manner for participation in each organization.

Score assigned	Nature of involvement
0	No participation
X_1 x 1	Participation as ordinary member
X_2 x 2	Participation as executive committee member
X_3 x 3	Participation as executive committee officer

Here X_1, X_2, or X_3 refer to the years an individual is involved in that organization.

If an individual is an executive committee member for 5 years, his score for this participation will be (5x2) = 10. Organizational participation score of a respondent was obtained by adding the score of his/her participation in all the organizations and duration on the basis of his/her responses.

3.3.1.7 Extension media contact

The extension media contact of a respondent was measured by the total scores of extension media contact on the basis of his/her nature of contact with 14 selected extension media. The extent of contact was determined against a four-point scale and scores were arranged for all 14 related media were shown in table 3.3.

Table 3.3 Measurement of extension media contact of the respondent

Types	Extension media	Extent of adoption	Scores assigned
Individual contact			
1.	Sub-Asstt. Agril. Officer	Frequently : 4 or more times/month Occasionally: 1-3 times/month Rarely : 3 times/year Not at all : never	3 2 1 0
2.	NGO worker (s)	Frequently : 4 or more times/month Occasionally : 1-3 times/month Rarely : a few times/year Not at all : never	3 2 1 0
3.	Other extension workers (eg-health worker, BRDB's field officer, Imam.etc.)	Frequently : 4 or more times/month Occasionally : 1-3 times/month Rarely : a few times/year Not at all : never	3 2 1 0
4.	Agricultural input dealer	Frequently : 4 or more times/month Occasionally : 1-3 times/month Rarely : a few times/year Not at all : never	3 2 1 0
5.	Thana agriculture Officer/Aditional agriculture Officer/ Agriculture Extension Officer	Frequently : At least 1 time/ month Occasionally : at least 1 time/ 2 month Rarely : 1-5 times/year Not at all : never	3 2 1 0
6.	Others (friends/Relatives/ Neighbours	Frequently : 4 or more times/month Occasionally : 1-3 times year Rarely : 1 time/year Not at all : never	3 2 1 0
Group Contact			
1.	Participation in group discussion	Frequently : 4 or more times/year Occasionally : 2-3 times/year Rarely : 1 time/year Not at all : never	3 2 1 0
2.	Participation in demonstration meeting (Result & method demonstration)	Frequently : 4 or more times/year Occasionally : 2-3 times/year Rarely : 1 time/year Not at all : never	3 2 1 0
3.	Participation in field day/farmers rally	Frequently: 4 or more times/month Occasionally : 1-3 times/month Rarely : a few times/year Not at all : never	3 2 1 0
4.	Participation in training	Frequently : 3 or more times/year Occasionally : 2 times/year Rarely : 1 time/year Not at all : never	3 2 1 0

Types	Extension media	Extent of adoption	Scores assigned
Mass Media Contact			
1.	Listening Farm Radio talk	Frequently : 4 or more times/month Occasionally : 2-3 times/month Rarely : 1 time/month Not at all : never	3 2 1 0
2.	Watching agricultural Programme in TV	Frequently : 4 or more times/month Occasionally : 2-3 times/month Rarely : 1 time/month Not at all : never	3 2 1 0
3.	Reading agricultural magazine (Krishikatha, booklet, leaflet etc.)	Frequently : 5 or more times/year Occasionally : 3-4 times/year Rarely : at least 1-2 times/year Not at all : never	3 2 1 0
4.	Visiting agricultural fair	Frequently : 3 or more times/year Occasionally : 2 times/year Rarely : 1 time/year Not at all : never	3 2 1 0

Extension media contact of a respondent was determined by adding his scores for contact with all the media according to the above formula. Thus the score of a respondent could range from 0 to 42. 0 indicating no extension media contact where 42 indicating very high extension media contact. The item related to extension media contact could be seen in the item no.7 (Appendix-A).

3.3.1.8 Innovativeness

Innovativeness of a respondent was measured by computing a innovativeness score on the basis of his/her extent of use of 12 selected modern agricultural practices. Score were assigned on the basis of time dimension in the following manner.

Period of adoption	score assigned
Do not use	0
Below 1 year	1
1-3 years	2
Above 3 or more years	3

Innovativeness score of a respondent was obtained by adding his/her scores for all the items. Therefore, the possible innovativeness score of the respondents could rang from 0 to 36,while 0 indicating no innovativeness and 36 indicating very high innovativeness.

3.3.1.9 Knowledge on IPM

Knowledge on IPM practices score of a respondent was measured on the basis of 15 questions of different aspects of IPM practices. Scores were assigned for correct responses of different questions. Each question contains 2 marks. According to nature of answering, the respondent could get 2, 1, or 0, for correct, partially correct and incorrect responses to all 15 questions. S/he could get a total score of 30 while for wrong responses to all the 15 questions s/he could get (Zero). Thus, the knowledge score of the respondents could range from 0 to 30,while 0 indicating no Knowledge and 30 indicating very high knowledge.

3.3.1.10 Cosmopoliteness

The cosmopoliteness score of each respondent was assigned on the basis of place and frequency of his visit external to and outside of his own social system. Cosmopoliteness score was computed according to Table 3.4.

Table 3.4 Measurement of cosmopoliteness of the respondents

Places of visit	Weighing System	Scores assigned
1. Visit to market/ relatives/friends outside of his own village but within his own Union	Frequently : 8 or more times/month Occasionally : 4-7 times/month Rarely : 1-3 times/month Not at all : 0 time/month	3 2 1 0
2. Visit to other Union	Frequently : 5 or more times/month Occasionally : 3-4 times/month Rarely : 1-2 times/month Not at all : 0 time/month	3 2 1 0
3. Visit to own upazila headquarter	Frequently : 5 or more times/month Occasionally : 3-4 times/month Rarely : 1-2 times/month Not at all : 0 time/month	3 2 1 0
4. Visit to own town/headquarter	Frequently : 4 or more time/year Occasionally : 3-4 times/year Rarely : At least once/year Not at all : 0 time/year	3 2 1 0
5. Visit to other upazila headquarter	Frequently : 4 or more time/year Occasionally : 3-4 times/year Rarely : At least once/year Not at all : 0 time/year	3 2 1 0
6. Visit other district	Frequently : 3 or more times/year Occasionally : 2 times/year Rarely : At least once a year Not at all : 0 time/year	3 2 1 0
7. Visit capital city or other metropolitan city	Frequently : 3 or more times/year Occasionally : 2 times/year Rarely : At least once a year Not at all : 0 time/year	3 2 1 0

3.3.2 Measurement of dependent variable

Adoption of IPM practices by the vegetable growers was measured on the basis of their adoption of different kinds of IPM technologies. The practices score of the respondents was calculated on the basis of the respondents' adoption of 10 integrated pest management strategies. Among ten recommended practices the respondent may adopt one or more for a period of time. Score of adoption was calculated on the basis of adoption of how many practices and for how many years. Score 1 was assigned for adoption of each practices of IPM. For the period of adoption the following scores were assigned: 0=0 year of adoption; 1=1 year of adoption; 2=2 years of adoption; 3=3 years or above.

For example, if a vegetable grower adopted 3 practices for 1,2 and 3 years respectively, his adoption score could be (1×1) + (1×2) + (1×3) = 6. The adoption score of 10 practices could range from 0 to 30, where 0 indicating adoption of no practices and 30 indicating adoption of all practices of IPM in the field.

However, a four point rating scale was used to rank the adoption of recommended 10 IPM practices by the vegetable growers. The respondents indicated their adoption of 10 recommended IPM practices by choosing a suitable answer from four options, such as, "frequently," "occasionally," "rarely" and "never". Then an effort was also made to compare the relative adoption of these practices. An IPM Practice Adoption Index (IPAI) was developed to fulfill this objectives using the following formula:

$IPAI = N_1 \times 3 + N_2 \times 2 + N_3 \times 1 + N_4 \times 0$

Where, IPAI = IPM Practice Adoption Index

N_1 = Number of vegetable growers used IPM practices frequently

N_2 = Number of vegetable growers used IPM practices occasionally

N_3 = Number of vegetable growers used IPM practices rarely

N_4 = Number of vegetable growers never used IPM practices

The IPAI for each of the IPM practice could range from 0-300

3.3.3 Measurement of Adoption Quotient

Adoption could be measured in a number of ways. The simplest amongst them are preparation of indexes. Bose (1965), developed an "Adoption Index" by asking the farmers how many improved practices recommended by the extension service they had adopted and for how many years.

Based on the adoption quotient formula forwarded by Bose (1965), a modified formula was developed by M.H. Bhuiyan, supervisor of this research for measuring the extent of adoption of IPM practices by the vegetable growers. The formula is:

$$\text{Adoption Quotient} = \frac{\text{Mean score of IPM adoption / Mean adoption period}}{\text{Number of practices}} \times 100$$

More the adoption quotient, more the adoption of IPM practices

3.4 Statement of Hypothesis

As defined by Goode and Hatt (1952) "A hypothesis is a proposition, which can be put to test to determine its validity. It may be seen contrary to, or in accordance with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test." In studying the relationship between variables, research hypotheses are formulated which state the anticipated relationship between the variables. However for statistical test it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no relationship between concerned variables. If a null hypothesis is rejected on the basis of statistical test, it is assumed that there is a relationship between the concerned variables.

3.5 Instrument for Collection of Data

In order to collect relevant information from the respondents an interview schedule was used as the research instrument. The schedule was carefully designed keeping the objectives of the study in mind. Both open and closed forms of questions were used to collect information. Simple, direct questions and scales were included in the interview schedule for collecting information regarding the adoption of IPM practices by the vegetable growers and 10 individual characteristics namely age, level of education, family size, farm size, annual income, organizational participation, extension media contact, innovativeness, knowledge on IPM and cosmopoliteness.

3.6 Pre-testing of the Interview Schedule

The interview schedule was pre-tested with 10 farmers and final shape was given to the interview schedule according to the experience of pre-test. The pre-test 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 suggestion and comments of the appropriate authority. An English version of the interview schedule is presented in Appendix-A.

3.7 Collection of Data

Data were collected with the assistance of AAO, and BS of Sreepur upazila. Before the collection of data Additional Agriculture Officer of Sreepur upazila. and one of the Sub-assistant Agriculture Officer (Block Supervisor, BS) provide me necessary assistance and cooperation in connection with data collection. Researcher himself collected data through face to face interview. Respondents were interviewed at their leisure time. While starting interview with any respondent at first the researcher took all possible care to establish rapport so that s/he did not hesitate to give proper responses to the question and statements included in the interview schedule. However, if any respondent felt difficulty in understanding any question, the researcher took care to explain and clarify the question. Data were collected during 1 to 30 June 2005.

3.8 Compilation of Data

After completion of field survey all the interview schedules were compiled. Local units were converted to standard unit. Appropriate scoring technique was followed to convert the qualitative data into quantitative forms. The responses of the individual respondent contained in the interview schedules were transferred to a master sheet for entering the computer. Soon after entering the data into the computer, these were analyzed in accordance with the objectives of the study.

3.9 Categorization of Data

For describing the independent and dependent variables the respondents were classified into appropriate categories. In developing categories the investigator was guided by the nature of data and general consideration prevailing in the social system. The procedure of categorization have been discussed while describing the variables in the relevant chapter.

3.10 Statistical Treatment

The data after collection were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. Various statistical measures such as range, mean, percentage, standard deviation, were used in categorizing and describing the selected personal characteristics of the respondent. For clarity, a table was used for presentation of data. Coefficient of correlation(r) test was used to explore the relationship between independent and dependent variables. Throughout the study 1% (0.01) and 5% (0.05) level of probability were used to reject the null hypothesis.

CHAPTER 4

FINDINGS AND DISCUSSIONS

Vegetable growers have many interrelated attributes that are considered to be integral part of their behavior and personality. The behavioral characteristics of the vegetable growers influence them in adopting IPM practices. Ten characteristics of the vegetable growers were selected purposely and their salient feature presented below (Table 4.1). The results of the study and interpretations have been presented in three separate sections of this chapter. The first section deals with the selected individual characteristics of the respondents while the second section deals with the extent of use of IPM practices. The third section deals with the relationships between the respondents' selected characteristics and their extent of adoption of IPM practices.

4.1 Selected Characteristics of the Respondents

4.1.1 Age

Age of the respondents ranged from 16-65 years with the average of 43.52 and standard deviation of 11.8. Based on their age, the respondents were classified into three categories as shown in the Table 4.1. Data presented in the table indicates that the highest proportion (59 percent) of the vegetable growers were in middle group ranged from 31-50 years, while 14 percent and 27 percent belonged to young and old aged category. However, the data also revealed that 73 percent of the respondents of the study area are young to middle aged category. Young people are generally receptive to new ideas and things. However, they might have valuable opinion regarding adoption of IPM practices.

Table 4.1 Salient feature of the respondents with their characteristics (N=100)

Characteristics	Scoring system	Range		Categories	Farmers		Mean	Standard deviation
		Possible	Observed		No.	Percent		
Age	Actual year	-	16-65	Young aged (up to 30)	14	14	43.52	11.8
				Middle aged (31-50)	59	59		
				Old (above 50)	27	27		
Level of Education	Year of schooling	-	0-14	Illiterate (0)	15	15	6.47	3.9
				Primary level (1-5)	22	22		
				Secondary (6-10)	54	54		
				Above secondary (>10)	9	9		
Family Size	Numbers	-	3-16	Small (up to 4)	28	28	5.98	2.45
				Medium (5-6)	39	39		
				Large (>6)	33	33		
Farm Size	Hectares	-	0.17- 2.53	Marginal (0.02-0.4)	30	30	0.79	0.58
				Small (0.41-1.0)	46	46		
				Medium (1.01-2.5)	22	22		
				Large (>2.5)	2	2		
Annual Income	Computed score (in Thousand)	-	16.7- 160	Low (up to 50)	44	44	60.86	28.91
				Medium (51-100)	47	47		
				High (>100)	9	9		
Organizational Participation	Scale Score		0-41	No participation (0)	40	40	3.23	6.32
				Low participation (1-5)	45	45		
				Medium participation (6-20)	13	13		
				High participation (>20)	2	2		
Extension Media contact.	Scale score	0-42	8-30	Low (up to 14)	21	21	18.36	4.65
				Medium (15-22)	58	58		
				High (>22)	21	21		
Innovativeness	Scale score	0-36	7-20	Low (up to 10)	21	21	13.01	2.95
				Medium (11-16)	66	66		
				High (>16)	13	13		
Knowledge on IPM	Scale score	0-30	10-26	Low (up to 15)	5	5	20.28	2.81
				Medium (16-20)	49	49		
				High (>20)	46	46		
Cosmopoliteness	Scale score	0-21	5-14	Low (up to 7)	19	19	10.02	1.79
				Medium (8-11)	59	59		
				High (>11)	22	22		

4.1.2 Level of Education

Education of a vegetable grower was measured by the level of his formal education i.e. highest grade (class) passed by him. The education score of the respondents ranged from 0 to 14 with the average of 6.47 and standard deviation 3.9. Based on their level of education, the growers were classified into 4 categories as shown in the table 4.1. The data indicate that the majority (54 percent) of the growers had secondary level of education while 15 percent growers were illiterate, 22 percent had primary level and 9 percent had above secondary level of education. The present literacy rate of the country is 65.5 percent (Population census: 2001, BBS). The findings indicate that in the study area, the literacy rate seems to be higher than the national average.

4.1.3 Family Size

The family size of the respondents ranged from 3 to 16, with an average of 5.98 and standard deviation 2.45. The data in Table-4.1 indicate that majority of the respondents fell into medium (39 percent) family category, while 33 and 28 percent had large and small family size respectively. However, 67% percent of the respondents had small to medium family size. The data also indicate that the average family size (5.98 persons) in the study area was equal to the national average of 5.8 persons (BBS: 2002). One third of the respondents belong to large family.

4.1.4 Farm Size

The farm size of the farmers in the study area varied from 0.17-2.53 ha. Majority (46 percent) of the respondents had small farm size compared to 30 and 22 percent with marginal and medium farm size respectively. Only 2 percent of the growers belonged to large farm size. The average farm size of the respondents was 0.79 ha with standard deviation 0.58. Findings show that maximum growers of the study area had small farm size. It may be due to high population.

4.1.5 Annual Income

Annual income of the vegetable growers ranged from 16.7 to 160 thousand taka with the mean of 60.86 and standard deviation 28.91. On the basis of the annual income, the growers were classified into three categories as shown in Table-4.1.Data presented in Table 4.1 show that the highest proportion (47 percent) of the growers had medium annual income, while only 9 percent high and 44 percent had low income. As a result, the most (91 percent) of the growers in the study area had low to medium annual income.

4.1.6 Organizational Participation

Organizational participation scores of the respondents ranged from 0-41 with an average of 3.23 and standard deviation 6.29. It is revealed from the data in the Table 4.1 that a major portion (45 percent) of the respondents had low organizational participation and almost equal number of respondents (40%) had no participation. Only 15% had medium (13%) to high (2%) organizational participation enables the farmers to come in contact with people having diversified experiences and problem solving capabilities. This opportunity enables them to improve their knowledge and skills that results better management activities.

4.1.7 Extension Media Contact

Data furnished in Table 4.1 indicate that greater majority (58 percent) of the farmers of the study area had medium extension media contact while equal proportion of the respondents (21% each) had low and high extension media contact. The average score of extension media contact was 18.36 with standard deviation 4.65. The findings of the study area indicate that most of the respondents had low to medium contact with various information sources for getting agricultural information. Rabbany (2003), Islam (2002), Hussen (2001), Pal (1995), Basher (1993) observed almost the similar findings in their studies.

4.1.8 Innovativeness

Data in Table 4.1 indicate that majority (66 percent) of the respondents had medium innovativeness while 21 percent and 13 percent had low and high innovativeness respectively. The average innovativeness score of the respondents was 13.01 with 2.95 standard deviation. Rabbany (2003), also found almost similar findings in his study. Low extension media contact, low level of education and less cosmopoliteness resulted low innovativeness.

4.1.9 Knowledge on IPM

Scores of knowledge on IPM practices of the respondents could range from 0-30 while the observed score ranged from 10-26 with the average of 20.28 and standard deviation 2.81 as shown in the Table-4.1. Data presented in the table indicate that the highest proportion (49 percent) of the farmers had medium knowledge while 46 percent had high knowledge on IPM. Only 5 percent of the farmers had low knowledge on IPM practices.

4.1.10 Cosmopoliteness

The cosmopoliteness score of the farmers of the study area ranged from 5-14 against the possible range of 0-21. The mean and standard deviation were 10.02 and 1.79 respectively. The Table-4.1 indicates that 59 percent of the farmers had medium cosmopoliteness as compared to 19 percent low and 22 percent high cosmopoliteness respectively.

4.2 Dependent Variable

A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or manipulates the independent variables (Townsend 1953). For this study the extent of adoption of IPM practices was considered the dependent variable.

4.2.1 Comparison among the extent of adoption of selected IPM practices

In order to compare among the selected IPM practices regarding their extent of adoption, an IPM practice Adoption Index (IPAI) was developed following the formula as described in Chapter 3. The IPAIs along with their associated ranks has appeared in Table-4.2.

Table 4.2 Comparison of identified IPM practice adopted by the vegetable growers

N=100

Sl.No	Technologies	Degree of adoption					
		F	O	R	N	IPAI	Rank
1.	Weed management	37	41	18	4	211	1
2.	Use of healthy seeds	43	32	17	8	210	2
3.	Perching in the crop field for controlling insects	23	58	15	4	200	3
4.	Use of light trap for insect control	20	55	25	0	195	4
5.	Practice of crop rotation	27	47	18	8	193	5
6.	Other indigenous method (e.g. application of ashes, Hukkah water etc)	12	31	40	17	138	6
7.	Insect control by hand sweep	16	28	21	35	125	7
8.	Use of pesticides	4	28	54	14	122	8
9.	Collection & destroy eggs and larvae for controlling insect-pests by hand	6	19	39	36	95	9
10.	Cultivation of resistant variety	6	9	10	75	46	10

Abbreviations: F = Frequently, O = Occasionally, R = Rarely, N = Never, IPAI = IPM Practice Adoption Index

Among the 10 identified IPM practices "weed management" ranked first and indicated highest extent of use by the vegetable growers. The 2nd, 3rd and 4th position in the rank order were "Use of healthy seeds," "Perching in the crop field" and "use of light trap" respectively.

It is interesting to note that practice of relatively complex and costly practices were not popular among the vegetable growers. This was indicated by low IPAI values of "Use of pesticides" (IPAI = 122)," "Collection and destroy eggs and larvae by hand"

(IPAI = 95), and "Cultivation of resistant variety" (IPAI = 46). Again the top five practices in the rank order were found more popular among the vegetable growers, because they generally exert immediate and recognizable benefits.

4.2.2 Overall adoption of IPM practices

Observed practices of IPM scores of the vegetable growers ranged from 6-27 against the possible range 0-30. The average and standard deviation were 11.35 and 3.32 respectively. Based on the possible scores, the vegetable growers were classified into three categories as shown in Table 4.3.

Table 4.3 Distribution of FFS vegetable growers according to the adoption score of IPM

Categories	Frequency	Percent	Mean	Standard deviation
Low adoption (up to 10)	5	5	11.35	3.32
Medium adoption (11-16)	63	63		
High adoption (>16)	32	32		

Data presented in the Table 4.3 indicate that 95% of the respondents had medium (63%) to high (32%) adoption of IPM practices, while only 5% fell into low category. This finding of adoption of IPM practices by the growers is diagrammatically shown in Fig. 4.1.

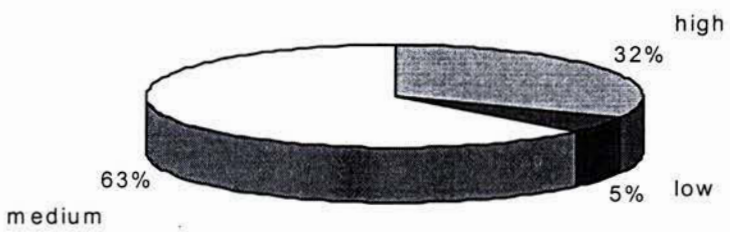

Fig: 4.1 Pie graph showing the extent of adoption of IPM practices by the vegetable growers of Magara district

4.2.3 Categorization of the respondent according to the land use for IPM practices.

Land use of IPM practices were determined by the following formula:-

$$\text{Land use for IPM} = \frac{\text{Land for IPM}}{\text{Total land}} \times 100$$

Observed land use for IPM practices ranged from 7-82 percent, with mean 33.83 and standard deviation 16.4.

Table 4.4 Distribution of vegetable growers according to their land use for IPM practices.

Categories	Frequency	Percent	Mean	Standard deviation
Low (1-25%)	35	35	33.83	16.4
Medium (26-50%)	45	45		
High (>50%)	20	20		

Data presented in the Table 4.4 indicates that highest proportion (45 percent) of the vegetable growers were medium category for their land use of IPM, while 35 percent and 20 percent of the growers fell into low and high categories respectively. This is shown in the figure 4.2.

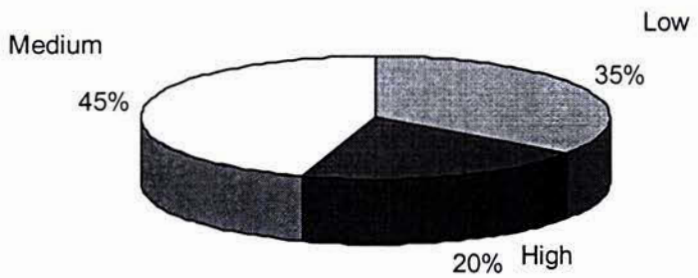

Fig: 4.2 Pie graph showing percentage of vegetable growers according to their land use for IPM practices.

4.2.4 Adoption quotient

Adoption quotient is the ratio scale designed to quantify the adoption behaviour of an individual (Chattapadhay, 1963). The method of adoption quotient is more accurate as it involves all the related concepts like potentiality, extent, time consistency and weightage.

To determine the extent of adoption of IPM practices by the vegetable growers, adoption quotient was calculated by the following formula:

$$A.Q. = \frac{\text{Mean score of IPM adoption/ Mean adoption period}}{\text{Number of IPM practices}} \times 100$$

$$= \frac{\frac{15.25}{2.15}}{10} \times 100$$

$$= 70.27$$

Here,

Mean score of IPM adoption = 15.25

Mean adoption period =2.17

Number of practices =10

A.Q = Adoption quotient

The adoption quotient of the vegetable growers could range from 0 to 100, where 0 indicate no adoption and 100 indicate highest adoption. More the adoption quotient more the use of IPM practices. Therefore, it could be concluded that the vegetables growers of Magura district had high adoption quotient.

4.3 Relationship between the selected characteristics of the respondents and their adoption of IPM practices

The purpose of this section is to explore the relationships between the selected characteristics of the vegetable growers and their extent of adoption of IPM practices in vegetable cultivation. The selected characteristics constituted the independent variables which were age, level of education family size, farm size, annual income, organizational participation extension media contact, innovativeness, knowledge on IPM practices and cosmopoliteness. Extent of adoption of Integrated Pest

Management practices on vegetable cultivation was the dependent variable. Spearman's coefficient 'r' has been used to test the null hypothesis. The null hypothesis was stated in chapter 3. The summary of the result of the correlation coefficient analysis has been presented in Table 4.5.

Table 4.5 Co-efficient of Correlation showing relationship between selected characteristics of the vegetable growers and their adoption of IPM practice

Characteristics of the respondents	Correlation coefficient (r) with adoption of IPM practices	Table Value	
		0.05	0.01
Age	0.025^{NS}	0.199	0.255
Level of education	0.586^{**}		
Family size	0.218^{*}		
Farm size	0.350^{**}		
Annual income	0.552^{**}		
Organizational participation	0.461^{**}		
Extension media contact	0.321^{**}		
Innovativeness	0.243^{*}		
Knowledge on IPM	0.444^{**}		
Cosmopoliteness	0.465^{**}		

NS = Not significant

* = Significant at 0.05 level (2-tailed)

** = Significant at 0.01 level (2-tailed)

d.f. = 98, N= 100

4.3.1 Relationship between age of the vegetable growers and their adoption of IPM practices

The relationship between age of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis.

Coefficient of correlation of the concerned variable was found to be r= 0.025 as shown in Table 4.5. This led to the following observations regarding the relationship with the variable under consideration.

a) There exists no relationship between the variables.
b) The compared value of 'r' (0.025) was smaller than the table value (r = 0.199) with 98 degree of freedom at 0.05 level of probability.

On the basis of the above findings, the null hypothesis could not be rejected. Hence, the researcher concluded that age of the vegetable growers had no significant relationship with their adoption of IPM practices. Similar findings were also observed by Rahman (1986), Rabbany (2003) and Rahman (2001) in their respective studies.

Although most researchers proved that age has no significant relationship with dependent variables, but it is true that age is considered to be the crucial factor in decision making process.

4.3.2 Relationship between education of the vegetable growers and their adoption of IPM practices.

The relationship between education of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis.

Correlation coefficient of the concerned variable was found to be 0.586 as shown in the Table 4.5. This led to the following observation regarding the relationship with the variable under consideration:

a) The relationship showed a positive trend.
b) The computed value of 'r' (0.586) was larger than table value (r = 0.255) with 98 degree of freedom at 0.01 level of probability.

On the basis of above findings, the null hypothesis was rejected and hence, it can be concluded that education of the vegetable growers had a significant and positive relationship with their adoption IPM practices.

Also the findings indicated that more education of the vegetable growers leads to a tendency towards more adoption of IPM practices. Education has direct influence in adoption of an innovation. Hossain (1971), Hoque (1993), Khan (1993), Pal (1995) and Roy (1997) also found positive and significant relationship between the farmers, education and their adoption of modern technologies.

4.3.3 Relationship between family size of the vegetable growers and their adoption of IPM practices

The relationship between family size of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis. Coefficient of correlation with the concerned variable was found to be 'r' = 0.218 as shown in the Table-4.5. This lead to the following observations regarding the relationship with the variable under consideration:

a) The relation showed a positive trend.
b) The computed value of r (0.218) was higher than the table value (r = 0.199) with 98 degree of freedom at 0.05 level of probability.

On the basis of the above finding, the null hypothesis was rejected and hence, it can be concluded that family size of the vegetable growers had a significant and positive relationship with their adoption of IPM practices. Similar findings were observed by

Chowdhury (1997), Okoro and Obibuaka (1992) in their respective studies.

Family factors are also related to the adoption of farm practices. Family members often serve as referents or consultants in decisions to adopt new farm practices.

4.3.4 Relationship between farm size of the vegetable growers and their adoption of IPM practices

The relationship between farm size of the vegetable growers and their adoption of IPM practices were examined. Coefficient of correlation with the concerned variable was found to be 0.350 as shown in the Table-4.5. This led to the following observations regarding the relationship with the variable under consideration:

a) The relationship showed a positive trend with the concerned variable.
b) The computed value of r (0.350) was higher than the table value (r= 0.255) with 98 degrees of freedom at 0.01 level of probability.

On the basis of above findings, the null hypothesis was rejected and hence, it can be concluded that farm size of the vegetable growers had a significant and positive relationship with their adoption of IPM practices. Gogoi and Gogoi (1989), Mohammad (1974), Oroko and Obibuaka (1992), Islam (2002) also found the similar findings in his study.

This may be due to a farmer having more land able to take risk in adopting any technology. Both large and small farm size can positively influence over in the adoption of innovation.

4.3.5 Relationship between annual income of the vegetable growers and their adoption of IPM practice

The relationship between annual income of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis. Coefficient of correlation of the concerned variable was found to be r = 0.552 as shown in Table-4.5. This led to the following observations regarding the relationship with the variable under consideration.

a) The relationship showed a positive trend with the concerned variable.
b) The computed value of r (0.552) was higher than the table value (r = 0.255) with 98 degrees of freedom at 0.01 level of probability.

On the basis of above findings, the null hypothesis was rejected and hence the researcher concluded that annual income of the vegetable growers had a significant and positive relationship with their adoption of IPM practices. Rabbany (2003), Mohammad (1974), Khan (1993), and Pal (1995) also found the similar findings.

High farm income nearly always is associated with high farm practice adoption levels and low-income farmers are slow to adopt practices. A reciprocal cause-and-effect relationship is likely. Quick adoption of new farm practices leads to higher income.

4.3.6 Relationship between organizational participation of the vegetable growers and their adoption of IPM practices

The relationship between organizational participation of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis:

Coefficient of correlation of the concerned variables was found to be r = 0.461 as shown in Table 4.5. This led to the following observations regarding the relationship with the variable under consideration:

a) The relationship showed a positive trend.
b) The computed value of r (0.461) was larger than the tabulated value (0.255) with 98 degrees of freedom even at 0.01 level of probability.

On the basis of above finding, the null hypothesis was rejected. Hence, the researcher concluded that organizational participation of the vegetable growers had a significant and positive relationship with their adoption of IPM practices. Hoque (1993), Hossain (1971) Khan (1993), Mohammad (1974), and Rabbany (2003) also observed the similar findings in their studies.

Organizational participation in very influential factor in adoption of innovation. A farmer having participation in any organization may quickly adopt new practices.

4.3.7 Relationship between extension media contact of the vegetable growers and their adoption of IPM practices

The relationship between extension media contact of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis.

Coefficient of correlation of the concerned variables was found to be r = 0.321 as shown in Table 4.5. This led to the following observations regarding the relationship with the variables under consideration:

a) The relationship showed a positive trend
b) The computed value of r (0.321) was larger than the table value (0.255) with 98 degrees of freedom even at 0.01 level of probability.

On the basis of above findings, the null hypothesis was rejected. Hence, the researcher concluded that extension media contact of the vegetable growers had a significant and positive relationship with their adoption of IPM practices.

Farmers become aware of the improved agricultural practices through the various extension communication media. Farmers having no or low extension contact are expected to be low in adoption of improved cultural practices because of their knowledge about the practices. It is likely that farmers with high extension contact received more information on farm affairs which strengthened the base of their agricultural knowledge. Such knowledge was probably conducive to motivate the farmers towards adoption of modern Boro rice. (1990), Bashar (1993), Pal (1995), Rabbany (2003), Mohammad (1974), and Roy (1997) also found the similar results.

4.3.8 Relationship between innovativeness of the vegetable growers and their adoption of IPM practices

The relationship between innovativeness of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis.

Coefficient of correlation of the concerned variables was found to be r = 0.243 as shown in the Table 4.5. This led to the following observation regarding the relationship with the variables under consideration:

a) The relationship showed a positive trend.
b) The computed value of r = 0.243 was higher than the table value (r = 0.199) with 98 degrees of freedom at 0.05 level of probability.

On the basis of above findings, the null hypothesis was rejected and hence the researcher concluded that innovativeness of the vegetable growers had a significant and positive relationship with their adoption of IPM practices. Mohammad (1974), Rahman (1973) Hossain (1999), and Islam (2002) also found similar result in their respective studies.

4.3.9 Relationship between knowledge on IPM of the vegetable growers and their adoption of IPM practices

The relationship between IPM knowledge of the vegetable growers and their adoption of IPM practices was examined by testing the concerned null hypothesis.

The computed value of correlation coefficient of the concerned variable was found to be r = 0.444 as shown in Table 4.5. This led to the following observations regarding the relationship with the variable under consideration:

a) The relationship showed a positive trend.
b) The computed value of r (0.444) was greater than the table value (r = 0.255) with 98 degrees of freedom at 0.01 level of probability.

Based on the above findings, the null hypothesis was rejected and hence, the researcher concluded that the knowledge of IPM practices of the vegetable growers had a significant and positive relationship with the adoption of IPM practices. Hoque (1993), Alam (1997), Sardar (2002), Rabbany (2003) also found similar results in their respective studies. The farmers who have more knowledge about an innovation, have a tendency to adopt that innovation.

4.3.10 Relationship between cosmopoliteness of the vegetable growers and their adoption of IPM practices

The relationship between cosmopoliteness of the vegetable growers and their adoption of IPM practices was examined. Coefficient of correlation of the concerned variables was found to be r = 0.465 as shown in Table 4.5. This led to the following observations regarding the relationship with the variables under consideration:

a) The relationship showed a positive trend.
b) The computed value of r (0.465) was larger than table value (r = 0.255) with 98 degrees of freedom at 0.01 level of probability.

On the basis of above findings, the null hypothesis was rejected. Hence, the researcher concluded that cosmopoliteness of the vegetable growers had a significant and positive relationship with their adoption of IPM practices. Similar findings were also observed by Hoque (1984), Khan (1993), Roy (1997), Hoque (1993), Rahman (2001), Aurangozeb (2002), Hossain (2003) and Rabbany (2003) in their respective studies.

The finding also justifiable because the cosmopolitant farmers might have more extension exposure, which influences them towards the adoption of IPM practices.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In this chapter summary of findings, conclusions and recommendations of the study are presented:

5.1 Summary of the Findings

5.1.1 Selected Characteristics of the Respondents

Age: Age of the respondents ranged from 16-65 with an average 43.52 years. The highest proportion (59 percent) of the respondents was middle aged.

Level of Education: Education score of the respondents ranged from 0-14 with the average of 6.47. The highest proportion (54 percent) of the respondents was secondary level followed by 15 percent illiterate.

Family Size: The highest proportion (39 percent) of the vegetable growers had medium (5-6 members) family, which was followed by 33 percent of large family (>6) and 28 percent small family. The average family size coincides with the national average.

Farm Size: Farm size of the respondents ranged from 0.17-2.53 hectares. The average farm size was 0.79 hectares and highest proportion (46 percent) of the respondents had small farm size followed by 30 percent marginal, 22 percent medium and only 2 percent large farm size.

Annual Income: Annual income of the respondents ranged from 16.7-160 thousand taka with an average of 60.86 thousand. The highest proportion (47 percent) of the vegetable growers and medium annual income compared to 44 percent low and 9 percent had high annual income.

Organizational Participation: Organizational participation scores of the respondents ranged from 0-41 with an average 3.23. The highest (45%) proportion of the respondents had low organizational participation followed by no organizational participation, However, only 15 percent of the respondents ranged from medium (13%) to high (2%).

Extension Media Contact: The extension media contact of the respondents ranged from 8-30 with an average of 18.36. The highest proportion of the vegetable growers (58 percent) belonged to medium extension media contact category followed by low and high categories containing 21 percent each.

Innovativeness: Innovativeness score of the respondents ranged from 7-20 with an average of 13.01. The majority (66 percent) of the respondents belonged to medium innovativeness category followed by 21 percent of low innovativeness category and 13 percent had high innovativeness.

Knowledge on IPM: Knowledge score of the respondent ranged from 10-26 with the average of 20.28. The highest (49 percent) of the respondents belonged to medium knowledge category followed by 46 percent had high knowledge on IPM.

Cosmopoliteness: The cosmopoliteness score of the respondents ranged from 5-13 with the average of 10.02. The highest portion of the vegetable growers (59 percent) belonged to medium cosmopoliteness followed by 19 percent and 22 percent of the respondents had low and high cosmopoliteness respectively.

5.1.2. Practice of IPM

IPM practice score of the respondents ranged from 6-27, against the possible range 0-30. The average and standard deviation were 11.35 and 3.32 respectively. The highest proportion (63 percent) of the vegetable growers having medium practice and 32 percent and 5 percent having high and low practice respectively.

5.1.3 Relationship of the selected characteristics of the vegetable growers with their adoption of IPM practices

Age and adoption of IPM practices

Age of the vegetable growers had no significant relationship with their adoption of IPM practices.

Level of education and adoption of IPM practices

Education of the vegetable growers had significant relationship with their adoption of IPM practices.

Family size and adoption of IPM practice

Family size of the vegetable growers had significant relationship with their adoption of IPM practices.

Farm size and adoption of IPM practices

Farm size of the vegetable growers had significant relationship with their adoption of IPM practices.

Annual income and adoption of IPM practices

Annual income of the vegetable growers had significant and positive relationship with their adoption of IPM practices.

Organizational participation and adoption of IPM practices

Organizational participation of the vegetable growers had a significant and positive relationship with their adoption of IPM practices.

Extension Media Contact and adoption of IPM practices

Extension media contact of the vegetable growers had a significant positive relationship with their adoption of IPM practices.

Innovativeness and adoption of IPM practice

Innovativeness of the vegetable growers had significant and positive relationship with their adoption of IPM practice.

Knowledge on IPM and adoption of IPM practices

Knowledge on IPM of the vegetable growers had a significant positive relationship with their adoption of IPM practices.

Cosmopoliteness and adoption of IPM practices

Cosmopoliteness of the vegetable growers had a significant positive relationship with their adoption of IPM practices.

5.2 Conclusions

Based on the finding and the logical interpretation of their meaning in light of relevant facts prompted the researcher to draw the following conclusions:

1. Most of the IPM practicing vegetable growers (63 percent) in the study area had medium practice of IPM, while 32 percent had high practices and there was only 5 percent of the respondent fell in low practices category. The finding might be a good scenario for undertaking IPM programme for present and future. Assuming that the finding have a general applicability throughout the country, it could be concluded that the farmers of Bangladesh are welcoming IPM practices.

2. Among the ten selected practices, the vegetable growers were found having good extent of IPM practices for a number of practices. Again practices do not exert immediate benefits and somewhat complex and expensive were found relatively less popular. So, IPM practices should be simple and less expensive. Thus it could be concluded that appropriate motivational campaign is necessary for making farmer understand the benefits of all the IPM practices.
3. The findings indicate that majority (73 percent) of the vegetable growers were young to middle aged. Age of the farmers had no relationship with their practices of IPM. It may be concluded that all aged group farmers are equal concerned about IPM strategy.
4. The findings indicate that the FFS vegetable growers had significant positive relationship with their education, family size, farm size, annual income, organizational participation, extension media contact, innovativeness, knowledge on IPM and cosmopoliteness. The FFS farmers can easily learn from FFS center. So it is necessary to establish more FFS and include more farmers in those schooling.
5. Annual income of the vegetable growers had a significant positive relationship with their adoption of IPM practices. This finding led to the conclusion that farmers having relatively high income can easily adopt all the practices of IPM.

5.3 Recommendations

Based on the findings and conclusions of the study the following recommendations are made as follows:

5.3.1 Recommendations for Policy Implication

1. As an overwhelming majority of the vegetable growers were in medium to high practicing of IPM practice category, DAE should carefully consider the findings. Thus IPM programs should be strengthened and the horizon should be bordered. At the same time proper strategy and realistic work plan should be developed to popularize IMP practices.

2. The findings indicate that the vegetable growers prefer those practices, which are comparatively less costly and exert quick benefits. So, DAE should take an appropriate strategy that will be in favour in this regard.
3. As all selected characteristics of the vegetable growers except age had a positive significant relationship with their adoption of IPM practices, the concerned authority should consider those characteristics in transferring any agricultural innovation, to the farmers of all ages.

5.3.2 Recommendation for further study

1. This study was conducted in only two unions of Sreepur upazila under Magura district. Similar study may be undertaken in other parts of the country to justify the findings of the present one.
2. The present study was conducted taking ten selected characteristics of the vegetable growers. Further study may be conducted considering other characteristics of the vegetable growers.
3. The present study has been conducted taking only FFS vegetable growers. Similar study should be conducted taking all categories of the farmers of farming community.
4. Further research may be conducted with farmers' problem confrontation in practicing of IPM.

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APPENDIX-A

Department of Agricultural Extension and Information System Sher-E-Bangla Agricultural University, Dhaka.

An Interview schedule on

"Adoption of IPM practices by the vegetable growers of Magura district."

Sample No.

Name of the respondent

Name .....

Village .....

Union .....

P,S .....

Dist.....

1. **Age:**

   What is your age? ..... Years,

2. **Level of education:**

   Please indicate your educational qualification by putting (√) mark.

   (a) Cannot read and write ( )

   (b) Can sign only ( )

   (c) Studied up to ..... class,

3. **Family Size:** ..... members.

4. Farm size: Please mention your farm size.

Sl. No.	Types of land	Area of land	
		Local unit	Hectare
01.	Homestead area		
02.	Own land under own cultivation		
03.	Own land given to/taken from others on borga		
04	Own land taken from others on lease		
05.	Own land given to others on lease		
06.	Others (fruit garden, pond etc.		
	Total		

5. Annual income

Please mention your annual family income against the appropriate sources.

Sl. No.	Sources of income	Total Price (Taka)
From Agriculture		
01.	Paddy	
02.	Wheat	
03.	Jute	
04.	Sugarcane	
05.	Pulses	
06.	Oils	
07.	Vegetables	
08.	Fruits	
09.	Cattle rearing and dairy	
10.	Poultry rearing	
11.	Fish culture	
From Non-agriculture		
01.	Business	
02.	Service	
03.	Daily wage	
04.	Others	
	Total	

6. Organizational participation

Please mention the nature and duration of your participation in the following organizations.

Sl. No.	Name of the organizations	Duration/Nature of the participation (yrs)			
		No Participation	Ordinary member	Executive Committee Member	Executive Committee Officer
01.	Union parishad				
02.	Chamber of commerce				
03.	Youth Club				
04.	Cultural Organization				
05.	School committee				
06.	Madrasa committee				
07.	Mosque/Temple Committee				
08.	Bazaar Committee				
09.	Cooperative Society				
10.	Rural arbitration committee				
11.	Other				

7. Extension Media contact

Please indicate your frequency of contact with the following media:

Sl No.	Name of the Extension media	Nature of communication			
		Frequently	Occasionally	Rarely	Not at all
a) Individual Contact:					
01.	Sub-asstt. Agri. Officer.	4 or more times/month	1-3 times/ month	3 times/year	Never
02.	NGO workers	4 or more times/month	1-3 times/ month	3 times/year	Never
03.	Other extension worker (eg-health worker BRDB's field officer, Imam etc.)	4 or more times/month	1-3 times/ month	3 times/year	Never
04.	Others (Friends/Relatives reighbours)	4 or more times/month	1-3 times/ month	3 times/year	Never
05.	Thana Agriculture Officer/Additional Agriculture Officer/ Agriculture Extension Officer	At least 1 time/month	At least 1 time/2 months	1-5 times/ year	Never
06.	Agricultural input dealer	4 or more times/month	1-3 times/ month	3 times/year	Never
b) Group contact					
01.	Participation in group discussion	4 or more times/year	2-3 times/ year	1 time/year	Never
02.	Participation in demonstration meeting (Result and method demonstration	4 or more times/month	1-3 times/ month	3 times/year	Never
03.	Participation in Field day/farmers rally	4 or more times/month	1-3 times/ month	3 times/year	Never
04.	Participation in training	3 or more times/ year	2 times/ year	1 time/year	Never
(c) Mass media contact					
01.	Listening Farm Radio talk	4 times/ month	2-3 times/ month	1 time/ month	Never
02.	Watching agricultural program in Television	4 times/ month	2-3 times/ month	1 time/ month	Never
03.	Reading agricultural magazine (Booklet/ Leaflet/Krishi Ktha etc.)	5 or more times/year	3-4 times/year	at least 1-2 times/year	Never
04.	Visiting agricultural fair	3 or more times/ year	2 times/year	At least 1 time/year	Never

8. Innovativeness

Please indicate extent of use of the following modern agricultural practices:

Sl. No.	Name of innovations	Do not use	Used		
			Below 1 year	1-3 years	Above 3 years
01.	Use of green manure in crop cultivation				
02.	Use of Bio-fertilizer				
03.	Use of granular Urea				
04.	Use of Gypsum				
05.	Use of modern agricultural Machineries (Power tiller/pump/ Seed driller)				
06.	Use of herbicide/ weedicide				
07.	Use of light-trap				
08.	Use of seed treater				
09.	Use of Bamboo buster				
10.	Use of pheromon				
11.	Use of hybrid rice seed				
12.	Use of Leaf Colour Chart (LCC)				

9. Knowledge on IPM practices

Please answer the following questions:

Sl. No.	Questions	Full marks	Marks obtained
1.	What do you mean by IPM (Integrated Pest Management)?	2	
2.	Mention two examples of biological control	2	
3.	Mention two examples of mechanical control	2	
4.	Mention two examples of cultural method	2	
5.	What is bamboo buster? What is done by it?	2	
6.	Wheat are the advantages of crop rotation?	2	
7.	What are the benefits of hand sweeping?	2	
8.	What is light trap?	2	
9.	What do you mean by resistant variety?	2	
10.	What is the benefit of insect zoo?	2	
11.	Mention two insects which are controlled by the light trap?	2	
12.	Why perching is done in the crop field?	2	
13.	What are the advantages of weed management?	2	
14.	What are the characteristics of quality seed?	2	
15.	In which stage of pest attack do you apply pesticide?	2	
	Total number	30	

10. Cosmopoliteness

Please indicate how frequently you visit the following places within a specific period.

Sl. No.	Place of visit	Degree of Visit			
		Regularly	Occasionally	Rarely	Not at all
1.	Visit of market/relatives /friends outside of your own village but within your own Union	8 or more times/month	4-7 times/ month	1-3 times/ month	No visit
2.	Visit to other Union	5 or more times/month	3-4 times/ month	1-2 times/ month	No visit
3.	Visit to own Thana head quarter	5 or more times/month	3-4 times/ month	1-2 times/ month	No visit
4.	Visit to own town/headquarter	4 or more times/year	3-4 times/ year	At least once/ year	No visit
5.	Visit to other Thana headquarter	4 or more times/year	3-4 times/ year	At least once/ year	No visit
6.	Visit to other district town/headquarter	3 or more times/year	2 times/year	At least once a year	No visit
7.	Visit to capital city or other metropolitan city	3 or more times/year	2 times/year	At least once a year	No visit

11. Adoption of IPM Practices

(a) Do you control pests in vegetable cultivation? Yes/No.

(b) If yes, Please mention how frequently do you use the following IPM technologies in your crop field

SL. No.	Technologies	Degree of adoption				Year/s of adoption
		Frequently	Occasionally	Rarely	Never	
1.	Insect control by hand sweep					
2.	Use of light trap for insect control					
3.	Collection and destroy eggs and larvae for controlling insect pest by hand					
4.	Adoption of crop rotation					
5.	Perching in the crop field for insect control					
6.	Weed management (Prevention, eradication and control)					
7.	Use of healthy seeds (free from insects and diseases)					
8.	Cultivation of resistant variety					
9.	Use of pesticide					
10.	Other indigenous methods (Spreading ashes/spray of Hukkah water etc.)					

(c) How much land have you taken under IPM ?

Local unit ...../ ..... hectare

Thanks for your Cooperation.

Signature of the interviewer

APPENDIX-B

Correlation matrix of the dependent and independent variables of IPM vegetable growers under Magura district (N=100)

Variables	Practice on IPM	Age	Education	Family size	Farm Size	Annual income	Organizational participation	Extension Media Contact	Innovativeness	Knowledge on IPM	Cosmopoliteness
Practice on IPM	1.000										
Age of the respondent	0.025	1.000									
Year of education	0.586(**)	0.226(*)	1.000								
Family Size	0.218(*)	0.401(**)	0.193	1.000							
Farm Size	0.350(**)	-0.062	0.452(**)	0.485(**)	1.00						
Annual Income	0.552(**)	0.096	0.349(**)	0.307(**)	0.522(**)	1.000					
Organizational Participation	0.461(**)	0.073	0.409(**)	0.095	0.213(*)	0.342(**)	1.000				
Extension Media Contact	0.321(**)	0.174	0.100	-0.012	-0.191	0.244(*)	0.331(**)	1.000			
Innovative ness	0.243(*)	0.281(**)	0.125	0.241(*)	0.220(*)	0.415(**)	0.326(**)	0.327(**)	1.00		
Knowledge on IPM	0.444(**)	-0.164	0.435(**)	0.109	0.411(**)	0.340(**)	0.325(**)	0.027	0.155	1.000	
Cosmopoliteness	0.465(**)	-0.082	0.386(**)	0.342(**)	0.395(**)	0.271(**)	0.207(*)	0.017	0.147	0.305(**)	1.00

** Correlation is significant at the 0.01 level (2-tailed). Table value 0.255

* Correalation is significant at the 0.05 level (2-tailed). Table value 0.199