# A STUDY ON FACTOR AFFECTING THE ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES IN SIRAJGANJ

**NUSAIBA WAHID**

**DEPARTMENT OF MANAGEMENT AND FINANCE**

**SHER-E-BANGLA AGRICULTURAL UNIVERSITY**

**DHAKA-1207**

**JUNE, 2021**

**A STUDY ON FACTOR AFFECTING ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES OF SIRAJGANJ DISTRICT**

**BY**

**NUSAIBA WAHID**

**Reg. No. 19-10089**

**A Thesis**

**Submitted to the Faculty of Agribusiness Management**

**Sher-e-Bangla Agricultural University, Dhaka, in**

**partial fulfillment of the requirements**

**for the degree of**

**MASTER OF SCIENCE (MS)**

**IN**

**MANAGEMENT & FINANCE**

**SEMESTER: JAN-JUNE, 2021**

**Approved by:**

| | |
|---|---|
| **Mosammod Mahamuda Parvin** | **Dr. Md. Sadique Rahman** |
| **Chairman** | **Associate Professor** |
| **Associate Professor** | **Co-supervisor** |
| **Supervisor** | **Dept. of Management and Finance** |
| **Dept. of Management and Finance** | **Sher-e-Bangla Agricultural University** |
| **Sher-e-Bangla Agricultural University** | |

**Mosammod Mahamuda Parvin**
**Chairman**
**Associate Professor**
**Examination Committee**
**Dept. of Management and Finance**
**Sher-e-Bangla Agricultural University**

**Department of Management & Finance**
**Sher-e-Bangla Agricultural University**
**Sher-e-Bangla Nagar, Dhaka-1207**

# *CERTIFICATE*

*This is to certify that the thesis entitled "**A STUDY ON FACTOR AFFECTING ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES OF SIRAJGANJ**" submitted to the Faculty of Agribusiness Management, Sher-e- Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE (M.S.) in MANAGEMENT & FINANCE, embodies the result of a piece of bona fide research work carried out by **NUSAIBA WAHID, Registration No. 19-10089** 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 been duly acknowledged.*

**…….**
**Dated: 22-02-2022**
**Place: Dhaka, Bangladesh**

**Mosammod Mahamuda Parvin**
**Associate Professor**
**Chairman**
**Supervisor**
Department of Management & Finance
Sher-e-Bangla Agricultural University
Sher-e- Bangla Nagar, Dhaka-1207

DEDICATED TO
MY
BELOVED PARENTS

# ACKNOWLEDGEMENT

All praises are due to Almighty Allah, the Great, Gracious and Merciful, Whose blessings enabled the author to complete this research work successfully. Guidance, help and co-operation have been received from several persons or authority during the tenure of the study, the author is grateful to them all who made a contribution to this research work. Although it is not possible to mention all by names it will be an act of ungratefulness if some names are not mentioned here for their immense contribution to the accomplishment of this study.

In particular, the author takes the opportunity to express her deepest sense of gratitude her honorable **Supervisor Mosammod Mahamuda Parvin,** Associate Professor, Department of Management & Finance, Sher-e-Bangla Agricultural University, Dhaka for her continuous inspiration, valuable suggestions, constructive criticism, constant guidance and intensive supervision through the period of the study and preparation of this thesis without her intense co-operation this work would not have been possible.

The author deems proud privilege to extend her extreme gratefulness and best regards to her venerable **Co-supervisor Dr. Md. Sadique Rahman**, Associate Professor, Department of Management & Finance, Sher-e-Bangla Agricultural University, Dhaka for his keen interest, valuable advice, creative suggestions, co- operation and encouragement to bring this thesis up to its present standard.

It is also a great pleasure for the author to express hearty appreciation and regard to all teachers of Department of Management & Finance, Sher-e- Bangla Agricultural University, Dhaka for their affectionate feelings and valuable suggestions during the research work.

The author would like to express her deepest respect and boundless gratitude to Ministry of "National Science & Technology" for its funding to prepare my research.

The author deeply acknowledges the cooperation and sincere help of **Md. Shahidul Islam**, Upazila Agriculture Officer, of Raigonj Upazila and Upazila Extension officer, entrepreneurs and SAAOs of Bahuli union. The author also expresses her heartfelt gratitude to the respondents of the study area who patiently provided the information during the interview with the author.

The author expresses her grateful thanks to all staff and employees of the Department of Management & Finance, Sher-e-Bangla Agricultural University, Dhaka for their co-operation and encouragement to prepare this thesis. Last but not least, the author expresses her deepest sense of gratitude, indebtedness and profound respect to her beloved father, mother, uncles, brothers, sister, relatives and friends for their blessings, encouragement and moral support in all phases of this academic pursuit from beginning to the end. At the end, I beg pardon to my well-wishers, for my inability to provide them all of the time they might have wanted from me.

***The Author***

LIST OF CONTENTS

## LIST OF TABLE

## LIST OF FIGURES



## LIST OF APPENDICES

## ACRONYMS

| | |
|---|---|
| **IPM** | Integrated Pest Management |
| **DAE** | Department of Agricultural Extension |
| **SPSS** | Statistical Package for Social Sciences |
| **FAO** | Food and Agriculture Organization |
| **GDP** | Gross Domestic Product |
| **BBS** | Bangladesh Bureau of Statistics |
| **GOB** | The Government of Bangladesh |
| **ICT** | Information and Communication |
| **BNFE** | Bureau of Non-formal Education |
| **FFS** | Farmers Field Schools |

# A STUDY ON FACTOR AFFECTING ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES IN SIRAJGANJ

**NUSAIBA WAHID**

## ABSTRACT

IPM (Integrated Pest Management) is the management of agricultural and horticultural pests that minimizes the use of chemicals and emphasizes natural and low-toxicity methods. The objectives of the study were to assess the socio-economic profile of the farmers and identifies the factors affecting the adoption of IPM. Primary Data were collected from 100 farmers of 6 village from Sirajganj district. Data were collected between 1 to 17 March 2021 through face-to-face interview. Descriptive statistics and Logistic Regression were employed for the analysis. About 59.41% of farmers partially adopted IPM practices, while only 24.75% of them fully adopted the IPM. About 15.84% of the farmers did not adopt IPM practices. Knowledge on IPM, experience, age, family size were key determinants of the adoption of IPM. To increase the adoption of IPM, the policy makers could invest on improving the facility of training (e.g. farmers field schools) and enhancing the knowledge of the farmers and ensuring the availability of IPM practices can also play a vital role in adoption.

# CHAPTER I

# INTRODUCTION

## 1.1 General background

Bangladesh is an economically agriculture based developing country. Agriculture is the main source of livelihood for the most of the people of Bangladesh. Out of total GDP agriculture constitutes 13.29 percent (BBS, 2020-21). About 50 percent of the population are employed in this sector and about 70 percent people overall depend on agriculture for their livelihood. A significant proportion of the poor relies on agriculture as the key source of income and employment. Indirect dependence on agriculture is reflected through employment in agro-based services and rural enterprises. It is recognized worldwide that there is a need to make an effort to increase food production to meet the demand of the existing as well as the ever-rising population trend. However, the goal of increasing food production is challenged by various factors of which one is pests.

The word 'pest' refers to organisms such as insects, rodents and birds that cause damage or annoyance to man, his animals, crops or possessions. Pests and diseases are the rising problems in the agricultural commodity in the world. Use of pesticides against these problems has been leaving an adverse effect on human health and whole ecosystem, pest outbreak, their resurgence and uprising as well. Pesticides are any substance or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or for regulating plant growth. With the overwhelmingly increased awareness of the growers, consumers, traders and scientific communities in developed and developing countries enormous efforts have been made to look alternatives to the chemical pesticides through either judiciary use of chemicals or through the use of bio-products.

Overuse of pesticides specially in vegetable farming is very common in Bangladesh. There are even instances of daily applications of pesticides in the country (Mian et al. 2016). About half of the pesticides used in vegetable farming have been classified as highly hazardous (Dasgupta et al. 2005). In addition to the health and environmental issues, pesticides increase production costs. Replacing the use of pesticides would bring substantial economic benefit to vegetable farmers in Bangladesh. The Government of Bangladesh (GoB) highlighted environmentally friendly pest management practices

and announced a national integrated pest management (IPM) policy to help farmers to grow healthy crops and increase their incomes on a sustainable basis (GoB 2002). The IPM programme in vegetables in Bangladesh began in 1996 and gained momentum in early 2000 (Rahman et al. 2018).The government took up the project, 'Safe Crop Production through Integrated Pest Management (IPM)' in July 2013 to encourage farmers and support them to grow safe food crops through integrated pest management (IPM) practices. A survey showed that after implementation of the scheme, every year 12.7 per cent of new farmers and 10.4 per cent of land have been included in the IPM system .

IPM is the management of agricultural and horticultural pests that minimizes the use of chemicals and emphasizes natural and low-toxicity methods. IPM farming encourages healthy biodiversity, which plays a critical role in how resilient, or not, a farm is to issues like bad weather, disease, and pests. To avoid the negative effect of pesticides and at the same time to increase the crop production on a sustainable basis, a viable alternative to sole dependence on chemical pesticides is integrated pest management (Zul-Ekram, 2014; Anderson et al.,1996; Migliore et al., 2012; Del Giudice et al., 2018). Several IPM practices such as Pheromone trap, Biological control, Soil solarization, Soil amendments, Grafting, Botanicals and manual cleaning are used in vegetable farming**.** In this context, the present study was undertaken to identifies the factors affecting adoption of practices. Without identifying attributes of low adoption, extension activities will need more time and resources to reach and convince farmers to adopt IPM. It is therefore important to identify the factors affecting IPM adoption for more efficient use of extension resources.

### 1.2 Justification of the study

Integrated Pest Management (IPM) approach has been globally accepted for achieving sustainability in agriculture and maintaining the agro-eco-system. It is more relevant due to a number of advantages like safely to environment, pesticide-free food commodities, low input based crop production. Integrated Pest Management, therefore, emphasizes not only reduction in use of chemical pesticides and keeping the level of pest causing economic injury but also facilitates the use of cultural, physical, mechanical and biological methods of pest control. Although, IPM is the best strategy in crop production program yet this practice could not reach the farmers' field. The

extent of adoption of IPM practices among farmers is not very encouraging. Considering the importance of IPM practices, the present study was undertaken to focus on determining adoption status of IPM practices by vegetable growers as well as identifying the factors that influenced the adoption of IPM practices in vegetable cultivation at Sirajganj district in Bangladesh. As very little research in the field of adoption of IPM in the study areas has been conducted so far, the researcher deemed it timely necessity to undertake the present study entitled ”Factor affecting adoption of Integrated pest Management practices in Sirajganj ”.

### 1.3 Objectives of the study

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

i. To compare the socio-economic status of adopters and non-adopters of IPM;

ii. To identify the factor affecting adoption of IPM practices.

### 1.4 Assumptions of the study

An assumption is the supposition that an apparent fact or principle in true in the light of the available evidence (Good, 1945). The researcher has the following assumption in mind while undertaking this study:

1. The responses furnished by the respondents were reliable. They expressed the truth about their opinion and interest.

2. The researcher who acted as interviewer was adjusted to social and environmental conditions of the study area. Hence, the data collected by her from the respondents where free from bias.

It included in the sample for this study were competent enough to furnish proper responses to the queries included in the interview schedule.

### 1.5 Limitations of the study

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

1. The study was confined to six villages and two Upazila namely Bohuli, Rajapur, Shealkoal, under Sirajganj sadar upazila and Ghurka, Dhangora and Chandaigona under Raigonj upazila of Sirajgang district**.**

2. Characteristics of the farmers were many and varied but few characteristics were selected for investigation in this study.

3. The extent of using IPM practices of farmers was measured on the basis of their response to the selected statements.

4. The findings could be applicable for the study area and similar situations in physical, socio-economic cultural and geographic conditions only.

5. Finally, for collection of information, the researcher had to depend on the data furnished by the respondents during their interview with him. As none of the farmers kept records of their farming activities, they furnished information to the different questions by recall.

6. In some cases, the researcher faced unexpected interference from the over interested side talkers while collecting data from target respondents. However, the researcher tried to overcome the problems as far as possible with sufficient tact and skill.

7. Facts and figures were collected by the investigator applied to the present situation in the selected area.

# CHAPTER II
# REVIEW OF LITERATURE

## 2.1 Literature Review on content of Adoption of Integrated Pest Management

The goal of this Chapter is to represent the findings of previous researchers related to the investigation. The reviews are accessibly existed here based on the major objectives of the study. This Chapter consists of two sections. The first section deals with the extent of use of integrated pest management practices by the cultivators; second section is dedicated to the reason behind non-adoption of IPM technology.

**Rahman M.H. (2021)** it was evident that the adoption of IPM practices by mango growers was in satisfactory level. The IPUI index underlined that mango growers are used pesticides at high level from early stage of flowering to fruit maturity for controling the insect-pests and diseases with minimal use of other ecofriendly management tools. The adoption of IPM practices was influenced by several key factors, including contact with IPM club, IFMC, FFS and annual income from mango cultivation. Overall, it is worth mentioning that the initiatives to increase these facilities to cover a larger part of the mango growers could play an important role toincrease the adoption of IPM practices.

**Rahman (2020)** The study identifies that about 29% of the initial adopters dis-adopted IPM practices. Poor understanding of the concept of IPM may have contributed to a somewhat higher initial adoption and subsequent dis-adoption. The farmers who have larger farm size, own spraying machines, and have perceived that IPM needs more time to work dis-adopted the IPM practices. On the other hand, likelihood of dis-adoption was lower for farmers who were member of societal organization, live near the extension office, and who were aware of the beneficial effects of IPM.

The adoption of IPM was positively associated with farmers' education, spouses' education, large farm size, mass media coverage, and high perception of pesticide applications cost.

**Rashid and Rahman (2020)** The study indicate that some differences in selected characteristics (distance to highway, training, contact with neighbor, chemical fertilizer, and material cost) were significant between adopters and non-adopters, while other characteristics were almost identical. Significant differences between adopters and non-adopters in terms of training and contact with neighbouring farmers suggest

that the farmers-to-farmers extension approach may play an important role in the adoption process. More than 45% of the farmers agreed that IPM can easily be integrated with traditional pesticide-based pest control technologies for better results. It is also clear that a large proportion of the farmers did not know anything about the beneficial effects of IPM, which indicates that the IPM concept is still not clearly understood by farmers. More awareness building programmes should be arranged in the study areas to encourage farmers to reduce harmful pesticide applications.

**Rahman (2020)** This study categorized vegetable farmers into four groups on the basis of complexity in the use of IPM practices. Descriptive statistics suggested that most farmers were in the group of medium adopters, while only 4.2% were in the group of high adopters. This finding indicates that growers are reluctant to adopt complex IPM practices. Perception analysis revealed that about one-third of the farmers had no idea that IPM is an environmentally friendly pest control approach that can be integrated with traditional pesticide-based pest control measures. This finding may be due to the fact that farmers in developing countries, like Bangladesh, have very little access to training and extension services, while access to advice was found to have a positive contribution to farmers' knowledge of pesticide handling. Due to lack of knowledge and awareness, farmers may not be able to reduce pesticide applications to a large extent.

**Mueller, Stewart *etl* (2020)** This study suggests that IPM may benefit from a rebranding or renaming, as it is difficult for potential consumers and users to understand and identify. It should focus not only on educating farmers about IPM, but also on consumers who drive demand and thus influence the production of food and partnering with design faculty and students, who specialize in visual communication to stakeholders, is an example of focusing on the 'human aspect' needed to increase IPM adoption, Some of the most important outcomes of this project include the non-specialist identification of six IPM Challenges and the development of seven Key Messages for IPM communication efforts. Focusing on Key Messages in future IPM communication projects may serve as a way to more successfully impact intended stakeholders and increase IPM adoption.

**Alwang, Larochelle *etl*** (2019) This study suggest that IPM technologies are not widely adopted in lower-income countries. It attributes low adoption to outreach and training

deficiencies, poorly aligned incentives (such as subsidies for pesticides), and insufficient farmer management skills, among others. Access to information about IPM and sufficient training in IPM techniques are clear obstacles to broader adoption. As a result, most IPM programs have components to overcome these barriers, but lack of information may not be the only obstacle. It is considered that farm size to be a significant determinant of IPM adoption, and those that do (e.g. find the size effect to be rather small. One explanation for low spread may be that IPM is not profitable for large-scale innovating farmers who tend to lead others in their adoption of new technologies.

**Dara (2019)** This paper showed the influence of these factors on development, outreach, and successful implementation of IPM practices around the world. Since IPM is a part of agriculture, which is a consumer-oriented enterprise, and agriculture is a part of global trade, which is influenced by several other factors, By reconfiguring the components and including various factors that influence them, the new IPM model provides a template for focusing on different areas of the paradigm and to encourage collaboration among different disciplines. This new model is expected to guide IPM strategies around the world to develop and implement sustainable agricultural practices to ensure profitability for the growers, affordability to consumers, and food security to the growing world population.

**Norton and Rahman (2019)** This study shows that Adopters, on average, used more seedlings than non-adopters. Non-adopters applied more synthetic fertilizer than adopters. Comparison between the two groups indicated they were similar in terms of farm size, number of active members, distance to market and extension contacts. There is the possibility to improve technical efficiency level of growers. Few eggplant growers adopted the full package of IPM and only a few trainings and demonstrations were conducted in the study areas which may explain the lack of difference between groups. More training and field days to familiarize eggplant growers with IPM may improve returns to growers. Adoption of IPM has cost advantages and increases returns from eggplant cultivation.

**Rahman (2019)** Findings indicate that IPM training and other farmer decisions to adopt can significantly influence the adoption decision of the primary farmers. Additional awareness-building program and field visits to disseminate information about bitter gourd IPM practices should increase adoption. Additional training sessions and field demonstrations are warranted to increase the efficiency level of the adopters. The

findings also reveal that IPM adoption reduced the pesticide applications, which may result in environmental benefits. IPM adopters received marginally higher yield than non-adopters, which may have a positive effect on the income of the growers. Hence, there is a scope for raising the role of vegetable IPM in anti-poverty program in Bangladesh.

**Despotovic, F., Rodic, V. *etl*** (2019) The study reveals that it is necessary to promote positive attitudes toward the usefulness of IPM for farmers, society and the environment. By means of a language that is familiar to them, farmers should be sensitized to the benefits that they could gain from including more environmental practices in their farm management and trained to develop all the technical practices and capacities needed. Indeed, training on IPM practices may enable farmers to reduce pesticide use by increasing farmers' capacity to critically evaluate inputs and their effects on natural resources. Based on the results of this study, farm size was found to be significantly and negatively associated with the adoption of IPM while other variables such as environmental knowledge, the level of education and the use of extension service have not been identified to have a significant role in the IPM adoption.

**Heberling, Bruins *etl*(2018)** The study focused on a wide range of factors such as information, profits (farm income and off-farm income), land tenure, farm size, experience, and education. Certain factors, studied in isolation, show a clear and positive effect on IPM adoption; these include access to credible information, government subsidies, environmental consciousness, and profitability of practices. The effects of some other factors, including farm size, land tenure, diverse operation, farmer experience, education, age, gender, political views, and social political beliefs, were unclear or debatable**.** We also find that further progress has been made to elucidate the roles of social norms and peer pressure and the influence of macro factors such as geographic regions, policies, markets, business, with their associated uncertainty and risks**.**

**Thapa (2016)** It has been found that the number of female participant (63%) is more than the male (37%) but they did not give more time in the field due their busywork in household task. From the discussion with participants it was also found that most of the females were illiterate, so they could not identify applied methods; types of useful and harmful pests; preparation of organic fertilizers; usefulness of biopesticides and

botanical pesticides etc in the study area. It is also found that only 5% participants of Farmer's Field School (FFS) are following IPM practices in their own farm after taking training. Other 95% farmers are not following the IPM practice in their field. a significant difference has been found in the knowledge about the amount of pesticide used, biological method of pest control for IPM by FFS participant and nonparticipant farmers, it is not observed in their behavior during the cultivation of crops in the farm.

**Rainis and Kabir (2015)** This study assessed what extent the vegetable growers adopt IPM technologies as well as analyzed barriers of adoption of these environment friendly technologies by considering the issue of non-adopters. The findings revealed less than one third farmers (30%) adopted IPM practices. The results also revealed that the rest farmers did not adopt IPM because of several barriers among which lack of knowledge about IPM, lack of training facility and inadequacy of IPM materials were the three most important. Besides, factors analysis revealed farmers faced by three types of barriers namely; social, institutional and management while institutional barriers were the most important to them.

**Ghimire, B. and Kafle, N. (2014)** The result revealed that the adoption level of IPM practice increases with the increase of trainings and group approach of extension while adoption level decreases with the increase in age of the farmers. For best adoption trainings should be provided to younger farmers. IPM farmer field school is playing significant role in the process of adoption. Farmers in the study area are more concerned with environment and soil health. Further, adoption level can also be raised by making available of those tools and materials used in IPM practice. The study revealed that about 53 percent of farmers were satisfied with the practice. The findings of this study can also be used as reference for adoption of other agricultural technologies in the district.

**Rainis and Kabir (2014)** The survey of the study revealed that the adoption rate of IPM is 30 %. From the result, it can be said that majority of the farmers were still far behind the IPM adoption. The study also discovered that the adoption of IPM is influenced by several factors, including the farmer field school training, land ownership status, perception toward IPM, use of improved varieties and extension contact. Farmers who had training facilities and frequent extension contact were more interested in adopting IPM. Therefore, it is worth mentioning that the initiatives to increase these facilities to cover a greater part of the farmers play an important role to increase the

adoption of IPM. Besides, because of the time of farmer selection for training and extension contact, emphasis should be given to those who are tenant farmers, use local variety and belong to the unfavorable perception toward IPM. As the study revealed, the more the use of improved verities the more the probability of IPM adoption.

**Satya Gopal** et al. (2014) indicated that, lack of knowledge was perceived as the major constraint in adoption of IPM technologies in rice and was ranked first by the rice farmers. Trichogramma, Pheromone traps, Light traps, Clipping of leaf tips, dipping of nursery bundles in insecticidal solution were the major technologies being not adopted or discontinued by the rice farmers because of Lack of proper knowledge in those technologies. This might be due to fact that the above technologies require more comprehension for its adoption by the farmers.

**George, S. and Hegde, M.R. (2013)** The study revealed that IPM package was not adopted by majority of the farmers due to various reasons. The important among them being the non- availability of critical inputs locally for adoption of IPM package and farmers had not understood the philosophy of IPM. They revert back to chemical methods of pest and disease control because it gives knock down effect and shows immediate results. In order to make them adopt the IPM package, FFS was initiated with the objective of convincing the farmers about the philosophy of IPM; facilitating the identification and effective management of pest and diseases. For this purpose an IPM team was constituted with scientists from the divisions of plant pathology, entomology, vegetable crops, soil science and agricultural extension

**Rainis and Kabir (2013)** The study finds that adoption of IPM is influenced by a number of factors that can be classified into four broad items like economic, social, institutional, and management. The importance of economic factors is more among all while the influences of management factors are comparatively less. It also find that measurement adoption with proportional measure is comparatively better than others to determine the level or rate of IPM adoption.

**Rainis and Kabir (2013)** This study mainly focused on the present scenario and future prospect of IPM. Additionally, DAE and NGOs should create more training facilities to cover all categories of farmers especially the small and medium farmers, who are the majority in number (57 % of total farmers) but have low risk bearing capability. Another significant issue is IPM farming is more profitable than conventional farming

in social, economic and environmental aspect. Relative advantage is an important criterion of technology adoption.

**George, S., Hegde, M.R. *etl* (2012)** It was found that majority of the vegetable growers (63.7 per cent) had medium adoption level of IPM practices. So there is scope for increasing adoption of IPM in vegetable crops. It is concluded that with the increased level of education, social participation, land holding, annual income, risk orientation, economic motivation , attitude towards IPM, information seeking behaviour, mass media contact, vegetable growers' adoption level also increased. Overcoming psychological barriers occurs in any change process and IPM is no exception. IPM practices may promise ecological sustainability, environmental conservation and even better health for the society, but they must undergo social acceptance by farmers. Until IPM practices are demonstrated in farmers' fields, and then their potential in pest management will remain illusive.

**Borkhani, F., Fami, H. *etl* (2011).** . The study's findings revealed that paddy farmers were relatively middle-aged and agricultural experience of most of them was higher than 20 years. Farmers based on experiences and indigenous knowledge, were self-made. They were combined new knowledge with their experiences and use in farm management decisions. The findings revealed that farmers' attitude toward IPM practices and the extent of IPM practices application were correlated. For improving farmers' attitude, it is recommended that extension agents state clear advantages of IPM practices. Using delivery methods such as field demonstration and farmer field schools (FFS) are proper methods to achieve this purpose.

**George, S. and Hegde, M.R. (2010)** This study reveals useful information for better understanding common problems in tomato production in the study area and farmers' knowledge of integrated pest management. Some farmers had adequate knowledge about the impact of IPM practices in tomato production, but there were significant gaps in farmers' knowledge concerning IPM practices. Farmers needed training about integrated pest management strategies to ensure sustainable tomato production, as there is still great room for farmers to improve their knowledge. On issues related to IPM, the extension services should be certainly strengthened. Promoting new concepts, such as IPM for environmentally friendly crop protection to farmers is crucial, but not sufficient. Related to the new concepts training and extension services are also needed.

# CHAPTER III

# METHODOLOGY

Research methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic. In a thesis, the methodology section allows the reader to critically evaluate a study's overall validity and reliability. Methodology deserves a very careful consideration in conducting scientific research. Importance of methodology in conducting any research cannot be undermined. Methodology enables the researcher to collect valid and reliable information and to analyze them properly to arrive at correct decisions. Keeping this point in view, the researcher took utmost care for using proper methods in all the aspects of this piece of research work. Methods and procedures followed in conducting this study has been described in this chapter.

## 3.1 Method used in the study

In assessing the characteristics comparison between Adopter and no adopter farmer and factors affecting adoption of IPM several researchers have adopted several techniques in forming their research methodology. Adoption of methodology depends on the researcher idea that what kinds of methods are best appropriate to reach their research objectives. No single method can be told as the universal method to assess the characteristics comparison between adopter and non-adopter farmer. A brief overview of the study with used methods is given in the following flowchart.

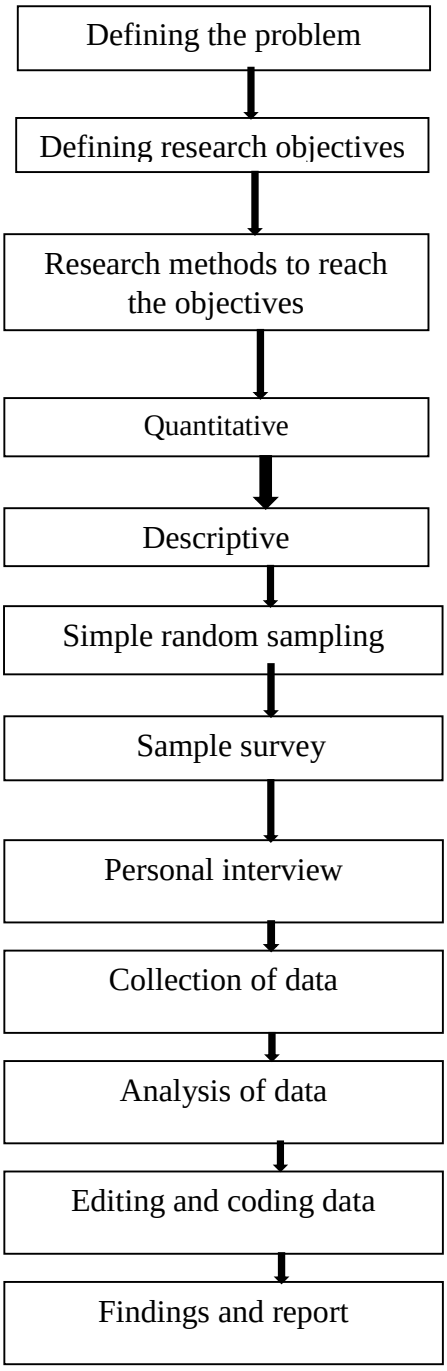


**Figure 3.1: Flow-chart of current research**

### 3.2 The Locale of the Study

Bahuli and Shealkoal unions of Sirajganj Sadar Upazila and Ghurka, Dhangora, Chandaighona Unions of Raigpnj Upazila under Sirajganj district was purposefully selected due to easy communication as well as easy contact with the farmers. According to the guidance of the research supervisory committee two Upazila with IPM as the more cultivated crop were to be the study area of the present research. Six villages were selected from selected two unions. Sirajganj is a district in Northern Bangladesh. It is a part of the Rajshahi Division. 2497.95 square kilometers (964.46 square miles). 2497.95 square kilometers (964.46 square miles).

### 3.3 Population and Sampling Design

The farmers of the selected villages were the population of the study. The total numbers of farmers are 200 in these six villages and 100 farmers were selected for this study where adopted and non-adopted farmer both are included. Half of the populations were selected purposively from each village as the sample of the study. So, 62 farmers are practicing IPM and 38 are not practicing IPM, farmers were the sample of the study. If anyone included in the original sample were unavailable during data collection, the next farmers regarding that list were considered turn by turn for collecting data. The distribution of populations, sample and reserve list are shown in the Table 3.1

Table 3.1 Distribution of sample

| District | Upazila | Village | Sample size | population |
|---|---|---|---|---|
| Sirajganj | Sirajganj Sadar | Bahuli | 25 | 50 |
| | | Rajapur | 9 | 18 |
| | | Shealkhol | 7 | 14 |
| | Raigonj | Dhangora | 19 | 38 |
| | | Ghurka | 21 | 42 |
| | | Chandaikona | 19 | 38 |
| | | Total | 100 | 200 |

*Field survey: March,2021

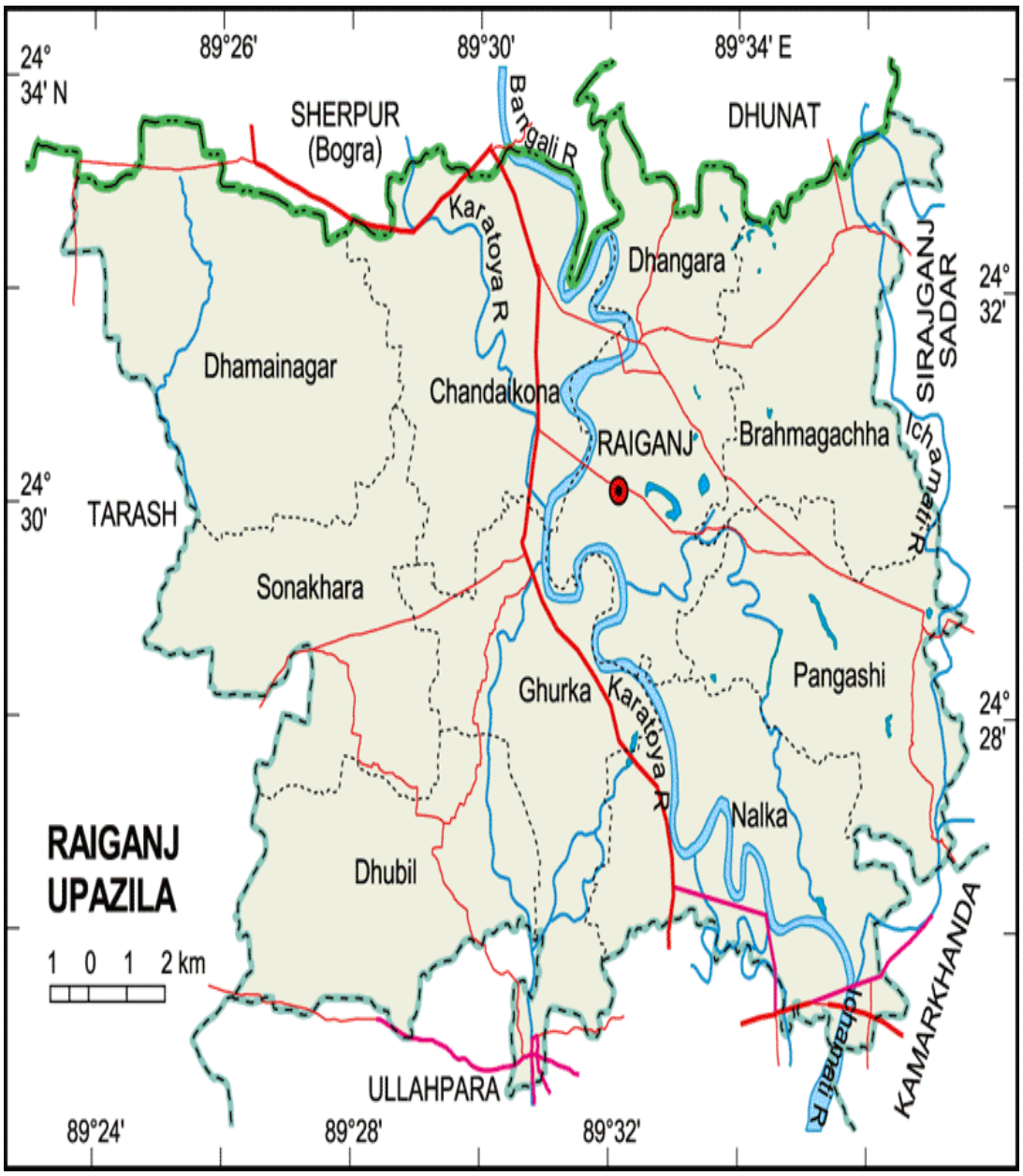


**Fig: 3.2 A map of Sirajganj district showing Raigonj upazila.**

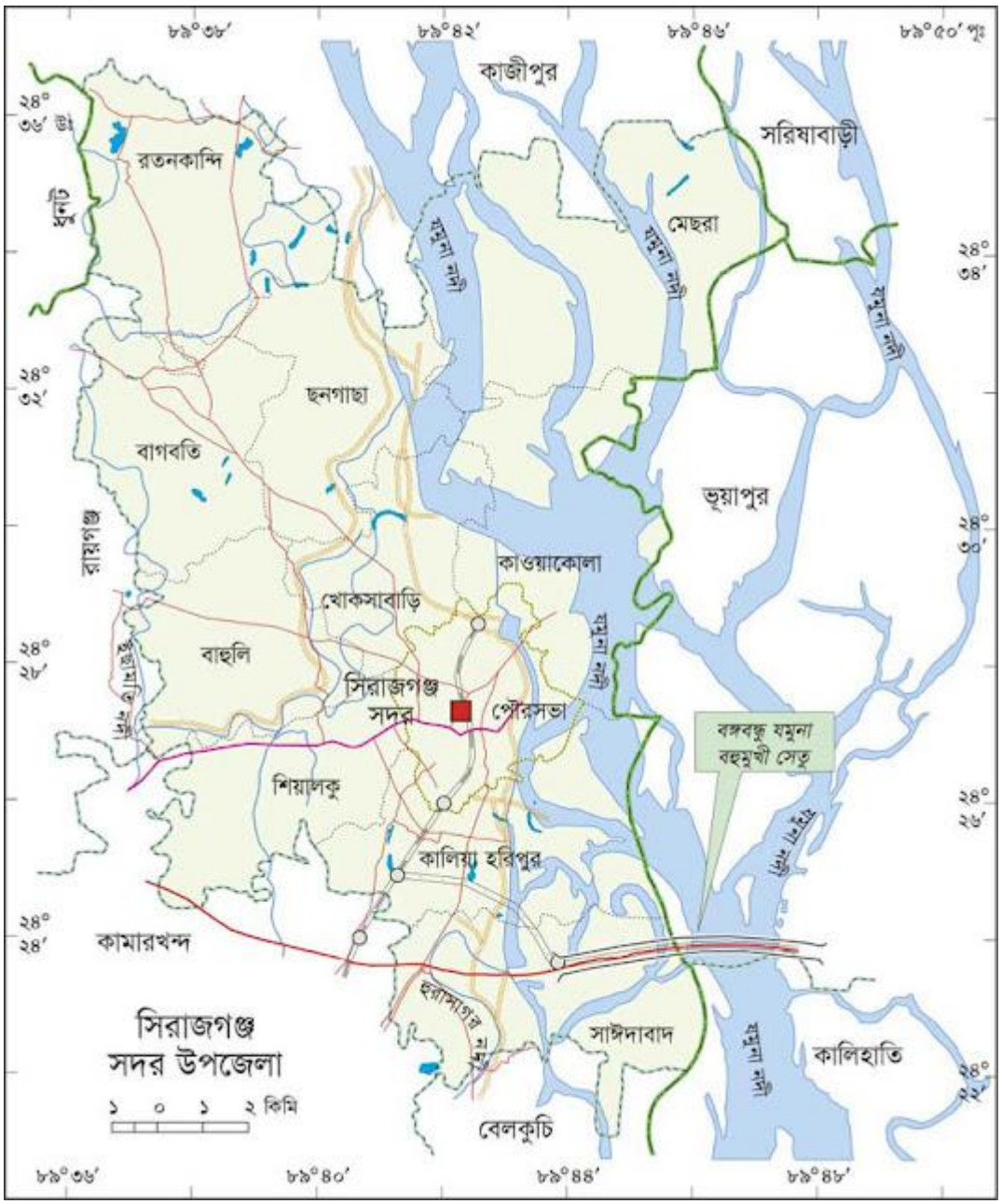


**Fig: 3.3 A map of Sirajganj district showing Sirajganj sadar upazila.**

### 3.4 Instruments for data collection

In order to collect reliable and valid Information from the IPM farmers, an interview schedule was prepared carefully keeping the objectives of the study in mind. The interview schedule contained both open and closed form questions. Appropriate schedule was also developed to operationalize the selected characteristics of the IPM farmers. The draft interview schedule was prepared in English version and was pre-tested with IPM farmers. This pre-test facilitated the researcher to examine the suitability of different questions and statements in general. The interview schedule may be seen at Appendix-i.

### 3.5 Measurement of variable

A variable is any characteristic, which can assume varying, or different values in successive individual cases (Ezekiel and Fox, 1959). An organized research usually contains at least two important variables, viz. an independent and a dependent variable. An independent variable is that factor which is maintained by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). According to the relevant research area, the researcher selected 10 characteristics of the IPM farmers as independent variable and adoption of IPM as the dependent variable.

### 3.6 Measurement of independent variables

The independent variables of the study were 10 selected characteristics of the IPM growers. These were, age, education, farm size, training received , farmers experience, family size, access to credit, IPM practices, annual income, severity of extreme. The procedures followed in measuring the independent variables are briefly discussed below:

#### 3.6.1 Age

In the study, all categories of farmers of the study area were classified into different age groups. First group ages range between 20-30 years. Second group ages range from 31-50 years and the last group were selected who are more than 51 years. This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.2 Education

Education was measured in terms of successful years of schooling. Education for all farmers were categorize into four groups. First group present illiterate group (0). Second group indicated primary education (1-5), third group represent high school or secondary school (6- 10) and last group refers college or more (12). This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.3 Family size

In this study, family size were divided into three separate group namely small family (up to 4 person), medium family (5-7 person) and lastly large family (more than 7 person). This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.4 Farm size

The farm size of a IPM farmer referred to the total area of land, on which his family carried out farming operations, in terms of full benefit to his family. The farm size wa s measured in hectares for each CSA farmers using the following formula:

The data were first recorded in term of local unit i.e. bigha and then converted to hectare. Total farm size of each respondent was categorized into 5 types (Islam, 2007). The farmers who had land bellow 0.02 hectare were considered as landless farmer. The farmers who had land between 0.02-.20 hectare were considered as marginal farmers ; the farmers who had the land between 1.00 hectare were considered as small farmers; the farmers who had land between 1.01-3.0 hectare of land considered as medium farmers and above hectare considered as large farmers This variable appears in the interview schedule as presented in Appendix-i

### 3.6.5 Training received

In the study, all categories of farmers of the study area were classified into different training receive group. The first group indicated lower training received group (less than 4 days), second group were medium training received group (5-7 days) and last group of training receive group is high training receive group (above 8 days). This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.6 Access to agriculture related credit

This independent variable are categorized into only two types. The farmers who receive agriculture related credit were defined yes and on the other hand the farmers who didn't receive any agriculture related credit mentioned it no. This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.7 Total experience of the farmers

In this study, total experience of farmers were categorized into different experienced group. The first group namely lower experienced group (less than 20 years), second group indicated medium experienced group (21-30 years) and lastly higher experienced group (more than 31 years). This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.8 Total Annual income of the farmer

In this study, the annual income of farmers are divided into different categorized. The first category were the group of farmers whose annual income is less than 56000 tk, second category referred the farmers group whose income is ranges from 56000-250000 tk and the last group were categorized into the group of farmers whose income is more than 251000 tk. This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.9 Extension contacts

Good extension programs and contacts with producers are a key aspect in technology dissemination and adoption. A recent publication stated that "a new technology is only as good as the mechanism of its dissemination" to farmers (IFPRI, 1995 p. 168). Most studies analyzing this variable in the context of agricultural technology show its strong positive influence on adoption. In fact Yaron, Dinar and Voet, (1992) show that its influence can counter balance the negative effect of lack of years of formal education in the overall decision to adopt some technologies. In this study, the Visit of farmers to Agricultural office are divided into different categorized. The first category were the group of farmers who visit one times in a month , second category referred the farmers group who visit 2-3 times in a month and the last group were categorized into the group of farmers who visit 4 times in a month. This variable appears in the interview schedule as presented in Appendix-i.

### 3.6.10 Knowledge on IPM practices

After thorough consultation with relevant experts and reviewing of related literature, 4 question regarding IPM practices were selected and those were asked to the respondent to determine their knowledge on IPM practices. Scores two (2), one (1) and zero (0). for each correct answer farmer will get 2 and zero (0) for wrong or no answer. Thus,

possible scores for the knowledge on IPM practices of the respondents could range from 0 to 8, where 0 to 3 indicating very poor knowledge, 4 to 6 indicate medium knowledge and 7 to 8 indicate the very high knowledge on IPM practices. This variable appears in the interview schedule as presented in Appendix-i.

### 3.7 Measurement of dependent variable

The extent of use of IPM practices used by the farmers was measured on the basis of 7 selected IPM practices. The respondents were asked to express their degree of use in the form of low adoption(0-3), medium adoption(4-5) , high adoption(6-7) of IPM practices.

### 3.8 Statement of the hypotheses

In order to guide relevant data collection, analysis and interpretation of data, a set of hypothesis would be formulated for empirical testing. As defined by Goode and Hatt (1952), "Hypothesis is a proposition which can be put to test to determine its validity. It may seem contrary to, in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test." In broad sense, hypothesis may be divided into two categories, namely, research hypothesis (H1) and null hypothesis (HA). In studying relationships between variables an investigator first formulates research hypothesis which states anticipated relationships between the variables. On the other hand, for statistical test, it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no contribution with the concerned variables. The following null hypothesis would be formulated to explore the relationship of the selected characteristics of the growers with their adoption of IPM. There is no significant contribution with the selected characteristics of the growers and their adoption of IPM.

H0: There is no contribution of independent variable on the adoption of IPM practices.

HA: There is a contribution of independent variable on the adoption of IPM practices.

### 3.9 Instrument for data collection

In order to collect relevant information an interview schedule was carefully designed keeping the objectives of the study in mind. The interview schedule was designed in English to ensure easy communication between the researcher and the respondent. The interview schedule initially prepared was pre-tested by administering the same to ten IPM farmers of the study area. The pre-test was helpful to identify faulty questions and

statements in the draft schedule. Necessary additions, corrections alterations and adjustments were made in the schedule on the basis of the pre-test experience. The schedule was multiplied in its final form for the collection of data. An English version of the interview schedule has been presented in the Appendix I

### 3.10 Data processing

A detail coding plan was prepared. Data were coded into a coding sheet. These were then compiled, analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative form by means of suitable scoring techniques for the purpose of analysis.

### 3.11 Categorization of respondents

For describing the various independent and dependent variables the respondents were classified into various categories. In developing categories, the researcher was guided by the nature of data and general consideration prevailing on the social system. The procedures have been discussed while describing the variable in the sub-sequent sections of next chapter.

### 3.12 Model Specification

#### 3.12.1. Characteristics of respondents

For measuring socio-economic and demographic characteristics of respondent descriptive statistics like percentage, frequencies and cross-tabulation was used for analysis. Stata 12 and stata 14 were used for these analyses.

#### 3.12.2. Factors affecting adoption of IPM practices

Binary logistic regression used for find out factors affecting adoption of IPM practices. . Following logistic regression model is used

$\ln[p/(1-p)]=b0+b1X1+b2X2+\ldots\ldots+bnXn+ei$

Here,

P= is the probability of adoption of IPM practices (which range from 0-1)

$p/(1-p)$= is the odds ratio (which range from $0-\infty$)

$\ln[p/(1-p)]$= is the log of odds ratio (which range from $-\infty$ to$+\infty$)

ei= Error term

X1, X2…….Xn= independent variables (Age, Education, Farm size, Family size, Training received, Access to agricultural credit, Total experience of the farmer, Information,, Total income, Extension contacts, Knowledge on IPM practices)

The logistic regression coefficient b associated with a predictor x is the expected change in log odds of having the outcome per unit change in x. so increasing the predictor by 1 unit multiplies the odds of having the outcome by $e^{\beta}$

Odds ratio compares the odds of two event here it can be adoption of IPM or not. The odds of the adoption of IPM are the probability that adoption of IPM occurs divided by the probability of non-adoption of IPM. Odds ratio that are greater than 1 indicate that the probability of adoption is more likely to occur and less than 1 indicate that the probability of IPM adoption is less likely to occur as the predictor increases.

# CHAPTER IV

# RESULT AND DISCUSSION

This chapter provides results on socio-demographic character, livelihood status, knowledge on IPM practice throughout the year, farmers' perception on Integrated pest management, adoption choices, problems of adoption and Binary logistic regression model for assessing the factors determining adoption of IPM practices.

## 4.1. Socio-demographic characteristics

### 4.1.1 Age distribution

In the study, all categories of farmers of the study area were classified into different age groups as presented in table 4.1. It is evident from the table that most of the adopter and non-adopter farmers were under middle aged group. Out of the 62 adopters, 14.52% belongs to the age group 51.61% belonged to the age group 31-50 years and 33.87% were under the age group of above 51, For non-adaptor of IPM practices 36.84% belonged to the age group of 20-30 years, 47.37% belonged to the group of 31-50 years and Rest of them were under the age group of above 50 years .This finding imply that majority of the sample farmers were in the most active age group of 31-50 years indicating that they may provide more physical efforts for farming.

Table 4.1 Age distribution

| Age category | Percentage of IPM adopter | Percentage of IPM non-adopter |
|---|---|---|
| 20-30 years | 14.52 | 36.84 |
| 31-50 years | 51.61 | 47.37 |
| 51-70 years | 33.87 | 15.79 |
| Total | 62 | 38 |

Source: Field Survey, 2021.

### 4.1.2 Educational status

Education increases the efficiency of man. Bangladesh it has, an adult literacy rate of 70.20% (BER, 2019). Table 4.2 shows for IPM adaptor 17.74% farmers were illiterate, 17.74% farmers had primary education, 43.55% farmers had completed secondary level education, 20.97% farmers had completed their higher secondary level education. And for non-adaptor 21.05% farmers were illiterate, 23.68% farmers had primary education, 47.37% farmers had completed secondary level education 7.89% farmers had completed their higher secondary level education which indicates that their education made them more efficient in farming.

Table: 4.2 Education level distribution

| Education Level | Percentage of Adopter | Percentage of Non-Adopter |
|---|---|---|
| Illiterate | 17.74 | 21.05 |
| Primary | 17.74 | 23.68 |
| High-school | 43.55 | 47.37 |
| College and above | 20.97 | 7.89 |
| Total | 62 | 38 |

Source: Field Survey, 2021.

### 4.1.3 Gender distribution

The proportion of women in the agricultural labour force increased from less than 20% to 33.6% of the total (Bangladesh Bureau of Statistics, 2010). Table 4.3 depicts that for IPM adaptor 61.29% of farmers were male and 38.71% were female. And for IPM non adaptor 47.37% of farmer were male and 52.63% of farmer were female. Findings shows that women are less involved in agriculture compared to male it means women empowerment is limited here

Table 4.3 Gender distribution

| Sex | Percentage of IPM Adopter | Percentage of IPM non-adopter |
|---|---|---|
| Male | 61.29 | 47.37 |
| Female | 38.71 | 52.63 |
| Total | 62 | 38 |

Source: Field Survey, 2021.

**4.1.4 Family size** In the study, all categories of farmers of the study area were classified into different age groups as presented in table 4.4 It is evident from the table that most of the farmers were medium family in the study area. Out of the 68 sample farmers 43.55% belonged to the group of small family, 40.32% belonged to the group of Medium family and 16.13% fell into the group of large family for adaptor of IPM practices. And out of total 38 sample farmers 57.89% belonged to the group of Small family, 42.11% belonged to the group of Medium family and zero% fell into the age group of large family. This finding imply that majority of the sample farmers were Small family which indicates that high farmers are not interested to take risk adopting new technique.

Table 4.4 Family size distribution

| Particular | Percentage of IPM adopter | Percentage of IPM non-adopter |
|---|---|---|
| Small (Up to 4 persons ) | 43.55 | 57.89 |
| Medium (5-7 persons) | 40.32 | 42.11 |
| Large (More than 7 persons) | 16.13 | _ |
| Total | 62 | 38 |

Source: Field Survey, 2021.

**4.1.5 Farm Size**

Table 4.5 indicates that for IPM adaptor the medium farm holder constitutes the highest proportion 54.84% followed by small farm holder 32.26%, whereas 11.29% was large farm holder. Again for IPM non-adaptor the small farm holder constitute the highest proportion 50% followed by medium farm holder 47.37% where other holding zero%. The findings of the study reveal that majority of the IPM farmers were small to medium

sized farm holder. This findings also indicates the farmer with landless and marginal farm size has very little scope to experiment about new technologies as their earnings depend on mainly in agriculture.

**Table 4.5 Farm Size distribution**.

| Particulars | Percentage of IPM adopter | Percentage of IPM non-adopter |
|---|---|---|
| Landless (<0.02 ha) | | - |
| Marginal (0.021-0.20 ha) | 1.61 | - |
| Small (0.21-1.00 ha) | 32.26 | 50 |
| Medium (1.01-3.0 ha) | 54.84 | 47.37 |
| Large (>3.0 ha) | 11.29 | 2.63 |
| total | 62 | 38 |

Source: Field Survey, 2021.

### 4.1.6 Knowledge on IPM Practice

On the basis of knowledge on IPM farmers were classified into three categories such as, low knowledge, medium knowledge, high knowledge on IPM. The distribution of the farmers according to their knowledge on IPM scores is shown in the table 4.6 Findings shown that for IPM adaptor has maximum very high knowledge 48.39% where for IPM non-adaptor has medium knowledge 60.53%. which indicates that their knowledge on IPM influence them to take this technology.

**Table 4.6 Knowledge on IPM Practice**

| Particulars | Percentage of IPM adopter | Percentage of IPM non-adopter |
|---|---|---|
| Poor Knowledge (0-3) | 6.45 | 39.47 |
| Medium Knowledge (4-7) | 45.16 | 60.53 |
| High knowledge (8-10) | 48.39 | - |
| Total | 62 | 38 |

Source: Field survey,2021

### 4.1.7 Farmers training received on IPM practices

Table 4.7 indicates that for IPM adaptor most of the farmer High range that means 97.92% of farmer received training for above 8 days where IPM non adaptor received training on medium range that means 57.14% of this practices. On the other hand 0 % of farmer are in lower level and only 2% of farmer received medium days training. The findings of the study reveal that majority of the IPM farmers were medium to high training holder which indicates that if they get more training facilities the adoption will also increase.

Table 4.7 Farmers training received

| Particulars | % of IPM adopter | % of IPM non-adopter |
|---|---|---|
| Low (Less than 4 days) | - | 3.57 |
| Medium (5-7 days) | 2.08 | 57.14 |
| High (Above 8 days) | 97.92 | 39.29 |
| Total | 62 | 38 |

Source: Field Survey, 2021.

### 4.1.8. Access to agriculture related credit

Table- 4.8 shows that out of the total sample, for IPM adopter farmers only 77.42% farmers hold agricultural related credit and remaining 22.58% farmer didn't receive any kind of agricultural credit from any organization. This findings refers most of the farmer are not self-sufficient and depends on agricultural credit or loan. Again for IPM non adopter farmer only 94.74 % of farmers received agricultural related loan where remaining 5.26% farmers didn't received any kind of agricultural related credit.

Table-4.8 Access to agriculture related credit

| | Percentage of IPM adopter | | Percentage of IPM non-adopter | |
|---|---|---|---|---|
| Particulars | Yes | No | Yes | No |
| Access to Ag. Related credit | 77.42 | 22.58 | 94.74 | 5.26 |
| total | 48 | 14 | 36 | 2 |

Source: Field Survey, 2021.

**4.1.9 Farmers experience in agriculture** In the study, all categories of farmers of the study area were classified into different experience groups as presented in table 4.9. It is evident from the table that most of the farmers were medium family for adopter and lower in non-adopter in the study area. Out of the 62 sample farmers 24.19% belonged to the group of lower experienced, 50% belonged to the group of Medium experienced and 25.8% fell into the group of Large experienced group for adaptor of IPM practices. And out of total 38 sample farmers 71.05% belonged to the group of lower experienced, 13.16% belonged to the group of Medium experienced and 15.8% fell into the age group of Large experienced group. This finding imply that majority of the sample farmers were Medium experienced which indicates that low and higher experienced farmer are more interested in traditional farming.

Table 4.9 Total experience in Agriculture

| Particulars | % of IPM adopter | % of IPM nonadopter |
|---|---|---|
| Lower Experienced (<20 years) | 24.19 | 71.05 |
| Medium Experienced (21-30 years) | 50.00 | 13.16 |
| Higher Experienced (>31 years) | 25.81 | 15.79 |
| Total | 62 | 38 |

Source: Field Survey, 2021.

**4.1.10 Annual income status**

Almost 20.80% of the population live in poverty, and 10.30% of the population live in extreme poverty (BER, 2020). The $1.90/person/day Purchasing Power Parity (PPP) line is the current definition of extreme poverty (World Bank, 2011). For IPM adaptor it is evident from the table 4.10 that 19.35% farmers are below the extreme poverty line, which indicates that their yearly income below Tk. 56000. Most of the farmer's yearly income belonged to the category of Tk. 57000-250,000 and it is 59.6% and we can also see 16.2% of the farmer income was less than 600000tk.4.84% of the farmer income less than 800000. It refers that most of the farmers were well sufficient by following IPM practices. On the other hand for IPM non-adaptor table 4.10 also shows 34.4% farmers were below the poverty line that is huge under consideration. Again remaining 52.6 & were under the category of 57000-250000 and 13.2% were the category number 3 (More than 251000) and for fourth category is 0%. So from this we

can conclude that the farmers who practice IPM are more advanced and sufficient than farmers who weren't practicing integrated pest management.

Table: 4.10 Annual income status

| Income level | Percentage of IPM adopter | Percentage of IPM nonadopter |
|---|---|---|
| Less than 56000 | 19.35 | 34.21 |
| 57000-250000 | 59.68 | 52.63 |
| 251000- 600000 | 16.13 | 13.16 |
| More than 600000 | 4.84 | - |
| total | 62 | 38 |

Source: Field Survey, 2021.

### 4.1.11 Contact with extension

Extension is a source of information about better farming practices. Frequent extension contacts are expected to positively impact adoption of all IPM technologies. In the study, all categories of farmers of the study area were classified into different groups as presented in table 4.11 It is evident from the table that most of the farmers were occasinally visit to the extension office in adopter and rarely visit in non-adopter in the study area. Out of the 62 sample farmers 81.82% belonged to the group of frequent visit, 18.18% belonged to the group of regular visit and 0% fell into the rarely visit group for adaptor of IPM practices. And out of total 38 sample farmers 100% belonged to the group of rarely visiting in SAAO office. Which indicate that who are rarely visit are not practicing IPM.

Table 4.11 Extension contact

| Visit (in month) | Percentage of IPM adopter | Percentage of IPM non adopter |
|---|---|---|
| Rarely (0-3days) | - | 100.00 |
| Occasionally (4-9 days) | 81.82 | - |
| Regularly (10-20 days ) | 18.18 | - |
| Total | 62 | 38 |

Source: Field Survey, 2021.

### 4.1.12 Distribution of the IPM farmers according to their adoption of IPM

Data contained in the Table 4.11, revealed that the majority (59.41%) of the farmers had medium adoption as compared to 15.84% and 24.75% having low and high adoption respectively. The majority (75.25 percent) of the farmers had in low to medium adoption.

Table 4.12 Distribution of adoption of IPM practices

| Particulars | IPM practices adopter (percent) |
|---|---|
| Low adoption (0-3) | 15.84 |
| Medium adoption (4-5) | 59.41 |
| High adoption (6-7) | 24.75 |
| Total Sample | 100 |

Source: Field Survey, 2021.

### 4.2 Econometric Model Results

Table 4.12 presents the results of the Logistic regression of estimated parameters and marginal effect. Overall, the regression offers a good fit with factors predicting the adoption status by the study households. The chi-square statistics indicate the strong explanatory power of the model. Moreover, most of the explanatory variables in the model were found to be statistically significant with an expected sign (see discussion below).

Table 4.13 Factors affecting Adoption of IPM Technology

| **Explanatory Variable** | | **Dependent Variable (IPM Practices )** | | | |
|---|---|---|---|---|---|
| | **Coefficient** | **Standard error** | **Z Value** | **P Value** | **Marginal effect** |
| Constant | -12.99 | 4.020 | -3.23 | 0.001 | - |
| Age | 0.065 | 0.038 | 1.66 | 0.098 | 0.006* |
| Education | 0.138 | 0.092 | 1.52 | 0.127 | 0.013 |
| Family Size | 0.533 | 0.280 | 1.98 | 0.057 | 0.051* |
| Farm Size | -0.511 | 0.477 | -1.07 | 0.285 | -0.488 |
| Training received | 0.108 | 0.889 | 0.01 | 0.990 | 0.001 |
| Access to credit | 0.095 | 1.165 | 0.08 | 0.935 | 0.009 |
| Extension Contact | -0.003 | 0.863 | -0.00 | 0.996 | -0.000 |
| Total Experience | 0.125 | 0.054 | 2.39 | 0.017 | 0.125** |
| Knowledge | 0.994 | 0.288 | 3.75 | 0.001 | 0.095*** |
| Annual Income | -0.150 | 0.390 | -0.41 | 0.068 | -0.015 |
| | Logistic regression<br>LR chi2 = 71.74<br>Log likelihood = -30.026 | | Number of observation = 100<br>Prob > chi2 = 0.0000<br>Pseudo R2 = 0.544 | | |

****p<0.01, **p<0.05, *p<0.1*

**Source:** Authors estimation from survey data, 2021

P-values and coefficients in regression analysis describe which relationships in model are statistically significant and the nature of those relationships. The coefficients discuss the mathematical relationship between each independent variable and the dependent variable. The p-values for the coefficients indicate whether these relationships are statistically significant. If the p-value for a variable is less than significance level, sample data provide enough evidence to reject the null hypothesis for the entire population Changes in the independent variable are associated with changes in the dependent variable at the population level. Marginal effects show the change in probability when the predictor or independent variable increases by one unit.

### 4.2.1 Significant contribution of age to the farmers' adoption of Integrated pest Management

From Logistic Regression, it was concluded that the contribution of age to the farmers adoption of Integrated pest Management was measured by the testing the following null hypothesis;

"There is no influence of age on adoption of Integrated pest Management".

The p-value of independent variable age for IPM practices is 0.098 which is significant at 10% level of significance that means we will reject the null hypothesis. It indicates that Age has a positive significant relationship with Adoption of IPM at 10% level of significance ($p<0.1$. The marginal effect indicates that 1 year additional age will increase the likelihood of adoption by 0.6%. Based on the above finding, it can be said that farmers increase in age will increased farmers adoption of Integrated Pest Management because when age will increase experience also increased which will induce farmer to adopt IPM. So, age has high significant contribution to the farmer adoption of Integrated pest management.

### 4.2.2 Significant contribution of Family size to the farmers' adoption of Integrated pest Management

From Logistic Regression, it was concluded that the contribution of family size to the farmers adoption of Integrated pest Management was measured by the testing the following null hypothesis;

"There is no influence of family size to the farmers adoption of Integrated pest Management".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.The p-value of independent variable family size for IPM practices is 0.057 which is significant at 10% level of significance that means we will reject the null hypothesis. It indicates that family size has a positive significant relationship with Adoption of IPM at 10% level of significance ($p<0.1$). The marginal effect indicates that 1 additional family member will increase the likelihood of adoption by 5.1%. Based on the above finding, it can be said that if farmers have more family member will increased farmers adoption of Integrated Pest Management.

So, family size has high significant contribution to the farmer adoption of Integrated pest management.

### 4.2.3 Significant contribution of Total experience to the farmers' adoption of Integrated pest Management

From Logistic Regression, it was concluded that the contribution of training received to the farmers adoption of Integrated pest Management was measured by the testing the following null hypothesis;

"There is no influence of total experience to the farmers adoption of Integrated pest Management".

The following observations were made on the basis of the value of the concerned variable of the study under consideration. The p-value of independent variable total experience for IPM practices is 0.017 which is significant at 5% level of significance that means we will reject the null hypothesis. It indicates that total experience has a positive significant relationship with Adoption of IPM at 5% level of significance ($p<0.05$). The marginal effect indicates that 1 year additional experience will increase the likelihood of adoption by 12.5%. Based on the above finding, it can be said that farmers with more experience will increased farmers adoption of Integrated Pest Management. So, Total experience has high significant contribution to the farmer adoption of integrated pest management.

### 4.2.4 Significant contribution of Knowledge on IPM to the farmers' adoption of Integrated pest Management

From Logistic Regression, it was concluded that the contribution of Knowledge on IPM to the farmers adoption of Integrated pest Management was measured by the testing the following null hypothesis;

"There is no influence of knowledge to the farmers adoption of Integrated pest Management".

The following observations were made on the basis of the value of the concerned variable of the study under consideration. The p-value of independent variable Knowledge on IPM for IPM practices is 0.001 which is significant at 1% level of significance that means we will reject the null hypothesis. It indicates that knowledge

has a positive significant relationship with Adoption of IPM at 1% level of significance ($p<0.01$). The marginal effect indicates that 1 additional extension contacts with knowledge will increase the likelihood of adoption by 9.5%. Based on the above finding, it can be said that farmers had more Knowledge on IPM will increased farmers adoption of Integrated Pest Management. So, Knowledge on IPM has high significant contribution to the farmer adoption of Integrated pest management.

### 4.3. Problems regarding Integrated Pest Management

In the study area farmers appear some barriers to adaptation such as Ignorance of SAAO about giving IPM instrument, Unavailability of sex pheromone trap, Lack of training program, lack of monitoring, Lack of quality seed etc.

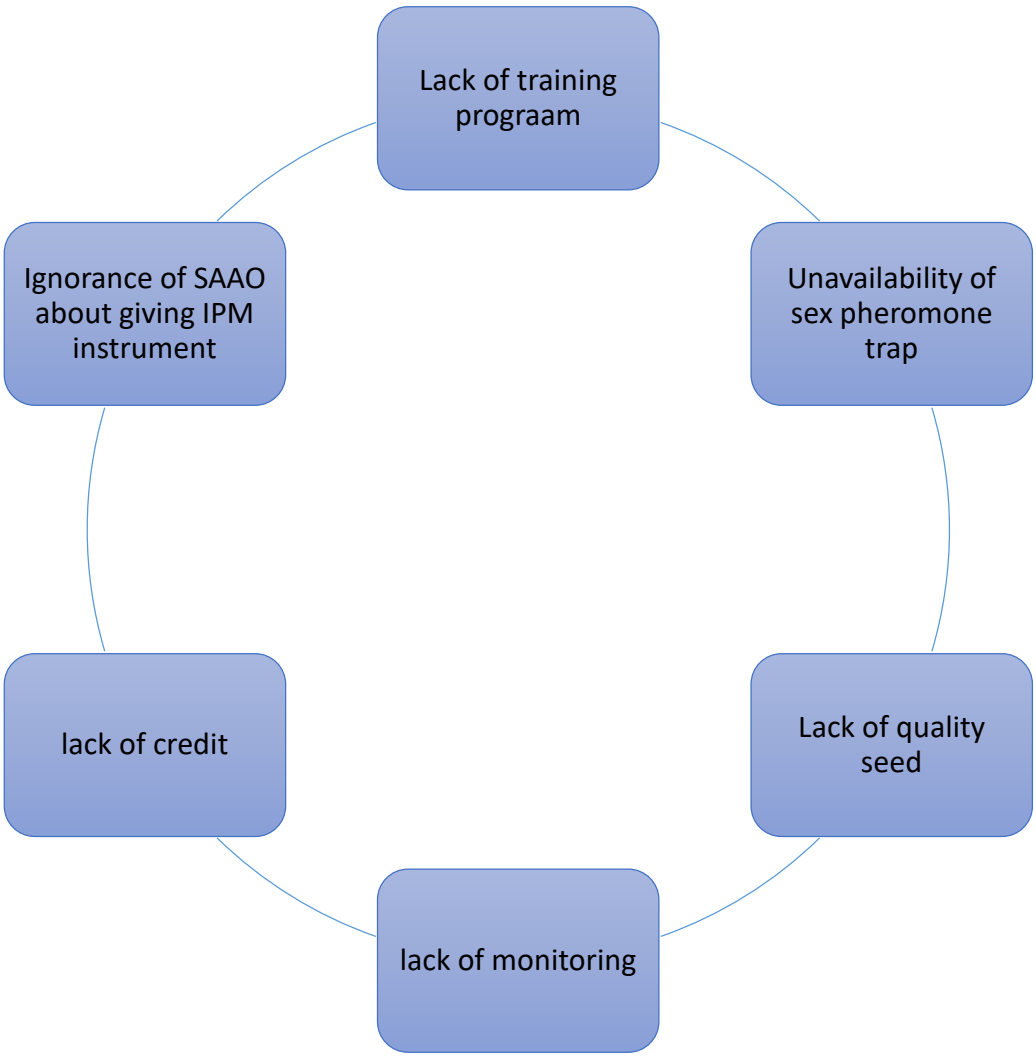


**Fig 4.1 :** Problems regarding Integrated Pest Management

### 4.3.1. Lack of training program

Firstly, from the figure-4.2 we can see that 84.5% farmers faced problem of lack of training program very highly where 11.3% were response high, 2.7% were medium and 1.5% were low.

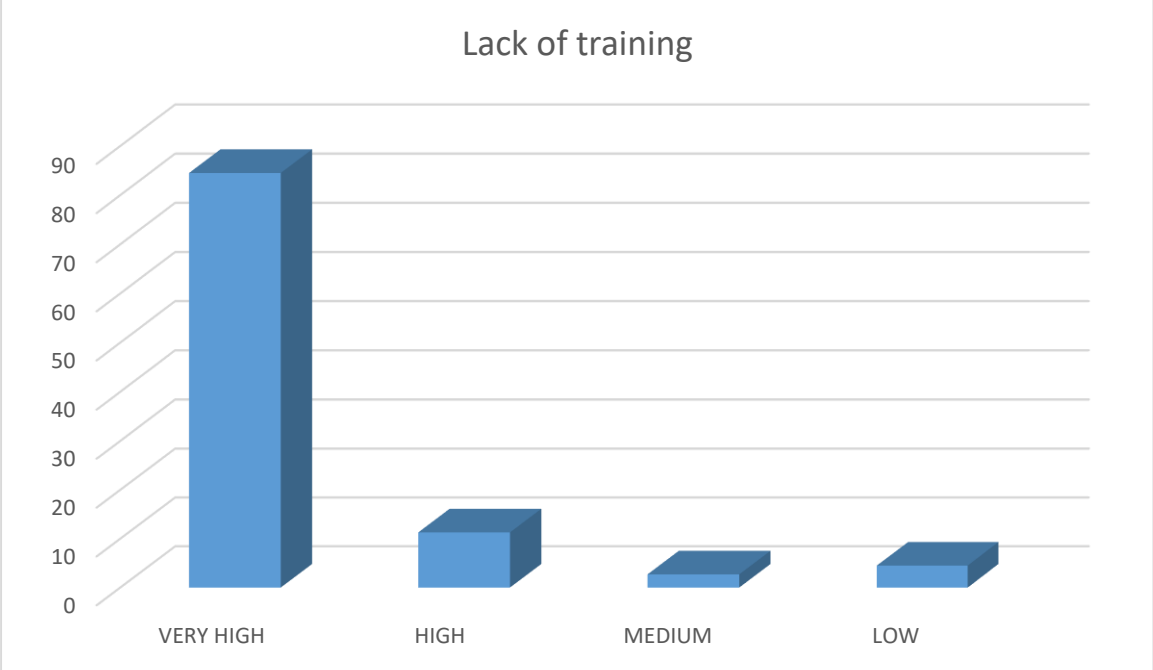


Figure 4.2 : Farmers problems regarding ***Lack of training*** program on IPM.

### 4.3.2. Unavailability of sex pheromone trap

Secondly, from the figure-4.2.14 we can see that 81.1% farmer faced the problem of unavailability of sex pheromone trap very highly where remaining 14.3% farmers faced problem highly, 3.9% were response it medium and 0.7% farmers were response it lowly.

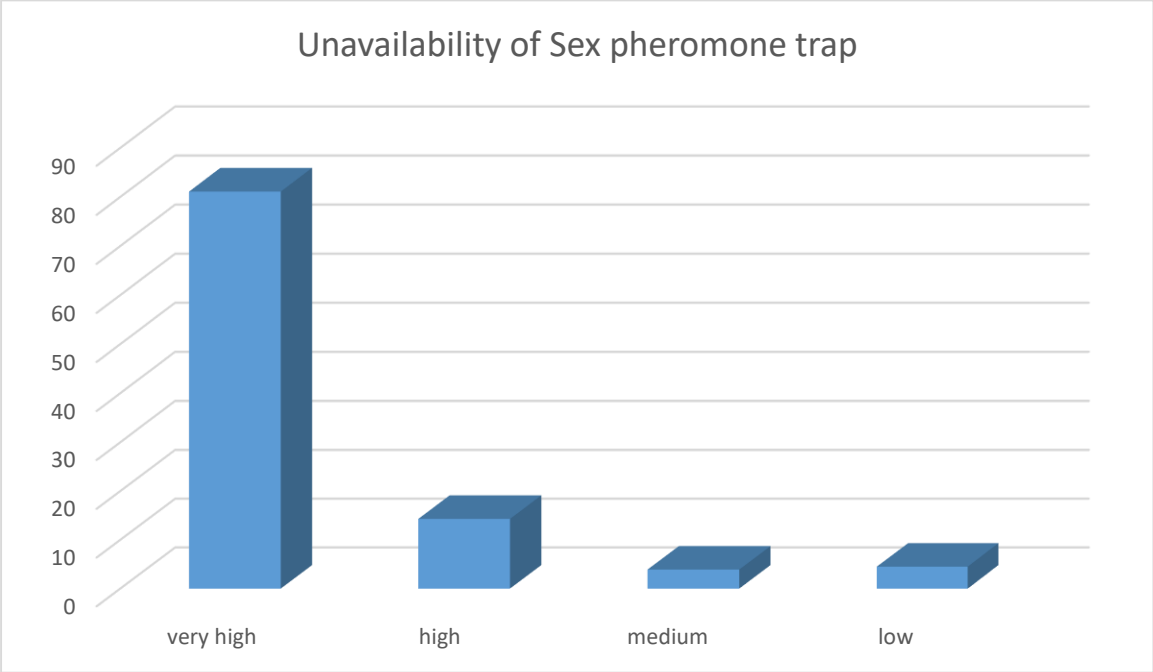


Figure 4.3 : Farmers problems regarding ***Unavailability of sex pheromone trap*** on IPM.

### 4.3.3. Lack of quality seed

Thirdly, from the figure-4.2.14 we can see that for transportation problem 44.8% farmers faced it very highly, 40.6% farmers claimed it high, 10.2% farmers claimed it moderate and remaining 4.4% farmers claimed it low.

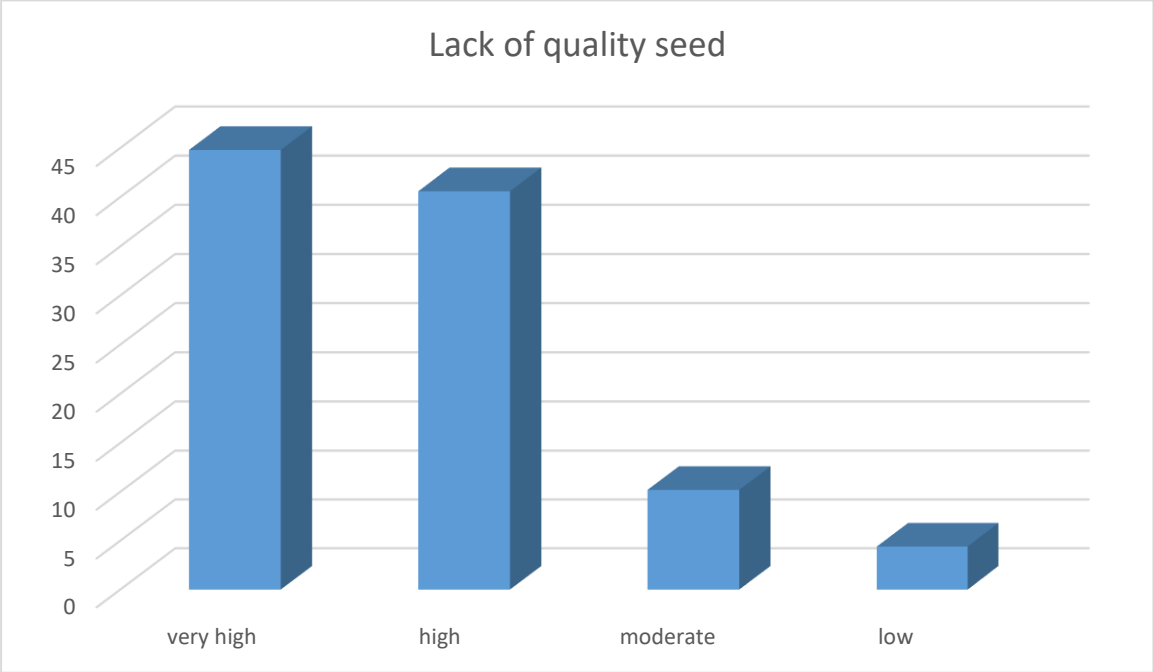


Figure 4.4: Farmers problems regarding ***Lack of quality seed*** on IPM

### 4.3.4. Lack of Monitoring problem

Secondly, from the figure-4.2.14 we can see that 73.1% farmer faced the lack of monitoring problem very highly where remaining 14.3% farmers faced problem highly, 10.9% were response it medium and 1.7% farmers were response it lowly.

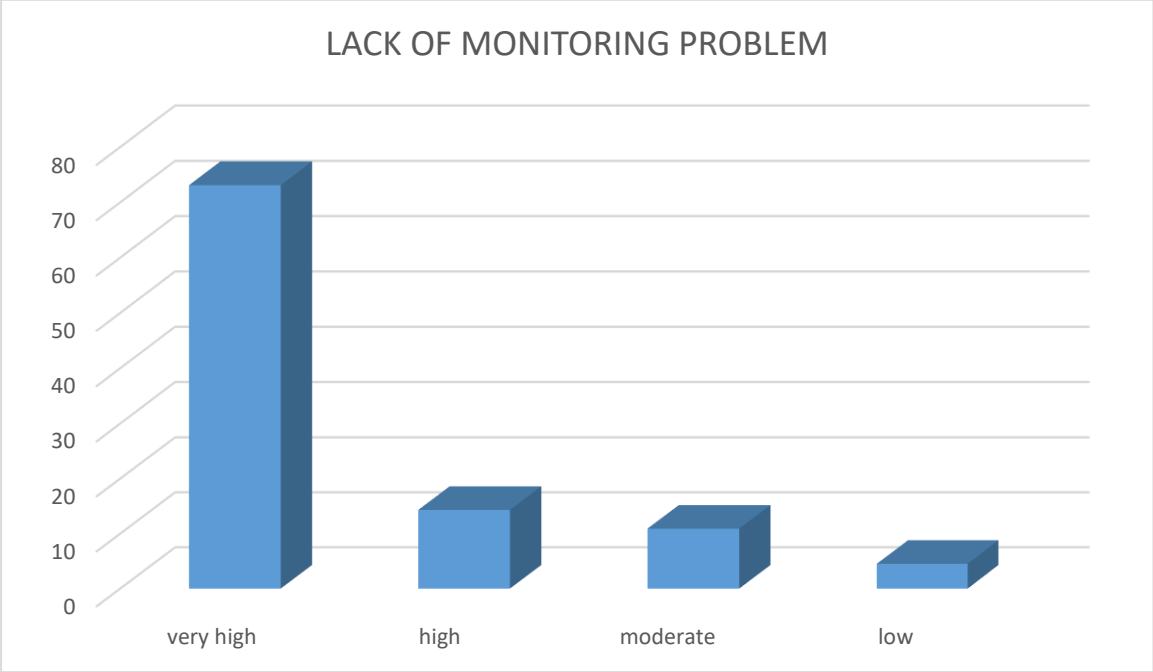


Figure 4.5: Farmers problems regarding ***Lack of monitoring*** on IPM

### 4.3.5. Lack of credit access

Fourthly, from the figure-4.2.14 we can see that for lack of credit, 38.8% farmers faced that problem very highly, 49.3% farmers claimed it highly, 9.8% farmers claimed it medium and remaining 2.1% farmers claimed it as a low problem.

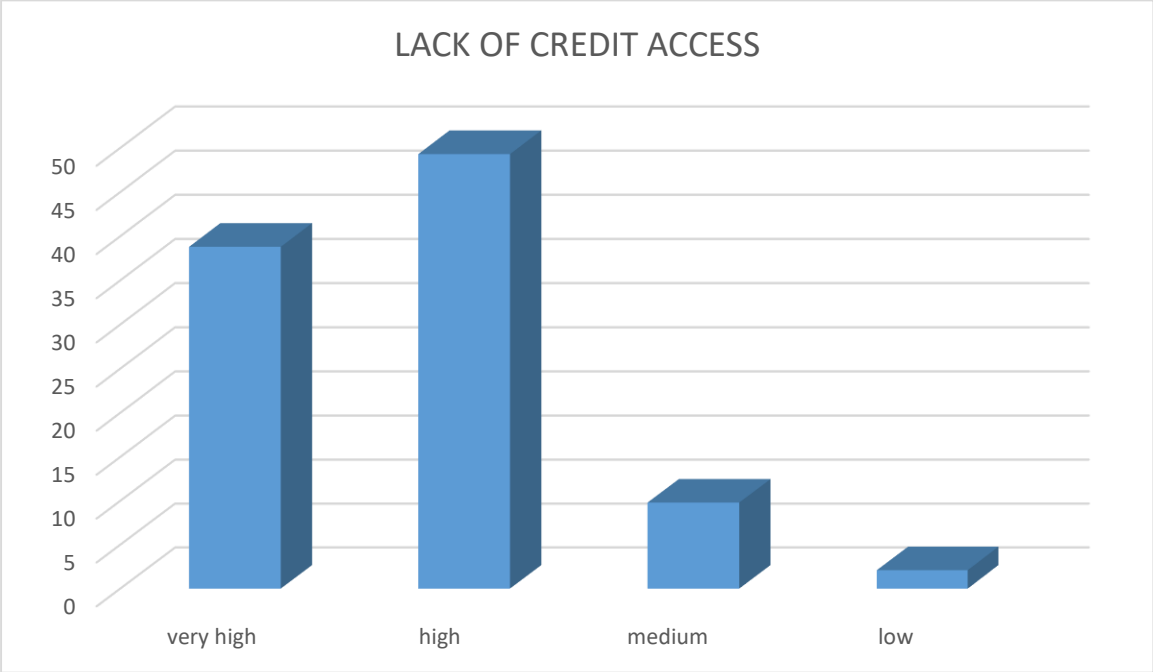


Figure 4.6: Farmers problems regarding ***Lack of credit access*** on IPM

### 4.3.6. Ignorance of SAAO about giving IPM instrument

Lastly, from the figure-4.2.14 we can see that 32.3% farmers faced the problem of Ignorance of SAAO about giving IPM instrument very highly, 38.6% farmers claimed it highly, 21.4% farmers claimed it medium and remaining 7.7% farmers claimed it lowly.

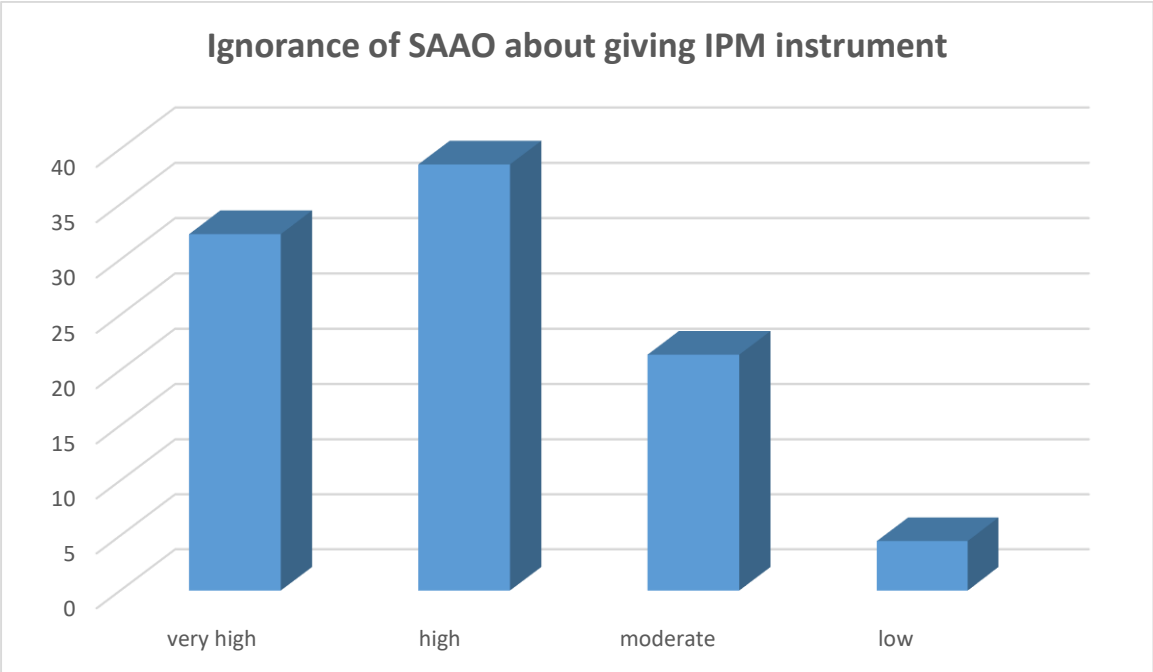


**Figure 4.7 :** Farmers problems regarding of **Ignorance of SAAO about giving IPM instrument**

# CHAPTER V
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Summary

This chapter includes detailed representation and discussion of relationship between the adoption status and socio-economic factors affecting these dimensions. This study considered 4 dimensions for factor affecting adoption of IPM. Different socio-economic factors that are explained in as independent variables and factor affecting adoption are considered as dependent variable. Logistic regression was separately run for each dimension to determine the relationships of factors affecting adoption of IPM with these dimensions. Respondent age, education, family size, farm size, training, annual income, experience, access to credit, knowledge and extension contact are considered as factors affecting the adoption of Integrated pest management.

The age distribution of the farmers 14.52 percent belonged to the age group of 20-30 years, 51.61 percent belonged to the age group of 31-50 years and 33.87 percent fell into the age group of above 51 for adaptor of IPM practices. Again for IPM, non-adopter farmers 36.84 percentage belonged to the group of 20-30 years, 47.37 percentage belonged to the group of 31-50 years and 15.79 percentage fell into the age group of above 50 years old. This finding imply that majority of the sample farmers were in the most active age group of 31-50 years indicating that they provided more physical efforts for farming

The level of educational status Respondent in Highschool category constitute the highest proportion (43.55 percent) for IPM adopter and (47.37 percent) for IPM non-adopter followed by primary (17.74 percent) for IPM adopter & (23.68 percent) for IPM non-adopter. On the other hand, Illiterate is 17.74 percent for IPM adopter and 21.05 percent for IPM non-adopter farmers.

Family size for IPM adopter farmers 43.55 percent belonged to the group of small family, 40.32 percent belonged to the group of Medium family and 16.13 percent fell into the group of Large family for adaptor of IPM practices. Again for IPM non-adopter farmers 5 percentage belonged to the group of Small family, 56.5 percentage belonged to the group of Medium family and zero percentage fell into the age group of Large family. This finding imply that majority of the sample farmers were small family. The researcher found that the medium farm holder for IPM adapter constitutes the highest

proportion (54.84 percent) followed by small farm holder (32.26 percent), whereas 11.29 percent was large farm holder and marginal land holder are 1.61 in percentage. The researcher also found that the small farm holder for IPM non-adapter constitutes the highest proportion (50 percent) followed by medium farm holder (47.37 percent), whereas 2.63 percent was large farm holder. The findings of the study reveal that majority of the IPM adopter and non-adopter farmers were small to medium sized farm holder.

Findings shown that for IPM adaptor has maximum very high knowledge with 48.39% where for IPM non-adaptor has medium knowledge 60.53 percent.

For IPM adaptor most of the farmer in high range that means 97.92% of farmer received training above 8 days where IPM non adaptor received training on IPM practices in less than 4 days is 3.57% and 57.14% for medium range and 39.29% for more than 8 days. On the other hand 0% of farmer are in lower level and only 2.08% of farmer received 5 to 7 days training. The findings of the study reveal that majority of the IPM farmers were high training holder.

For IPM adopter farmers 24.19 percent belonged to the group of lower experienced, 50 percent belonged to the group of Medium experienced and 25.81 percent fell into the group of Large experienced group for adaptor of IPM practices. For IPM non-adopter farmers 71.05 percentage belonged to the group of lower experienced, 13.16 percentage belonged to the group of Medium experienced and 15.79 percentage fell into the age group of large experienced group. This finding imply that majority of the sample farmers were Medium experienced.

For IPM adaptor farmers only 77.42% farmers hold agricultural related credit and remaining 22.58% farmer didn't receive any kind of agricultural credit from any organization. This findings refers most of the farmer received agricultural credit or loan. Again for IPM non adaptor farmer only 94.74 % of farmers received agricultural related loan where remaining 5.26% farmers didn't received any kind of agricultural related credit.

For IPM adaptor 19.35% farmers are below the extreme poverty line, which indicates that their yearly income below Tk. 56000. Most of the farmer's yearly income belonged to the category of Tk. 57000-250,000 and it is 59.68% and we can also see 16.13% of the farmer income was above 251000tk and 4.84% of the farmer income was above 600000. It refers that most of the farmers were well sufficient by following advanced Integrated pest management. On the other hand for IPM non-adaptor 34.21% farmers

were below the poverty line that is huge under consideration. Again remaining 52.63% & were under the category of 57000-250000 and 13.16% were the category number 3 (More than 251000). So from this we can conclude that the farmers who practice Integrated pest management are more advanced and sufficient than farmers who weren't practicing Integrated pest management.

Among the IPM farmers, the highest 58.1 percent IPM farmers belong to the group of medium and the lowest percentage 18.1 percent in high adoption followed by low (23.8 percent) by the IPM farmers in adoption of Integrated pest management

The findings also indicated that 1-year additional age will increase the likelihood of adoption by 0.6% Similarly, 1 additional family member will increase the likelihood of adoption by 5.1%. Findings also indicates that 1 year additional experience will increase the likelihood of adoption by 12.5%. Findings indicates that 1 additional extension service with knowledge will increase the likelihood of adoption by 9.5%.

## 5.2 Conclusions

The findings and relevant facts of research work prompted the researcher to draw following conclusions:

Among the IPM farmers, the highest proportion (59.41 percent) belonged to the group of medium adoption compared to 24.75 percent and 15.84 percent in high and low adoption of Integrated pest management respectively. Therefore, it may be concluded that there is scope to increase the extant of adoption of IPM by the farmers.

Experience of the farmers had the highest contribution to adoption of IPM farmers in Sirajganj district. It is therefore, concluded that if the experience increases the adoption of Integrated pest Management will also increase.

Age of the respondent had significant positive contribution to their use of IPM practices. Therefore it may be recommended that attempts should be taken by the concerned authorities to increase use of IPM practices especially for the young and middle aged farmers.

Family size is the next contributor that has impact on the farmers' adoption of climate smart agriculture. The majority of the IPM farmers were in small family. It is therefore, concluded that family size had a great impact on the Integrated pest management.

Lastly, Knowledge on IPM is the main contributor in IPM practices, IPM adopter has High knowledge on this technology, if extension contact increases among those cultivator adoption on Integrated pest management will also be increased.

### 5.3 Recommendations

On the basis of observation and conclusions drawn from the findings of the study following recommendations are made to the planners and policy makers in contriving micro or macro level policy for increasing production:

a) Experience on IPM of the farmers had the highest contribution to adoption of IPM farmers in Sirajganj district. It is therefore, recommended that attempt should be taken by the concerned authorities to increase the knowledge of the farmers' by regular contact with them which will influence them to adopt this technology.

b) Knowledge on IPM of the respondent had significant positive contribution to their use of IPM practices. Therefore it may be recommended that attempts should be taken by the concerned authorities to increase training program of IPM which will expand farmer's knowledge especially for the young and middle aged farmers. .

c) The Department of Agricultural Extension (DAE) needs to pay more attention to ensure the adoption of integrated pest management (IPM) practices through building confidence among the farmers about use of IPM practices in cultivation by showing clear difference between traditional and recommended practices.

REFERENCES:


Allahyari M.S., Damalas C.A., Ebadattalab M. 2016. Determinants of integrated pest management adoption for olive fruit fly (Bactrocera oleae) in Roudbar, Iran. *Crop Protection.* **84**:113–120.

Allahyari M.S., Damalas C.A., Ebadattalab M. 2017. Farmers' technical knowledge about integrated pest management (IPM) in olive production. *Pesticides in agriculture system.* **7**(12):101.

Ali, A. and Sharif M. 2012. Impact of farmer field schools on adoption of integrated pest management practices among cotton farmers in Pakistan. *Journal of the Asia Pacific Economy*, **17**(3) : 498-513.

Alwang J., Norton G.W., Larochelle C. 2019. Obstacles to widespread diffusion of IPM in developing countries: lessons from the field. *Journal of Integrated Pest Management*.**10**(1): 1–8.

Amir H.M., Shamsudin M.N., Mohamed Z.A., Hussein M.A. and Radam A., 2012. Economic evaluation of Rice IPM practices in MADA, Malaysia. *Journal of Economics and Sustainable Development, **3***(9): 47-55.

Anderson M.D., Hollingsworth, C.S., Van Zee V., Coli W.M. and Rhodes M. 1996. Consumer response to integrated pest management and certification. *Agriculture, Ecosystems and Environment*, **60** (2e3): 97-106.

BBS, 2021. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

BBS, 2017. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

BBS. 2018. Yearbook of agricultural statistics of Bangladesh. Dhaka: Bangladesh bureau of statistics, statistical division, Ministry of planning, Government of the People's Republic of Bangladesh.

BBS. 2015. Bangladesh Beraue of Statistics. Bangladesh Population and Housing Census 2011: Zila Report: Sirajganj. Statistics and Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

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

Blake, G., Fami H.S., Rezvanfar A. and Pouratashi M., 2007. An assessment of growers perceptions and factors influencing adoption of IPM in commercial cranberry production. *Renewable agriculture and food systems,* **22**(2): 134-144.

Borkhani, F., Fami, H., Rezvanfar, A. and Pouratashi, M. 2011. Application of integrated pest management (IPM) practices by paddy farmers in Sari county of Mazandaran province, Iran. *Research African Journal of Agricultural* **6** (21): 4884-4892.

Dara S. K. (2019) The New Integrated Pest Management Paradigm for the Modern Age. *Journal of Integrated Pest Management,* 2019 **10**(1): 12; 1–9

Dasgupta S, Meisner C, Huq M. 2005. Health effect and pesticide perception as determinants of pesticide use:evidence from Bangladesh. World Bank Policy. Research Working Paper 3776, World Bank,Washington, DC. [accessed 2018 Dec 12].

David S, Asamoah C. 2011 Farmer's knowledge as an early indicator of IPM adoption: A case study of cocoa farmer field school in Ghana. *Journal of Sustainable Development in Africa.* **13**(4): 213-224.

Giudice D., Stranieri T., Caracciolo S., Ricci F.,Cembalo E.C., L., Banterle, A. and Cicia G.2018. Corporate social responsibility certifications influence consumer preferences and seafood market price. *Journal of Cleaner Production,* **178**: 526-533.

Despotovic F., Rodic V. and Caracciolo F. 2019. Factors affecting farmers' adoption of integrated pest management in Serbia: An application of the theory of planned behavior. *Journal of Cleaner Production,* **228**: 1196-1205.

Ezekiel, M. and K.A. Fox 1959. Method of Correlation and Regression Analyses- 3rd Edition. New York, John Wiley and Sons, Inc. *Biometrical journal*, **3**(2):144-145

George, S., Hegde, M.R. 2013 Impact of farmer field school in tomato. *Journal of Extension Education,* **24** (3): 4892-4896.

George, S., Hegde, M.R. and Doijode, D. 2012. Adoption of integrated pest management practices in vegetable crops in Karnataka, India. Pest Management in *Horticultural Ecosystems,* **18**(1): 118-119.

George, S. and Hegde, M.R. 2010. Impact of farmer field school in popularization of IPM practices in tomato cultivation. *Agricultural Science Digest,* **31** (2): 116-120.

Ghimire, B. and Kafle, N. 2014. Integrated pest management practice and its adoption determinants among apple farmers in mustang district of Nepal. *Scholars Journal of Agriculture and Veterinary Sciences*, **1**(2): 83–89.

GoB. 2002. National integrated pest management policy. Dhaka: Ministry of Agriculture, Government of the People's Republic of Bangladesh.

Good, W.J. and Hatt P.K. 1945. Methods of Social Research. New York: McGraw- Hill Book Company, Inc. *Biometrical journal,* **3**(2): 131-132

Hadi V., 2012. Exploring the determinants of adoption behaviour of clean technologies in agriculture: a case of integrated pest management, *Asian Journal of Technology Innovation,* **20**(1): 67-82.

Haque, M., Kabir, M. and Nishi, N. 2017. Determinants of rice farmers' adoption of integrated pest management practices in Bangladesh. *Journal of Experimental Agriculture International,* **14**(4): 1–6.

Liu T., Bruins R.J.F.2018 Influencing Farmers' Adoption of Best Management Practices: A Review and Synthesis. *Sustainability* **10:** 7-8

Mariyono, J., 2007 Adoption and diffusion of integrated pest management technology: A case of irrigated rice farm in Jogjakarta province, Indonesia. *Journal of Agricultural Technology,* **3**(1): 39–50.

Mian M.Y., Hossain M.S., Karim A.N.M.R. (2016) Integrated pest management of vegetables crops in Bangladesh, *Journal of Experimental Agriculture International,* **13**(4): 3–6.

Muniappan R., Heinrichs, E.A. 2012 Integrated Pest Management of Tropical Vegetable Crops, *Springer Science and Business Media Dordrecht,* **17:**235–249

Migliore G., Cembalo L., Caracciolo F. and Schifani, G. 2012. Organic consumption and consumer participation in food community networks. *New Meditation,* **11**(4): 46-48.

Mueller D.S., Stewart A, 2020 Using Design Interventions to Develop Communication Solutions for Integrated Pest Management. *Journal of Integrated Pest Management,* **11**(1): 10 1–10

Rahman M.H., Kamal M.M. 2021 Integrated pest management practices adopted by mango growers at Meherpur region in Bangladesh, *SAARC Journal of Agriulture,* **19**(1): 125-138

Rahman M.S., Rashid M.H.A. 2020 Farmers' Perception of Integrated Pest Management and its Impact on Cucumber Production in Bangladesh. *Journal of Bangladesh Agricultural University* **18**(3): 674–679

Rahman S. 2020 Farmers' perceptions of integrated pest management (IPM) and determinants of dis-adoption in vegetable production in Bangladesh. *International Journal of Pest Management.* **41**: 487–494

Rahman S. & Norton G.W.2019 Farm-level impacts of eggplant integrated pest management: a stochastic frontier production function approach. *International Journal of Vegetable Science* **25** (6): 590-600

Rahman MS., Norton G. 2019 Adoption and Impacts of Integrated Pest Management in Bangladesh: Evidence from Smallholder Bitter Gourd Growers. *Horticulturae 5,32*

Rahman MS, Norton GW, Rashid MH. 2018. Economic impacts of integrated pest management on vegetables production in Bangladesh. *Journal of Crop Protection*. **113**:6–14.

Rainis R. and Kabir H. 2015 Do Farmers Not Widely Adopt Environmentally Friendly Technologies? Lesson from Integrated Pest Management (IPM). *Modern Applied Science;* **9:**3

Rainis R. and Kabir H. 2013 Integrated pest management farming in Bangladesh: present scenario and future prospect. *Journal of Agricultural Technology* **9**(3): 515-547

Rainis R. and Kabir H. 2013 Determinants and Methods of Integrated Pest Management Adoption in Bangladesh: An Environment Friendly Approach. *American-Eurasian Journal of Sustainable Agriculture*, **7**(2): 99-107

Rainis R. and Kabir H. 2014 Adoption and intensity of integrated pest management (IPM) vegetable farming in Bangladesh: an approach to sustainable agricultural development. *Springer Science+Business*, **9**:3(4-6)

Satya P.V.G. 2014 Evaluation of profile characteristics of SRI cultivation farmer in relation to their extent of adoption of technologies. *Current Biotical* **8** (1)36-41

Soltani S., Azadi H. 2013 Organic agriculture in Iran: Farmers' barriers to and factors influencing adoption. *Renewable Agriculture and Food Systems:* **9**(3) 12-14

Thapa C.B. 2016. Survey of Integrated Pest Management (IPM) Practice in Vegetable Crops of Rupandehi District, Western Nepal. *Int. J. Appl. Sci. Biotechnical* **5**(2): 237-242

Thapa, G.B., Rattanasuteerakul k., 2011. Adoption and extent of organic vegetable farming in Mahasarakham province, Thailand. *Applied Geography*, **31**(1): 201-209.

Townsend, J. C. 1953. Introduction to Experimental Methods. New York: McGraw-Hill. New York, U.S.A. *Biometrical journal*, **3**(2): 44-45

Yaron, D., Voet, H., & Dinar, A. 1992. Innovations on family farms: the Nazareth region in Israel. American Journal of Agricultural Economics, **74**(2), 361-370.

Zul-Ekram, M. 2014. Adoption of commonly used Integrated Pest Management (IPM) Practices by Boro Rice Growers. M.Sc. (Ag. Ext. & Info. Sys.) Thesis. Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka.

https://thefinancialexpress.com.bd/economy/bangladesh/gdp-growth-rate-reaches-524pc-in-fy20-bbs-1597146553

https://www.thedailystar.net/supplements/30th-anniversary-supplements/news/revitalising-bangladeshs-agriculture-sector-2042629

https://openknowledge. worldbank.org/handle/10986/8572.

https://www.thedailystar.net/green-initiative-left-in-the-lurch-42371

http://www.fao.org/news/story/en/item/1398779/icode/

https://www.ifpri.org/publication/1995-ifpri-annual-report

https://bbs.portal.gov.bd

https://berdu.ac.bd

https://www.worldbank.org

**Appendix - I**

**An English Version of Interview Schedule Dept. of Management and Finance**

**Sher-e-Bangla Agricultural University**

**Factors affecting the non-adoption of IPM in vegetables cultivation in Sirajganj district**

**Sample no.: ----------**

**1. General information:**

**Name:** …… **Upazila:** ……

**District:** ……. **Contact No:** ……..

**2. Respondents profile:**

| Sl# | Relationship | Age (yrs) | Education (yrs) | Main occupation* | Family size | Working people |
|---|---|---|---|---|---|---|
| 1 | **Self** | | | | | |
| 2 | Spouse | | | | | |

*Occupation code: 1 =Agriculture, 2= service, 3=business, 4= unemployed, 5=others

**3.Farmsiz**

| Land type | Area (ha.) |
|---|---|
| Own cultivated land | |
| Sharecrop out | |
| Sharecrop in | |
| Lease out | |
| Lease in | |
| Homestead | |
| Pond | |

**4. Do you ever heard (aware) about IPM practices?** Yes (1) / No (0)

**If yes, from where:** …….

**5. Knowledge on IPM practices**: Please answer the following question

| SL. NO | Questions | Full Marks | Marks Obtained |
|---|---|---|---|
| 1 | What do you mean by IPM? | (2) | |
| 2 | Mention two examples of biological control. | (2) | |
| 3 | Mention two benefits of sex pheromone trap. | (2) | |
| 4 | Mention two benefits of yellow sticky trap. | (2) | |
| 5 | Mention two examples of mechanical control | (2) | |

**6. Do you adopted the following IPM practices in your crop field?**

| Sl# | Practices | Yes (1) | If yes, land area (ha.) | No (0) |
|---|---|---|---|---|
| 1 | Sex pheromone trap | | | |
| 2 | Yellow sticky trap | | | |
| 3 | Light trap | | | |
| 4 | Hand picking of insects | | | |
| 5 | Neem cake/oil | | | |
| 6 | Trico-compost | | | |
| 7 | Vermicompost | | | |
| 8 | Uprooting infected plants | | | |
| 9 | Use of beneficial insects | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |

**7. Other information about respondent's (last one-year information):**

| Questions | YES | NO | If yes | |
|---|---|---|---|---|
| | | | times | days |
| a. Have you received any agriculture related training? | | | | |
| b. Did you visit extension office/SAAO for advice? | | | | |
| c. Have you received any training on IPM? | | | | |
| d. Did you visit extension office/SAAO for IPM advice? | | | | |
| e. Are you confident about SAAO advice? | | | | |
| f. Do you think IPM practices are available in your area? | | | | |
| g. Do you have any bank account? | | | | |
| h. Did you receive any agriculture related credit? | | | | |
| i. Are you a member in any societal organization? | | | | |
| j. Is there any IPM club in your village? | | | | |
| k. Are you a member of IPM club? | | | | |
| l. Do you have electricity in your house? | | | | |
| m. Do you have your own spray machine? | | | | |
| n. Distance of your home to local market (km). | | | | |
| o. Distance to upazila agriculture office from home (km). | | | | |
| p. Distance of your home to highway (km). | | | | |
| q. Your total experience in agriculture (years). | | | | |
| r. How long you are practicing IPM? (years) | | | | |

| | |
|---|---|
| s. Do you receive IPM related information from mass media? | |
| t. Annual income from agriculture sector (Tk) | |
| u. Annual income from non-agriculture sector (Tk) | |

**8. Problems and suggestion regarding IPM**

a. Are there any problems of using IPM practices? Mention

them

i……

ii……...

iii……..

b. Suggestions for future development of IPM.

i……

ii……

iii……

# Appendixes -II

```
. logit Adoptionandnonadoption AGE EDUCATIONofrespondentyears familysize farmingarea  Haveyoureceivedanytrainingo knowledge  BG Didyour
> anyagricultural totalincome Yourtotalexperienceinagricul

Iteration 0:   log likelihood = -65.895568
Iteration 1:   log likelihood = -33.272669
Iteration 2:   log likelihood = -30.286312
Iteration 3:   log likelihood = -30.028555
Iteration 4:   log likelihood = -30.026281
Iteration 5:   log likelihood =  -30.02628

Logistic regression                             Number of obs   =        100
                                                LR chi2(10)     =      71.74
                                                Prob > chi2     =     0.0000
Log likelihood =  -30.02628                     Pseudo R2       =     0.5443
```

| Adoptionandnonadoption | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| AGE | .0631798 | .0381346 | 1.66 | 0.098 | -.0115625 | .1379222 |
| EDUCATIONofrespondentyears | .1410171 | .0924876 | 1.52 | 0.127 | -.0402553 | .3222895 |
| familysize | .5337929 | .2802649 | 1.90 | 0.057 | -.0155161 | 1.083102 |
| farmingarea | -.5110378 | .4779015 | -1.07 | 0.285 | -1.447707 | .4256318 |
| Haveyoureceivedanytrainingo | .010879 | .8893928 | 0.01 | 0.990 | -1.732299 | 1.754057 |
| knowledge | .9944584 | .2884649 | 3.45 | 0.001 | .4290777 | 1.559839 |
| BG | -.0041621 | .8635399 | -0.00 | 0.996 | -1.696669 | 1.688345 |
| Didyoureceiveanyagricultural | .0956931 | 1.165703 | 0.08 | 0.935 | -2.189043 | 2.380429 |
| totalincome | -.1601924 | .3908342 | -0.41 | 0.682 | -.9262134 | .6058286 |
| Yourtotalexperienceinagricul | .1315708 | .0549735 | 2.39 | 0.017 | .0238247 | .2393169 |
| _cons | -12.99824 | 4.020419 | -3.23 | 0.001 | -20.87811 | -5.118361 |

# Appendixes-III

```
. margins, dydx( AGE EDUCATIONofrespondentyears familysize farmingarea knowledge Haveyoureceivedanytrainingo BG Didyoureceiveanyagricultural
> totalincome Yourtotalexperienceinagricul)

Average marginal effects                        Number of obs   =        100
Model VCE    : OIM

Expression   : Pr(Adoptionandnonadoption), predict()
dy/dx w.r.t. : AGE EDUCATIONofrespondentyears familysize farmingarea Haveyoureceivedanytrainingo knowledge BG Didyoureceiveanyagricultural
               totalincome Yourtotalexperienceinagricul
```

| | Delta-method dy/dx | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| AGE | .0060492 | .0034856 | 1.74 | 0.083 | -.0007825 | .0128809 |
| EDUCATIONofrespondentyears | .0135017 | .0085172 | 1.59 | 0.113 | -.0031916 | .030195 |
| familysize | .0511081 | .0251914 | 2.03 | 0.042 | .0017338 | .1004824 |
| farmingarea | -.0489294 | .0448524 | -1.09 | 0.275 | -.1368385 | .0389797 |
| Haveyoureceivedanytrainingo | .0010416 | .0851581 | 0.01 | 0.990 | -.1658653 | .1679485 |
| knowledge | .0952146 | .0200349 | 4.75 | 0.000 | .0559468 | .1344823 |
| BG | -.0003985 | .0826788 | -0.00 | 0.996 | -.162446 | .161649 |
| Didyoureceiveanyagricultural | .0091621 | .1116441 | 0.08 | 0.935 | -.2096563 | .2279806 |
| totalincome | -.0153376 | .0373954 | -0.41 | 0.682 | -.0886313 | .057956 |
| Yourtotalexperienceinagricul | .0125973 | .0045603 | 2.76 | 0.006 | .0036592 | .0215354 |