FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF AGRO-CHEMICALS ON ENVIRONMENT

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This is to certify that the thesis entitled **"FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF AGRO-CHEMICALS ON ENVIRONMENT"** submitted to the department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension**, embodies the result of a piece of bona fide research work carried out by **MD. SHAHINUR ISLAM, Registration No. 14-06228** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:

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Dhaka, Bangladesh

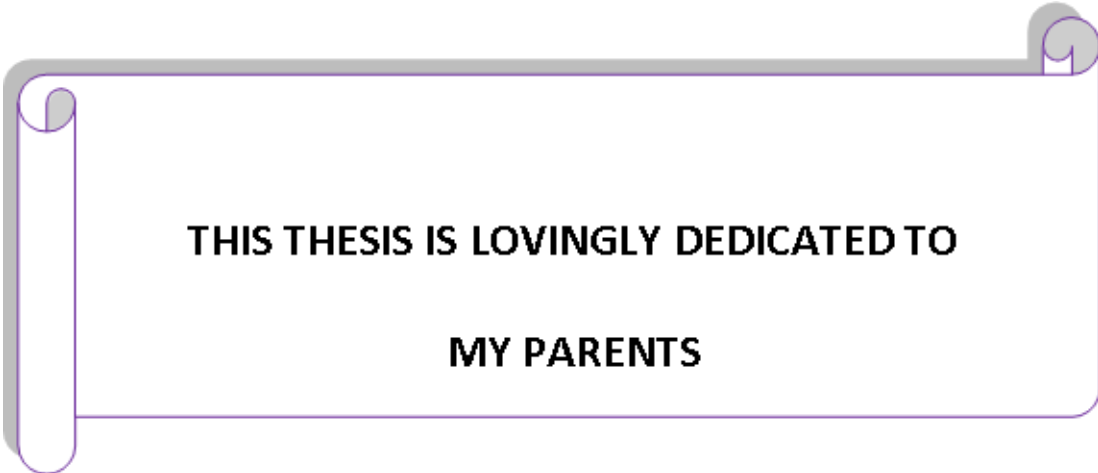……………….......................................

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THIS THESIS IS LOVINGLY DEDICATED TO

MY PARENTS

ACKNOWLEDGEMENT

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ABBREVIATIONS USED

GDP	Gross Domestic Product
BBS	Bangladesh Bureau of Statistics
GAP	Good Agricultural Practices
DAE	Department of Agricultural Extension
FFS	Farmers' Field School
FS	Farm size
SPSS	Statistical Package for Social Sciences
S D	Standard Deviation
SAAO	Sub-Assistant Agriculture Officer
NGOs	Non-Government Organizations
Ag. Ext. Ed.	Agricultural Extension Education
ICM	Integrated Crop Management
IPM	Integrated Pest Management

FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF AGRO-CHEMICALS ON ENVIRONMENT

MD. SHAHINUR ISLAM

ABSTRACT

The objectives of this study were to determine the extent of perception of the farmer's towards harmful effects of agro-chemicals on environment and to describe the selected characteristics of the farmers and to explore the relationship between each of the selected characteristics of the farmers with their perception towards harmful effect of agro-chemicals on environment. The study was conducted with randomly selected 108 farmers from four villages of Thakurgaon sadar upazila under Thakurgaon district. A pre-tested interview schedule was used to collect data from the respondents during March 15 to April 14, 2021. Farmers' perception towards harmful effects of agro-chemicals on environment was the main focus variable and this variable was measured by applying a 4-point Likert scale. The highest proportion 76.85 percent of the farmers had medium perception towards harmful effects of agro-chemicals on environment compared to having 16.67 percent high and 6.48 percent low perception towards harmful effects of agro-chemicals on environment. Five characteristics of the farmers' viz. education, farming experience, training exposure and knowledge on good agricultural practices had positive significant relationship with their perception towards harmful effects of agro-chemicals on environment but problem faced in good agricultural practice had negative significant relationship with their perception towards harmful effects of agro-chemicals on environment.

CHAPTER I
INTRODUCTION

1.1 General Background of the Study

Agriculture is the process of producing food, feed, fiber and other desired products through the cultivation of plants and the raising of domesticated animals. In a true sense, it is a productive unit where humans get the free gifts of nature namely land, light, air, temperature, rain water, humidity etc. which are integrated into a single primary unit indispensable for human beings (Mishra, 2013). Production and distribution of food is becoming increasingly industrialized and globalized, the industrial approach to produce food on a large scale could lead to degradation of soil, deforestation, eutrophication (the process by which nutrients runoff leads to oxygen depletion in water) and acidification of marine and fresh water systems, climate change and pesticide and antibiotic resistance (Leinonen, 2012). The effects of prolonged and over usage of chemicals in crop production has resulted in human health hazard and pollution of environment and ground water (Mishra, 2013). Abbasov (2015) opined that in order to decrease the negative effects of large-scale agricultural production on the environment, many countries are taking agro-environment measures. For the success of the agro-environment policies, which actually integrate the policies relate separately to agriculture and environment, the relationship between agriculture and environment should be understood well because agriculture evidently depends on the quality of soil and water, both of which are the elements of the environment (Abbasov, 2015).

Insecticides use plummeted sharply to about 1500 tons in 1974-75 and the trend continued upto 1978-79 due to the partial withdrawal of government subsidy from insecticide in 1973-74. (Karim, 2009).

Agriculture and environment interact in such a way that agriculture growth depends on the proper functioning of the environment process and the same way that environment soundness depends upon agriculture (Conway, 2010). Thus agriculture simultaneously becomes a victim and a cause of ecological destruction (Hossain et al., 2004).

Pesticide population and fertilizer wastes also caused microbial degradation in soil (Garg et al., 2004). Excessive use of chemical fertilizer and pesticide also reduce water

conservation capacity of soil (Khaleque, 2007 and Rezauddin, 2004). Most devastating ecological imbalance is caused due to indiscriminate use of pesticides. Pesticides affect fishes, living in the river tank, pond etc. It is proven that dangerous pesticides are present at an unacceptable level in the fishes of the Bay of Bengal which is too much harmful for human health. Fishes alone contributed to an unacceptable level of insecticides among Bangladeshi people which is five times more than their American counterpart (Sarker, 2003).

In Bangladesh, chemical control is still the principal method of pest control. At present 96 different kinds of pesticides (including one botanical) with 304 trade names have been registered in Bangladesh. In the year 2020, 2462 tons of active ingredients of pesticide were used in Bangladesh, covering an area of 13.63 million hectare, which equals to 180 grams of active ingredients per hectare per year. All these pesticides are imported every year expending hard earned foreign currency.

Although pesticides use in Bangladesh is relatively lower in comparison to neighboring countries (e.g. India, uses 320 grams of active ingredients per hectare per year), the use of pesticide has been increasing rapidly over the past two decades. A report titled "the impact of pesticides on farmer health: a medical and economic analysis in the Philippines" (Pingali el al. 2005) claimed that the value of crops lost to pests when pesticides are not used is invariably lower than the cost of treating diseases caused by their use. The health costs incurred by farmers exposed to pesticides are 61percent higher than those of farmers who are not exposed, it added. Higher level of pesticides uses also damage our natural resources such as land, fishes, diatoms, beneficial microorganisms, beneficial insects, plants and soon.

Although pesticides may provide temporary relief from pest outbreak in the crop fields, the rapid increase in the use of pesticides in agriculture in recent years has led to concern about its environmental effects. Two dangers are of particular importance in this context. First, pesticides use can have adverse health effects for farm workers and others exposed to pesticides. Second, it might contaminate ground and surface water, harming downstream users of that water and damaging inland fisheries.

It is clear that use of pesticide is increasing day by day. It is now widely accepted that indiscriminate use of pesticides not only creates serious environmental and human health problems but also promotes development of pest resistance to insecticides, destroys beneficial insects, upsets the balance between die pest and their natural enemies leading to the increase in the population of the target pests and even creates new pest problems. To avoid such consequences on the ecology and at the same time to increase crop production to a desirable extent, a viable alternative to sole dependence on chemicals for pest management is needed.

Hence, this study was undertaken to investigate farmer's perception towards harmful effects of agro-chemicals on environment. The findings of the present study may provide valuable guidelines for the researchers, planners, policy makers and other government and non-government organization for future study and programme development for the upliftment of rural people under different rural development programme.

1.2 Statement of the Problem

Modem agriculture and public health are closely associated with the use of chemicals. Pesticide is one of them and being used for controlling insect pests and diseases. Although pesticide use is an integral part of the modem agriculture to protect vegetable crops, but unfortunately it showed high level of adverse effect on environment as well as human health.

The excess use of pesticides for crops production creates a strong nutritional imbalance in soils by the increase of particular nutrient(s) or decreasing the initial status through enhanced uptake by crops. Pesticides also affect the physical, chemical and biological properties of soil. These adverse soil properties ultimately create a strong imbalance in soil ecology and affect the crop yields. The pesticides and organic fertilizers, on the other hand, tend to maintain good soil fertility without significant yield decline and also maintain healthy soil environment.

From different points of view, it is cleared that pesticides and chemical fertilizers have serious effect on ecosystem. Non-judicious use of pesticides damage natural resources like land, fishes, beneficial insects, soil microbes etc.

Analyzing the issues on using pesticides from farmers' perspective, this study was specially designed to find out the answers on the following questions:

- What is the farmers' perception towards harmful effects of agro-chemicals on environment?
- What are the characteristics of farmers affecting their farmers' perception towards harmful effects of agro-chemicals on environment?
- What are the relationships between farmers' selected characteristics and their perception towards harmful effects of agro-chemicals on environment?

1.3 Specific Objectives

1. To determine the extent of perception towards harmful effects of agro-chemicals on environment

2. To describe following the socio-economic characteristics of the farmers:
   - Age
   - Education
   - Farm size
   - Annual family income
   - Farming experience in cultivation
   - Training exposure
   - Extension contact
   - Problem faced in good agricultural practices
   - Knowledge on good agricultural practices

3. To explore the relationship between each of the selected characteristics of the farmers with their perception towards harmful effects of agro-chemicals on environment.

1.4 Justification of the Study

There are a number of studies have been conducted on perception of farmers towards harmful effect of agro-chemicals on environment. The size and density of the population in relation to land area and resources development have already caused a high degree of environmental degradation, as reflected by deforestation, loss of wild life, destruction of wet lands and inland fisheries, soil depletion and inland salinity intrusion. Nowadays farmers use pesticides during vegetables production in a large scale. The pesticides which are used in the cultivation of vegetables are very destructive for human health. The vegetables uptake or absorb the chemicals and when these vegetables are

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eaten/consumed by an individual, he swallows the chemicals which make various disorder in the metabolic system. The major cause behind these man made problems is the lack of institutional capacity in integrated planning and environmental management. Many government and nongovernment organizations are working in Bangladesh in the fields of agriculture and rural development. Sustainable agricultural growth and protection of environment are the issues of high priority today. The findings of this research will be useful to those who are concerned with planning, implementation and evaluation of agricultural, rural development and environmental programs. Various pesticides companies and firms also can make use of the findings of this research in determining policies and practices for the marketing of their products. The knowledge and skills gained by the researcher in conducting this research will enable him to conduct other similar studies in this field.

Considering the above findings, the researcher became interested to undertake a study to determine farmers perception towards harmful effects of agro-chemicals on environment so that the findings are likely to be helpful to develop a sound policy for the environment friendly agricultural research and extension system of the country.

1.5 Scope of the Study

The present study was designed to have an understanding of farmers perception towards harmful effect of agro-chemicals on environment. The findings of the study would fit to the areas of Bangladesh where physical, socio-economic, cultural and geographic condition do not differ much from those of the study area. Thus, the findings are expected to be useful to students, researchers, extension workers, and particularly for planners in formulating and designing the procedures for maintaining the natural balance. The findings may also be helpful to the field workers of different nation building departments to improve strategies of action to conform environment friendly sustainable production to the rural people. Lastly, the researcher believes that the findings and recommendations of this study will definitely lead to minimize the cost of production for crops and simultaneously reduce the risk of environmental damages.

1.6 Assumptions of the Study

An assumption has been defined as "the supposition that an apparent fact or principle is true in light of the available evidence" (Goode, 1945). An assumption is taken as a fact

or belief to be true without proof. So, the following assumptions were in mind of the researcher while carrying out this study:

- The respondents included in the sample were capable of furnishing proper responses to the questions of the interview schedule.
- Views and opinions furnished by the respondents were the representative views and opinions of the whole population of the study.
- The responses furnished by the respondents were reliable and they truly expressed their opinions on farmers' perception towards harmful effects of agro-chemicals on environment.
- The data collected by the researcher were free from bias.
- The researcher who acted as the interviewer was well adjusted to the social and cultural environment of the study area. Hence, the respondents furnished their correct opinions without any hesitation.
- The respondents had almost similar background and seemed to be homogenous to a great extent.
- The information sought by the researcher revealed the real situation to satisfy the objectives of the study.
- The findings were useful in choosing the clients as well as for planning execution and evaluation the extension programme.

1.7 Limitations of the Study

The present study was undertaken to have an understanding of the farmers' perception towards harmful effect of agro-chemicals on environment and to determine the relationship of each of the selected characteristics of the farmers. Considering the time, money and other necessary resources available to the researcher and to make the study manageable and meaningful from the point of view of research, it becomes necessary to impose certain limitations. The limitations were as follows:

i. The study was confined in two union of Thakurgaon sadar upazila under Thakurgaon district.

ii. The study was restricted within the farmers who had some cultivable land under their own cultivation.

iii. The population for the study was kept confined to the heads of the family who regularly cultivated their land.

iv. There were many characteristics of the farmers but in the study only nine (9) of them were selected for investigation.

v. For information about the study, the researcher depended on the data furnished by the selected respondents during their interview with him.

vi. Major information, facts and figures supplied by the respondents were applicable to the situation prevailing in the locality during the year 2021.

1.8 Definition of Terms

A researcher needs to know the meaning and contents of every term that he uses. It should clarify the issue as well as explain the fact to the investigator and readers. However, for clarity of understanding, a number of key concepts/terms frequently used throughout the study defined are interpreted as follows:

Age: Age was defined as the period of a respondent from her birth to the time of interview. It was measured in terms of years.

Education: Empirically it was defined to the development of desirable changes in knowledge, skill and attitudes in an individual through reading, writing, walking, observation and other selected activities. It was measured on the basis of classes a farmer has passed from a formal educational institution.

Farm size: Farm size meant the total area of land on which a farmer's family carried on farming operations in terms of full benefit to the family.

Annual family income: Income from cultivation of a respondent was defined in taka annually earned by cultivation.

Farming experience

Farming experience referred to the total duration attained by a respondent on farming and it was expressed as total number of years.

Training exposure: Training of a respondent was referred by the number of days a respondent trained. The measurement included from the day of starting training and till the day of data collection.

Extension contact: These terms referred to an individual's access to or contact to the communication media and sources being used for dispersion of new technologies among farmers.

Problem: Problem can be defined as a situation or a matter which is unwelcomed. It is treated as harmful and needing to dealt with and overcome.

Knowledge: Knowledge is operationally defined for the purpose of this investigation as 'those behaviors and test situations, which emphasized the remembering either by recognition or recall of ideas, material or phenomenon'. It referred to the amount of understood information possessed by the farmers on various aspects of botanical pesticides for controlling pest in vegetable cultivation.

Perception: The ability to see, hear, or become aware of something through the senses. Perception is the organization, identification, and interpretation of sensory information in order to represent and understand the presented information. Perception is the sensory experience of the world. It involves both recognizing environmental stimuli and actions in response to these stimuli. Through the perceptual process, we gain information about the properties and elements of the environment that are critical to our survival.

CHAPTER II
REVIEW OF LITERATURE

This chapter deals with the review of past researches related to the present study. The reviews are conveniently presented based on the major objectives of the study. In spite of sincere effort, adequate numbers of directly related literatures were not readily available for this study. However, the literatures of available studies have been briefly discussed in this chapter.

2.1 Review of Literature Related to Agro-Chemicals

Pavel (2020) conducted a study on and found that the highest proportion (56.19 percent) of the farmers had medium awareness on environmental pollution compared to having (26.67) percent high and (17.14) percent low awareness on environmental pollution.

Kumari and Sharma (2018) the study was conducted to evaluate farmers' perception on environmental effects of pesticide usage in Indian mountain of Western Himalayan state of Himachal Pradesh. The study was based on primary data collected from the farmers who involved in pesticides use in high value cash crops like apple and vegetables. The perception on various aspects of pesticide usage revealed that those farmers who had large farm size have more awareness for the usage of pesticides than those who had small farm size. All small land holding and majority of large land holding farmers were dependent only on farming for their livelihood. Hence, to increase their production farmers were doing excessive and indiscriminate use of pesticides. On all farm, more than four fifths of the farmers responded that productivity was decreasing and 94.51 percent of the farmers responded that cost of production was increasing. In comparison to large farmers, response of small farmers was less for adopting some of the strategies to minimize adverse effect of climate change and loss of natural resource base. The study concluded that all the farmers those who had awareness and those who don't have awareness on the impact of pesticide use were underestimating the use of pesticides which make an increase in agricultural production and productivity and have adverse effect on the human health and the ecosystem. Therefore, the message of the study is clear. There is a need to pay attention towards promoting scientific and rational use of pesticides and other agro-chemicals to avoid environmental effects and to promote balanced use of fertilizer including bio-fertilizer for restoring soil heath to protect the

livelihoods of multitude of small and large farmers. The government should, therefore, undertake policy measures to strengthen extension facilities to educate specifically small size farmers about environmental effects due to the use of agro-chemicals.

Kabir and Rainis (2012) the present study is conducted to determine the level of farmers' perception about harmful effects of pesticides on environment. Attempt has also taken to analyze some socio-economic characteristics that influence farmers' perception. Data were collected from 180 farmers of Dhaka district, Bangladesh through a face to face interview in September to November 2009. Results showed that an overwhelming majority (86.1 %) of the farmers had low to medium level of perception; while only 13.9% farmers had high perception regarding adverse effects of pesticides on environment. Results of linear regression analysis indicated that extension contact, experience in vegetable farming, education and training on integrated pest management (IPM) are the four factors that significantly influence the farmers' perception. It is concluded that if policy makers and extension organizations concentrate on these factors, then farmers' will be more aware about the adverse effects of pest.

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that the highest proportion (49.4 percent) of the farmers were in medium level of awareness on environmental pollution compared to 38.8 percent having low and 11.8 percent having high level of awareness on environmental pollution.

Hanif (2000) in his study indicated that among the Farmers' Field School (FFS) 100 percent farmers had high awareness on environmental pollution due to use of pesticides. In case of non FFS fanners, 66.67 percent had poor awareness, while 30 percent had medium and 3.33 percent had high awareness on environmental pollution due to use of pesticides.

Hamid (1995), in his study on farmers' awareness on environmental pollution caused by the use of agro-chemicals, found that 40 percent of the farmers were in moderate awareness category whereas 29 percent and 8 percent of them were in poor and high awareness category respectively.

Hossain (1999) found that the majority (63 percent) of the farmers had moderately favorable perception of the adverse effects of agro-chemical on environment while 22 and 15 percent of them had slightly favorable and favorable perception respectively.

Parveen (1995) found in her study that 65 percent of farm women had poor awareness while 29 percent had medium and 6 percent had high awareness on environmental degradation due to use of modem agricultural technologies.

Khan (2006) found that more than 60 percent of the growers were illiterate. Approximately 85 percent use pesticides on the recommendation of local pesticide dealers. Ninety percent vegetable and 80 percent fruit growers were found unaware of the recommended doses, spray intervals and the harmful effects of these chemicals on human health. Only 6.7 percent of the vegetable and 14.5 percent of the fruit growers had attended courses on the safe and effective use of pesticides. Sixteen percent (16 percent) of vegetable and fruit growers were found using protective clothing during the spraying.

2.2 Selected Characteristics of the Farmer and their Perception

2.2.1 Age and farmers' perception

Pavel (2020) conducted a study on farmers' awareness on environmental pollution. They found that age had positive and non- significant influence on the farmers' awareness.

Kabir et al. (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that age had negative and non- significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by the farmers in Ogbomoso, Nigeria. Adeola found that age had a significant influence on the farmers' perception.

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was no significant relationship between age of the respondents and their awareness on environment environmental

pollution.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. Pal found that age had no significant relationship with farmer's perception.

Majlish (2007) conducted a study regarding perception of participant women on social forestry program of BRAC. The study revealed that the relationship between age and perception of social forestry program was negatively significant.

Afique (Z006) mentioned that there was no significant relationship between the age of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that age of the farmers had no significant relationship with their perception of cause's und remedies of Monga in Kurigram district.

Sharmin (2005) stated that age of the rural women had no significant relationship with the perception of benefits of involvement in IGAs under a NGO.

Uddin (2004) conducted a study on perception of sustainable agriculture. The findings revealed that age of the respondents had negative significant relationship with their perception of sustainable agriculture.

Sayeed (2003) found that age had negative relation with farmers' perception of benefit from using manure towards INM for sustainable crop production by the farmers. Ismail (1979), Chowdhury (2001) and Alam (2001) obtained similar type of findings in their respective studies.

Kabir (2002) studied perception of farmers on the effects of integrated area development project towards environmental upgradation. The study revealed that there was no significant relationship between age and perception of environmental upgradation. Similar finding was obtained by Fardous (2002) in his study.

Islam (2000) stated that age of farmers had no significant relationship with their perception of the harmful effect of agro-chemical with regard to environmental pollution. Hossain (2000) and Parveen (1995) obtained similar result in their studies.

2.2.2 Education and farmers' perception

Pavel (2020) conducted a study on farmers' awareness on environmental pollution. They found that education had positive and significant influence on the farmers' awareness.

Kabir et al., (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that education had a positive and non-significant influence on the farmers' perception.

Kabir and Rainis (2012) conducted a study on farmers' perception on the adverse effects of pesticides on environment: the case of Bangladesh. They found that education had a significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that education had a significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that education had a positive significant influence on the farmers' perception.

Majlish (2007) found that the relationship between education of participant women and their perception of social forestry program of BRAC was positively significant.

Afique (2006) mentioned negatively significant relationship between personal education of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Snmity, (SUS).

Sharmin (2005) found that personal education of the rural women had significant positive relationship with their perception of benefits of involvement of IGAs under a NGO.

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Uddin (2004) concluded that the level education of the farmers had a significant positive relationship with their perception of sustainable agriculture.

Sayeed (2003) revealed that the education of the respondents had significant positive relationship with their perception from using manure towards Integrated Nutrient Management (INM) for sustainable crop production.

Fardous (2002) found a significant positive relationship between education of the farmers' and their perception of the forestry development activities of Village and Farm Forestry Program (VFFP) towards sustainable forestry development.

Alam (2001) found that education of farmers had a significant and positive relationship with their perception of Binamoog-5 as a summer crop. Majydyan (1996) and Islam (2001) found similar type of result. But, Kashem and Mikuni (1998) did not find any relationship between education of farmers and their perception about benefit of using Indigenous Technical Knowledge (ITK).

2.2.3 Farm size and farmers' perception

Pavel (2020) conducted a study on farmers' awareness on environmental pollution. They found that farm size had negative and significant influence on the farmers' awareness.

Kabir et al. (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that farm size had negative and non-significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that household size had a non-significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that farm size had no significant relationship with farmer's perception.

Majlish (2007) revealed from her study that the relationship between farm size of participant women and perception of social forestry program of BRAC was non-significant and followed a positive trend.

Afique (2006) stated that there was no significant relationship between family farm size of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that farm size of farmers had no significant relationship with their perception of both causes and remedies of Monga in Kurigram district.

Sharmin (2005) found in her study that farm size of the rural women had no significant relationship with their perception of benefits of involvement in IGAs under a NGO.

Uddin (2004) found that farm size of the farmers had significant and positive relationship with their perception of sustainable agriculture.

Sayeed (2003) observed that farm size of the farmers had a significant positive relationship with their perception of benefit from using manure towards Integrated Nutrient Management (INM) for sustainable crop productions.

Fardous (2002) found that there was no significant relationship between farm size of the farmers and their perception of Village and Farm Forestry Program (VFFP) towards sustainable forestry development. Hossain (2001), Hossain (1999) and Majydyan (1996) found similar findings in their respective studies.

2.2.4 Annual family income and farmers' perception

Pavel (2020) conducted a study on farmers' awareness on environmental pollution. They found that income had positive and non- significant influence on the farmers' awareness.

Kabir et al. (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that annual family had negative and non-significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study showed that annual family income had no significant relationship with farmer's perception.

Majlish (2007) found that the relationship between family income of participant women and perception of social forestry program of BRAC was non-significant but followed a negative trend.

Afique (2006) found no significant relationship between annual family income of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that annual income of the farmers had positive significant relationship with their perception regarding causes and remedies of Monga in Kurigram district.

Uddin (2004) concluded that annual family income of the farmers had significant and positive relationship with their perception of sustainable agriculture.

Sayeed (2003) found that annual family income of the farmers had a significant relationship with their perception of benefit from using manure towards Integrated Nutrient Management (INM) for sustainable crop production.

Kabir (2002) found that there was non-significant relationship between annual family income of the farmers and their perception of the effects of BIADP towards environmental upgradation.

Hamid (1995) found a positive relationship between annual income of the farmers and their awareness on environmental pollution.

2.2.5 Training and farmers' perception
Pavel (2020) conducted a study on farmers' awareness on environmental pollution. They found that training had positive and non- significant influence on the farmers' awareness.

Kabir et al. (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that training had a positive but non-significant influence on the farmers' perception.

Kabir and Rainis (2012) conducted a study on farmers' perception on the adverse effects of pesticides on environment: the case of Bangladesh. They found that training had a significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that training received had a positive significant influence on the farmers' perception.

Majlish (2007) found from her study that the relationship between training experience of participant women and perception of social forestry program of BRAC was positively significant.

Afique (2006) mentioned that there was no significant relationship between training exposure of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Sharmin (2005) reported from her study that training exposure of the rural women had no significant relationship with their perception of benefits of involvement in Income Generating Activities (IGAs) under a NGO.

Uddin (2004) from his study concluded that farmers' training exposure had a significant positive relationship with their perception of sustainable agriculture.

Kabir (2002) found that training experience of the farmers had a significant positive relationship with their perception of the effects of BIADP on environmental upgradation.

Fardous (2002) observed that training exposure of the farmers was significantly correlated with the perception of the respondents of VFFP towards sustainable forestry development.

2.2.6 Extension media contact and farmers' perception

Pavel (2020) conducted a study on farmers' awareness on environmental pollution. They found that contact had positive and non- significant influence on the farmers' awareness.

Kabir et al. (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that extension media contact had a positive significant influence on the farmers' perception.

Islam (2005) observed in his study that media contact of the farmers had no significant relationship with the perception of both causes and remedies of monga.

Sharmin (2005) in her study that extension media contact of the rural women had a significant relationship with their perception of benefits of involvement in IGAs under a NGO.

Sayeed (2003) reported that extension media contact of the farmers was a significant positive relationship between media contact of the farmers and their perception of benefit from using manure towards INM for sustainable crop production.

Fardous (2002) conducted a study and found that there was no significant relationship between knowledge of forestry of farmers and their perception of VFFP towards sustainable forestry development.

Kabir (2002) found that extension media contact of the farmers had a significant positive relationship with their perception of the effects of BIADP on environmental up gradation.

Hamid (1997) observed a positive relationship between extension media contact of the farmers and their awareness on the environment pollution.

2.2.7 Problem and farmers' perception

There was no available review of literature about the relationship between problem and farmers' perception.

2.2.8 Knowledge and farmers' perception

Kabir et al., (2018) conducted a study on farmers' perception towards harmful effects of climate change on agriculture. They found that knowledge on climate change had a positive significant influence on the farmers' perception.

Kabir and Rainis (2012) conducted a study on Farmers' Perception on the Adverse Effects of Pesticides on Environment: The Case of Bangladesh. They found that experience of farmers had a significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that farming knowledge had a significant influence on the farmers' perception.

Majlish (2007) conducted her study regarding perception of participant women on social forestry program of BRAC. She found from her study that the relationship between knowledge on tree plantation and perception of social forestry program of BRAC was positively significant.

Uddin (2004) conducted his study on farmers' perception of sustainable agriculture. He found that knowledge of environment friendly farming had significant and positive relationship with their perception of sustainable agriculture. He further conduct environment friendly farming had higher perception of sustainable agriculture.

Fardous (2002) conducted a study and found that there was a significant positive relationship between knowledge of forestry of farmers and their perception of VFFP towards sustainable forestry development.

2.3 Conceptual Framework of the Study

Farmer's perception towards harmful effect of agro-chemicals on environment was the main focus of the study. Farmers' characteristics might have relationship with their perception towards harmful effect of agro-chemicals on environment. On these considerations a simple conceptual framework for the study is drawn and shown in Figure 2.1.

EXPLANATORY VARIABLES

FOCUS VARIABLE

SELECTED CHARACTERDSTICS

- ❖ Age
- ❖ Education
- ❖ Farm size
- ❖ Annual family income
- ❖ Farming experience
- ❖ Training exposure
- ❖ Extension contact
- ❖ Problem faced in good agricultural practices
- ❖ Knowledge on good agricultural practices

Farmers' perception towards harmful effects of agro-chemicals on environment
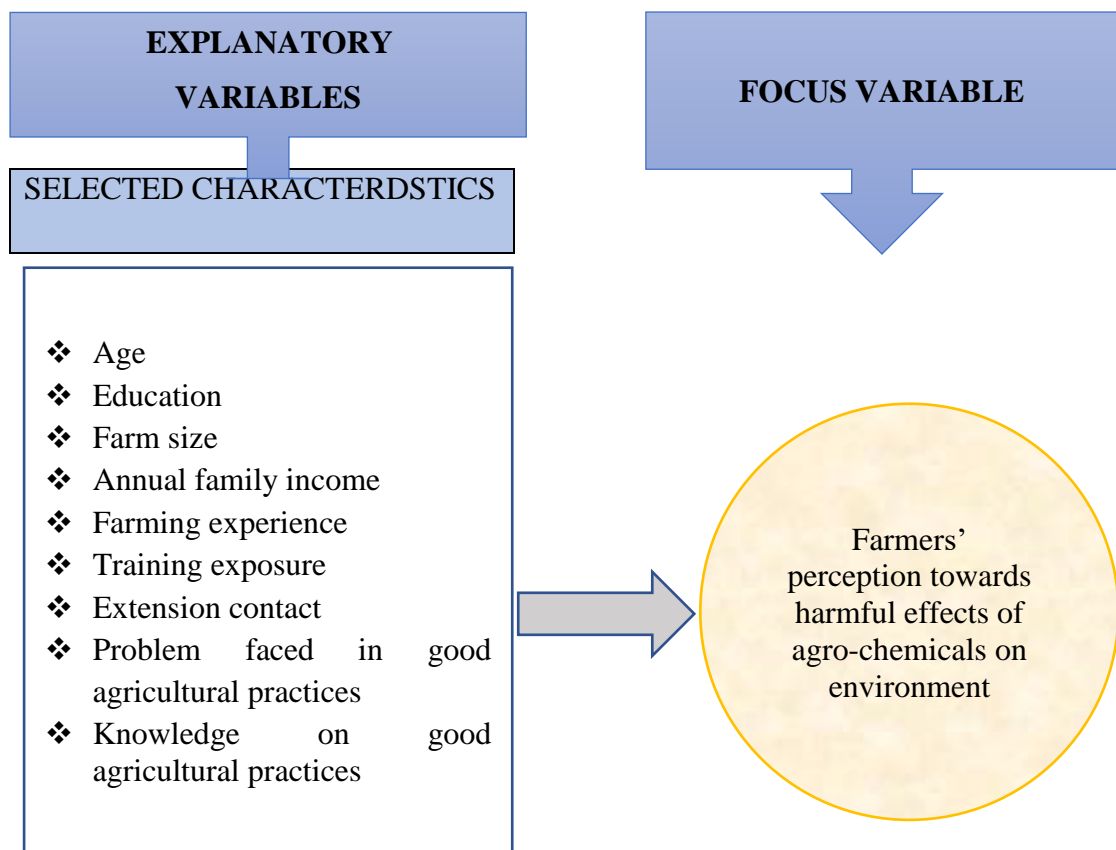
Figure 2.1. The conceptual framework of the study

CHAPTER III
MATERIALS AND METHODS

Methods and procedures used in conducting research need very careful consideration. Methodology enables the researcher to collect valid information and to analyze the same properly to arrive at correct decisions. The methods and procedures followed in conducting this research are being described in this chapter.

3.1 Locale of the Study

The study was purposively conducted at Thakurgaon sadar upazilla under Thakurgaon district. Two unions namely Akhanagar and Akcha were also purposively selected. Four (4) villages namely, Jhargaon and Velarhat from Akhanagar union and Bamonpara and Birpara from Akcha union were then selected randomly from the selected unions. All farmers from the selected four villages were constituted as the population of the study. A map of Thakurgaon district showing Thakurgaon sadar is presented in Figure 3.1. A map of Thakurgaon sadar upazila showing the study area is presented in Figure 3.2.

3.2 Population and Sample

All of the farmers under selected four villages were considered as the population of the study. Four (4) lists of farmers who are currently cultivating crops from selected four villages were prepared with the help of upazila Agriculture Officer and his field staffs. The number of farmers of the selected four villages was 1081 which constituted the population of the study. About 10 percent of the population was selected proportionally from the selected villages as the sample by following random sampling method. Thus, the total sample size stood at 108. Moreover, a reserved list of 10 farmers was prepared for use when the farmers under sample were not available during data collection.
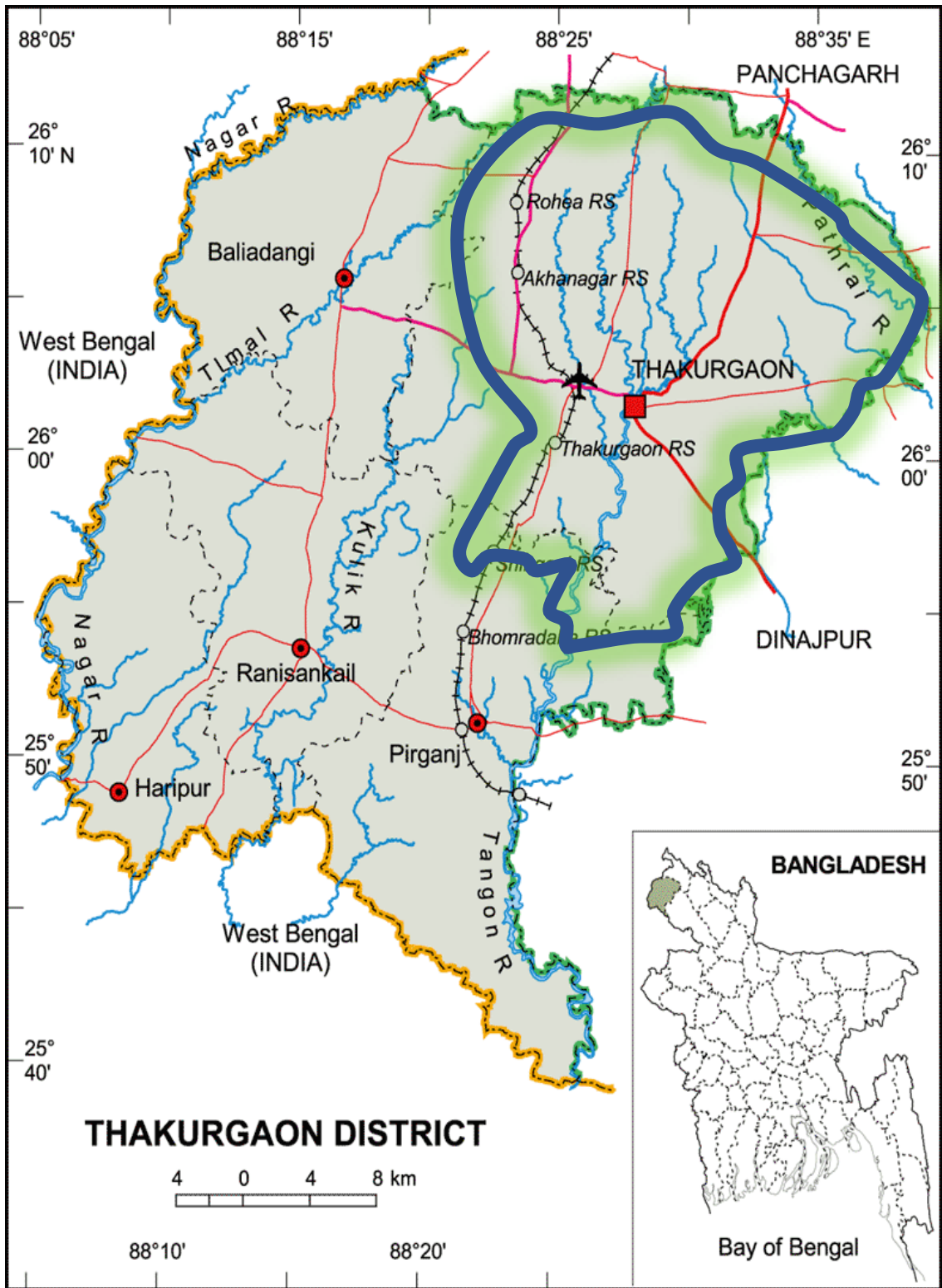
Figure 3.1: A map of Thakurgaon district showing Thakurgaon sadar upazila
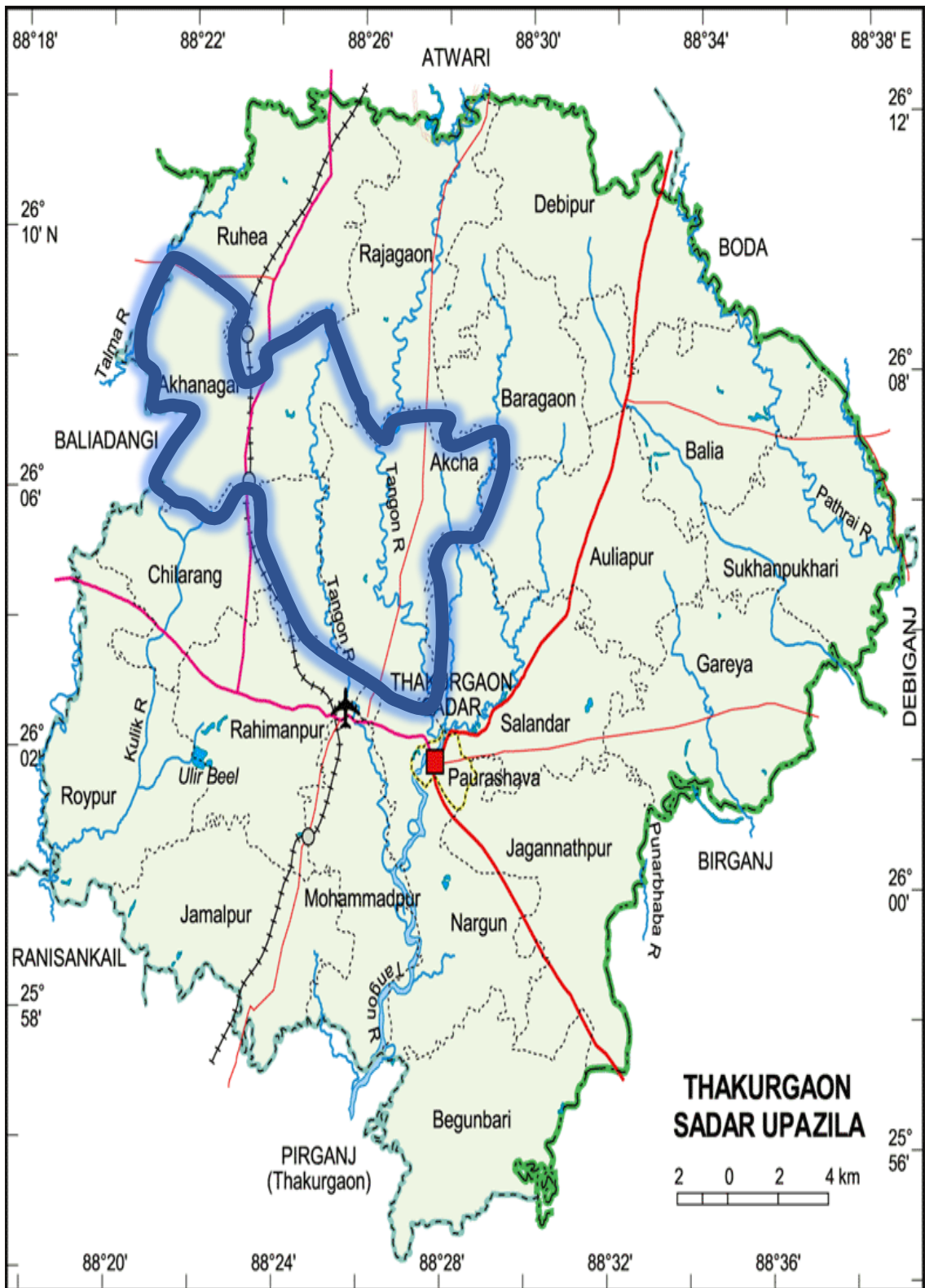
Figure 3.2: A map of Thakurgaon sadar showing the study area

The distribution of population, sample and reserve list of the selected villages is shown in the Table 3.1.

Table 3.1 Distribution of the sampled farmers in the study area

Unions name	Name of village	Total no. of farmers	Sample	Reserve list
Akhanagar	Jhargaon	321	32	3
	Velarhat	229	23	2
Akcha	Bamonpara	287	29	3
	Birpara	244	24	2
Total		**1081**	**108**	**10**

3.3 Measurement of Variables

The various characteristics of the farmers might have influence on their perception towards harmful effects of agro-chemicals on environment. These characteristics were age, education, farm size, annual family income, farming experience, training exposure, extension contact and problem faced in good agricultural practices and knowledge on good agricultural practices. Perception towards harmful effect of agro-chemicals on environment was the main focus of the study.

Measurement of all the characteristics of the farmers and their perception towards harmful effects of agro-chemicals on environment are discussed in the following sub sections:

3.3.1 Age

Age of farmers was measured by counting the actual years from his/her birth to the time of interview. It was expressed in terms of complete years.

3.3.2 Education

Education of farmers was measured by the number of years of schooling completed from an educational institution. A score of one (1) was given for each year of schooling completed. If farmers didn't know how to read and write, his education score was zero, while a score of 0.5 was given to farmers who could sign his/her name only. If farmer did not go to school but studied at home or adult learning center, his knowledge status was considered as the equivalent to a formal educational institution.

3.3.3 Farm size

Farm size of farmer referred to the total area of land on which his/her family carried out farming operations, the area being in terms of full benefit to his/her family. The farm size was measured in hectares for each farmer by using the following formulae:

$$FS = A_1 + A_2 + {}^1/2\,(A_3 + A_4) + A_5$$

Where,

FS= Farm size

A_1 = Homestead farm

A_2= Own land under own cultivation

A_3= Land given to others on borga

A_4= Land taken from others on borga

A_5= Land taken from others on lease

3.3.4 Annual family income

Annual family income of farmers was measured in Thousand Taka. The total yearly earning from agricultural (field crops, vegetables, fruits, spices, livestock and fisheries) and nonagricultural sources (service, business, and others) by the respondent himself/herself and other members of his/her family was determined. Thus, yearly earning from agricultural and nonagricultural sources were added together to obtain annual family income of farmers. A score of one was given for each Tk. 1,000 to compute the annual family income scores of the respondents.

3.3.5 Farming experience

Farming experience of a farmer was measured by the total number of years he/she cultivated. A score of one (1) was assigned for each year of cultivation.

3.3.6 Training exposure

Training exposure of the farmer was measured by the total number of days he/she participated in different training programmes. A score of one (1) was assigned for each day of training received.

3.3.7 Extension contact

This variable was measured by computing an media exposure score on the basis of a respondent's extent of contact with 9 selected media as obtained in response to item no.7 of the interview schedule (Appendix A). Each respondent was asked to indicate the extent of his/her contact with each of the selected media with five alternative responses as "regular", "often", "occasional", "rare" and "not at all" contact basis and weights were assigned as 4, 3, 2, 1 and 0 respectively.

Finally, media exposure score of a respondent was determined by summing up his/her scores for contact with all the selected media. Thus, possible media exposure score could vary from zero (0) to 36, where zero indicated no media contact and 36 indicated the highest level of media contact.

3.3.8 Problem faced in good agricultural practices

This variable was measured by computing the extent of various problems of the respondents with 10 selected items as obtained in response to questions no. 8 of the interview schedule (Appendix A). Each respondent was asked to indicate the extent of his/her problem as 'severe', 'medium', 'low 'and 'not at all 'problem and score was assigned as 4, 3, 2, 1 and 0 respectively.

Finally, the problem faced score of a respondent was determined by summing up his/her scores for all the problems. Thus, possible score could vary from zero (0) to 40, where Zero indicated no problem and 40 indicated the highest problem.

3.3.9 Knowledge on good agricultural practices

After thorough consultation with relevant experts and reviewing of related literatures, 15 questions regarding good agricultural practices were selected and those were asked to the respondent farmers to determine their knowledge on good agricultural practices. Two (2) score was assigned for each correct answer and zero (0) for wrong or no answer. Partial score was also assigned for partially correct answer. Thus, the knowledge on good agricultural practices score of the respondents could range from 0 to 30, where zero indicating very low knowledge and 30 indicate the very high knowledge on good agricultural practices.

3.3.10 Perception towards harmful effects of agro-chemicals on environment

After thorough consultation with relevant experts and reviewing of related literatures, 15 statement regarding perception towards harmful effects of agro-chemicals on environment were selected and those were asked to the respondent farmers to determine their perception towards harmful effects of agro-chemicals on environment. Perception towards harmful effects of agro-chemicals on environment was measured by a 4-point Likert scale. Scores were assigned as 3 for strongly agree, 2 for agree, 1 for disagree, 0 for strongly disagree. Finally, scores for all the statements were added to obtain the total score of perception towards harmful effects of agro-chemicals on environment. The scores could range from 0 to 45, where zero (0) indicating the lowest level of perception, while '45' indicating the highest level of perception towards harmful effects of agro-chemicals on environment.

3.4   Instruments for Data Collection

Data were collected by using a structured interview schedule. Both open and closed form questions were included in the schedule based on the measurement procedures discussed earlier in section 3.3.

Before finalization, the interview schedule was pre-tested with 20 farmers of the study area. On the basis of the pre-test experiences necessary corrections, modifications and alterations were made before finalizing the interview schedule for final data collection. During modification of the schedule, valuable suggestions were received from the research supervisor and relevant experts. The interview schedule was then printed in its final form and multiplied. Copies of interview schedule in English version are placed in Appendix A.

3.5   Collection of Data

Data were collected personally by the researcher himself through face to face interview. To familiarize with the study area and for getting local support, the researcher took help from the local leaders and the field staffs of Upazila Agriculture Office. The researcher made all possible efforts to explain the purpose of the study to the farmers. Rapport was established with the farmers prior to interview and the objectives were clearly explained by using local language as far as possible. Data

were collected during the period of March 15 to April 14, 2021.

3.6 Data Processing

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

3.7 Statement of Hypothesis

As defined by Goode and Hatt (1952) a hypothesis is a proposition, which can be put to a test to determine its validity. It may prove correct or incorrect of a proposition. In any event, however, it leads to an empirical test. Hypothesis are always in declarative sentence form and they relate either generally of specifically variables to sentence form and they relate either generally or specifically variables to variables. Hypothesis may be broadly divided into two categories, namely, research hypothesis and null hypothesis

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3.7.1 Research hypothesis

Research hypothesis states a possible relationship between the variables being studied or a difference between experimental treatments that the researcher expects to emerge. The following research hypothesis was put forward to know the relationships between each of the 9 selected characteristics of the farmers and their awareness on environment friendly farming practices:

"Each of the nine (9) selected characteristics of the farmers has significant relationship with their perception towards harmful effects of agro-chemicals on environment."

3.7.2 Null hypothesis

A null hypothesis states that there is no relationship between the concerned variables. The following null hypothesis was undertaken for the present study:

"There is no relationship between each of the selected characteristics of farmers and their perception towards harmful effects of agro-chemicals on environment."

3.8 Statistical Analysis

Data were analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative data by means of suitable scoring technique wherever necessary. The statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. Pearsons Product Moment Coefficient of Correlation (r) was used in order to explore the relationships between the concerned variables. Five percent (0.05) level of probability was the basis for rejecting any null hypothesis throughout the study.

CHAPTER IV
RESULTS AND DISCUSSION

In this Chapter the findings of the study and its interpretation are presented in three sections according to the objectives of the study. The first section deals with the extent of the farmers' perception towards harmful effects of agro-chemicals on environment while the second section deals with the selected characteristics of the farmers and the third section deals with the relationship between each of the selected characteristics of the farmers and their a perception towards harmful effects of agro-chemicals on environment.

4.1 Farmers' perception towards harmful effects of agro-chemicals on environment

The observed farmers' perception towards harmful effects of agro-chemicals on environment scores of the farmers ranged from 20-43 against the possible range of 0 to 45 with the mean of 33.17 and standard deviation of 4.34. According to their observed ranged of perception towards harmful effects of agro-chemicals on environment scores, the farmers were classified into three categories as shown in Table 4.1.

Table 4.1 Distribution of the farmers according to their perception towards harmful effects of agro-chemicals on environment

Categories	Farmers =108		Mean	SD
	Number	Percent		
Low perception (<Mean-SD i.e. <28.83)	7	6.48		
Medium perception (Mean ±SD i.e. 28.83- 37.51)	83	76.85	33.17	4.34
High perception (>Mean +SD i.e. >37.51)	18	16.67		
Total	**108**	**100**		

Data presented in the Table 4.1 indicated that the highest proportion (76.85 percent) of the farmers had medium perception towards harmful effects of agro-chemicals on environment compared to 16.67 percent had high and 6.48 percent had low perception towards harmful effects of agro-chemicals on environment. Findings again revealed that overwhelming (83.33 percent) of the farmers had low to medium perception

towards harmful effects of agro-chemicals on environment. Similar result was observed by Shanto (2011) where highest proportion of respondents had medium perception towards harmful effects of agro-chemicals on environment. It is quite logical that the farmers have moderate perception towards harmful effects of agro-chemicals on environment though they are using higher doses of agro-chemicals inputs for higher production.

4.2 Selected Characteristics of the Farmers

Nine characteristics of the farmers were selected for this research. The characteristics include: age, education, farm size, annual family income, farming experience, training exposure, extension contact, problem faced in good agricultural practice and knowledge on good agricultural practices. Some descriptive statistics of these characteristics are given in Table 4.2. Data contained in the Table 4.2 reveal the salient features of the characteristics of the farmers in order to have an overall picture at a glance. However, for ready reference, separate Tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics of the farmers.

Table 4.2 The salient features of the selected characteristics of the farmers

Categories	Measuring Unit	Range		Mean	S D
		Possible	Observed		
Age	Years	-	21-75	45.41	12.84
Education	Year of schooling	-	.00-18	7.01	4.55
Farm size	Hectare	-	.00-3.77	1.05	0.611
Annual family income	"000" Tk.	-	45-370	134.17	62.06
Farming experience	Score	-	5-50	23.58	10.15
Training exposure	Days	-	0-24	5.60	4.64
Extension contact	Score	0-36	21-36	29.98	2.93
Problem faced in good agricultural practice	Score	0-40	20-40	31.12	4.08
Knowledge on good agricultural practices	Score	0-30	16-30	22.21	2.81

4.2.1 Age

Age of the farmers ranged from 21 to 75 years, the average being 45.41 years and the standard deviation was 12.84. According to age, the respondent farmers were categorized into three categories based on the classification provided by the Ministry of Youth and Sports, Government of the People's Republic of Bangladesh. The distribution of the farmers according to their age is shown in

Table 4.3 Distribution of the farmers according to their age

Categories	Farmers		Mean	SD
	Number	Percent		
Young aged (up to 35)	29	26.85		
Middle-aged (36-50)	44	40.74	45.41	12.84
Old (>50)	35	32.41		
Total	**108**	**100**		

Table 4.3 showed that the highest proportion (40.74 percent) of the farmers were "middle aged" while 32.41 percent of them were "old aged" and 26.85 percent of the farmers were "young aged". The findings again indicated that a large proportion (73.15%) of the farmers were middle to old aged.

4.2.2 Education

The education scores of the farmers ranged from 0 to 18. The average was 7.01 and the standard deviation was 4.55. On the basis of their educational scores, the farmers were classified into five categories, namely, illiterate (0), can sign only (0.5), primary (1-5), secondary (6-10) and above secondary (above 10) as shown in table 4.4.

Table 4.4 Distribution of the farmers according to their education

Categories	Farmers		Mean	SD
	Number	Percent		
Illiterate (0)	5	4.6		
Can sign only (.5)	16	14.8		
Primary level (1-5)	25	23.15	7.01	4.55
Secondary level (6-10)	44	40.74		
Above secondary level (>10)	18	16.67		
Total	**108**	**100**		

Table 4.4 indicated that the majority (40.74 percent) of the farmers had secondary level of education compared to 16.67 percent of them having above secondary level of education. About 4.6 percent of the farmers were illiterate, while 23.15 percent had primary level of education and 14.8 percent of them could sign their name only. Similar result was observed by Nasreen *et al*. (2013) where highest numbers of respondents were completed up to secondary education level. Similar findings were found by Hoque (2016) and Masud (2007).

4.2.3 Farm size

The farm size of the respondents varied from 0.11 to 4.05 hectares. The average farm size was 1.05 hectare with the standard deviation of 0.61. The respondents were classified into four categories based on their farm size as followed by DAE (1999) as 'marginal farm (upto 0.2 ha)', 'small farm (0.21 – 1.0 ha)', 'medium farm' (1.0 -3.0 ha') and 'large farm' (above 3.00 ha)'. The distribution of the farmers according to their farm size is shown in Table 4.5

Table 4.5 Distribution of the farmer according to their farm size

Categories	Farmers		Mean	SD
	Number	Percent		
Marginal area (up to 0.2 ha)	1	0.93		
Small area (0.21-1.0 ha)	61	56.48		
Medium area (1.01-3.0 ha)	43	39.81	1.05	0.61
Large area (above 3 ha)	3	2.78		
Total	**108**	**100**		

Table 4.5 indicated that more than half (56.48 percent) of the farmers possessed small farm size compared to 39.81 percent of them had medium farm size , 2.78% of the farmers had large farm size and 0.93% of the farmers had marginal farm size. Thus, the overwhelming majority (97.22 percent) of the farmers were the owners of marginal to medium farm size which is consistent with national scenario.

4.2.4 Annual family income

The score of annual family income of the farmers ranged from 45 to 370 thousand with the mean and standard deviation of 134.17 and 62.06, respectively. On the basis observe range of income, the farmers were classified into three categories namely 'low', 'medium' and 'high' annual family income. The distribution of the farmers according to their annual income is presented in Table 4.6.

Table 4.6 Distribution of the farmer according to their annual family income

Categories	Farmers		Mean	SD
	Number	Percent		
Low income (up to 100)	35	32.4		
Medium income (> 100 to 300)	69	63.9	134.18	62.06
High income (above 300)	4	3.7		
Total	108	100		

Data revealed that the farmers having medium income constitute the highest proportion (63.9 percent), while the lowest proportion (3.7 percent) had high income and (32.4 percent) had low income. Overwhelming majority (96.3 percent) of the farmers had low to medium annual family income.

4.2.5 Farming experience

Score of farming experience of farmers ranged from 5 to 50 with the mean and standard deviation of 23.58 and 10.15 respectively. On the basis of farming experience scores, the farmers were classified into three categories namely 'low, 'medium' and 'high' farming experience. The distribution of the farmers according to their farming experience is given in Table 4.7.

Table 4.7 Distribution of the farmers according to their farming experience

Categories	Farmers		Mean	S D
	Number	Percent		
Low experience (<Mean-SD i.e. <13.43)	18	16.67		
Medium experience (Mean± SD i.e. 13.43-33.73)	67	62.04	23.58	10.15
High experience (>Mean+ SD i.e. >33.73)	23	21.29		
Total	**108**	**100**		

Table 4.7 revealed that the majority (62.04 percent) of the farmers had medium experience in farming, whereas only 16.67 percent had low experience and 21.30 percent had high experience in cultivation category. The findings of the present study again revealed that overwhelming majority (83.33 percent) of the farmers in the study area had medium to high experience in farming.

4.2.6 Training exposure

Training exposure score of the farmers ranged from 0 to 24 with a mean and standard deviation of 5.60 and 4.64 respectively. Based on the training exposure score, the farmers were classified into three categories namely 'no','low', 'medium' and 'high'. The distribution of the farmers according to their training exposure is presented in Table 4.8.

Table 4.8 Distribution of the farmers according to their training

Categories (Scores)	Farmers		Mean	SD
	Number	**Percent**		
No (0)	18	16.67		
Low (up to 8)	67	62.04		
Medium (9-16)	20	18.52	5.60	4.64
High (above 16)	3	2.78		
Total	**108**	**100**		

Table 4.8 indicated that highest proportion (62.04 percent) of the farmers had low training exposure compared to 16.67 percent had no training exposure, 18.52 percent of the farmers had medium training exposure and only 2.78 of the farmers had high training exposure. Training makes the farmers skilled and helps them to acquire deep knowledge about the respected aspects. Trained farmers can face any kind of challenges about the adverse situation in their good agricultural practices.

4.2.7 Extension contact

The observed score of extension contact of the farmers ranged from 21 to 36 against the possible range of 0 to 36. The average score of the extension contact was 29.98 with a standard deviation 2.92 (Table 4.8). The farmers were classified into three

categories on the basis of their extension contact scores and distribution of the three categories namely 'low', 'medium' and 'high' extension contact is presented in Table 4.9.

Table 4.9 Distribution of the farmer according to their extension contact

Categories	Farmers		Mean	SD
	Number	Percent		
Low contact (<Mean-SD i.e. <27.05)	11	10.20		
Medium contact (Mean± SD i.e. 27.05-32.91)	80	74.10	29.98	2.93
High contact (> Mean+ SD i.e. >32.91)	17	15.70		
Total	**108**	**100**		

Data shows that the highest proportion (74.10 percent) of the farmers had medium extension contact compared to 10.20 percent of them had low extension contact and 15.70 percent of the farmers had high extension contact. From this Table, it was found that majority of the farmers had medium extension contact. It could be concluded that different media of the study area were available to the farmers. The finding was interesting but logical because in general the farmers in the rural areas of Bangladesh are less cosmopolite in nature and less exposed to different information sources. Finding revealed that 10.20 percent of the farmers had low extension contact which demands for strengthening and improving the communication strategy. Low extension contact might be the reason that some respondent may think that they have enough knowledge about good agricultural practices. Extension contact pertains to ones contact with multifarious sources of farming knowledge and information about good agricultural practices. This results in cognitive change of the users with an eventual change in behavior and also in skill. They receive information from their neighbors, relatives and workmates etc. at the study area.

4.2.8 Problem faced in good agricultural practice

The observed problem faced in good agricultural practice score of the respondents ranged from 10 to 30 against the possible range of 0-40. The mean score was 21.12 with the standard deviation 4.08. On the basis of problem faced in good agricultural practice scores, the respondents were classified into three categories namely, low

problem, medium problem and high problem as shown in Table 4.10.

Table 4.10 Distribution of the respondents according to their problem o good agricultural practices

Categories (Scores)	Farmers n		Mean	SD
	Number	**Percent**		
Low (<Mean-SD i.e. <17.08)	12	11.11		
Medium (Mean± SD i.e. 17.08-25.2)	82	75.93	21.12	4.08
High (>Mean+ SD i.e. >25.2)	14	12.96		
Total	**108**	**100**		

Data contained in the Table 4.10 revealed that three-fourth (75.93%) of the farmers faced medium problem as compared to 11.11% and 12.96% faced low and high problem respectively. Thus, overwhelming majority (88.89%) of the farmers faced medium to high problem in good agricultural practice.

4.2.9 Knowledge on good agricultural practices

Knowledge on good agricultural practices scores of the farmers ranged from 16 to 30 against possible score of 0 to 30. The average score and standard deviation were 22.21 and 2.81, respectively. Based on the knowledge on good agricultural practices scores, the farmers were classified into three categories namely, low, medium and high knowledge on good agricultural practices. The distribution of the farmers according to their knowledge on good agricultural practices is presented in Table 4.11.

Table 4.11 Distribution of the farmer according to their knowledge on good agricultural practices

Categories	Farmers		Mean	SD
	Number	Percent		
Low knowledge (<Mean-SD i.e. <19.4)	17	15.7		
Medium knowledge (Mean ± SD i.e. 19.4-25.02)	76	70.4	22.21	2.81
High knowledge (> Mean +SD i.e. >25.02)	15	13.9		
Total	**108**	**100**		

Data presented in the Table 4.11 revealed that the highest proportion (70.4 percent) of the farmers had medium knowledge on good agricultural practices, compared to 15.7 percent had low knowledge and 13.9 percent had high knowledge on good

agricultural practices. Thus, an overwhelming majority (86.1 percent) of the farmers had low to medium knowledge on good agricultural practices.

4.3 Relationship between selected characteristics of the farmers and their perception towards harmful effects of agro-chemicals on environment

To explore the relationships between the selected characteristics of farmers with their perception towards harmful effects of agro-chemicals on environment, Pearson Product Moment correlation was run. From this correlation test, it was found that education, farming experience, training exposure and knowledge on good agricultural practices of the farmers had positive significant relationship with their perception towards harmful effects of agro-chemicals on environment but problem faced in good agricultural practice by the farmers had negative significant relationship with their perception towards harmful effects of agro-chemicals on environment. Beside these five (5) characteristics, rest four characteristics of the farmers (age, farm size, annual family income and extension contact) had no significant relationship with their perception towards harmful effects of agro-chemicals on environment. Interco-relation among all the variables may be seen in Appendix-B.

The summery of the results of the Co-efficient of Correlation indicating the relationship between each of the selected characteristics of the farmers with their perception towards harmful effects of agro-chemicals on environment are shown in
.

Table 4.12 Co-efficient of correlation showing relationship between each of the selected characteristics of the farmers and their perception towards harmful effects of agro-chemicals on environment

Focus Variable	Selected characteristics of the farmers	Computed value "r"	Tabulated value of "r"	
			at 0.05 level	at 0.01 level
Farmers' awareness on environment friendly farming practices	Age	0.064^{NS}	0.185	0.241
	Education	0.279^{**}		
	Farm size	0.016^{NS}		
	Annual family income	0.014^{NS}		
	Farming experience	0.191^{*}		
	Training exposure	0.258^{**}		
	Extension contact	0.066^{NS}		
	Problem faced in good agricultural practices	-0.323^{**}		
	Knowledge on good agricultural practices	0.258^{**}		

^{NS}Not significant

*Significant at 0.05 level of probability

**Significant at 0.01 level of probability

4.3.1 Age and perception towards harmful effects of agro-chemicals on environment

The computed value of 'r' (0.064) was smaller than that of tabulated value (r=0.185) with 106 degrees of freedom at 0.05 level of probability as shown in Table 4.12. Hence, the concerned null hypothesis was accepted and it was concluded that age of the farmers had no significant relationship with their perception towards harmful effects of agro-chemicals on environment.

4.3.2 Education and perception towards harmful effects of agro-chemicals on environment

Relationship between education and a perception towards harmful effects of agro-chemicals on environment was determined by Pearson's product moment correlation coefficient.

The coefficient of correlation between education and perception towards harmful effects of agro-chemicals on environment was presented in Table 4.12. The coefficient of correlation between the concerned variables was found to be 0.279. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- ✓ The relationship showed a positive trend between the concerned variables.
- ✓ The observed value of "r" (0.279) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 106 degrees of freedom at 0.01 level of probability.
- ✓ The null hypothesis was rejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.01 level of probability.

Based on the above findings, it was concluded that education of the famers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment. It means that higher was the education, higher was the perception towards harmful effects of agro-chemicals on environment. They could understand the benefits of perception towards harmful effects of agro-chemicals on environment in respects of its food value; protein, vitamin and minerals. So, reasonably education had significant relationship with perception towards harmful effects of agro-chemicals on environment.

4.3.3 Farm size and perception towards harmful effects of agro-chemicals on environment

The computed value of 'r' (0.016) was smaller than that of tabulated value (r=0.185) with 106 degrees of freedom at 0.05 level of probability as shown in Table 4.12. Hence, the concerned null hypothesis was accepted and it was concluded that farm size of the farmers had no significant relationship with their perception towards harmful effects of agro-chemicals on environment.

4.3.3 Annual family income and perception towards harmful effects of agro-chemicals on environment

The computed value of 'r' (0.014) was smaller than that of tabulated value (r=0.185) with 106 degrees of freedom at 0.05 level of probability as shown in Table 4.12. Hence, the concerned null hypothesis was accepted and it was concluded that annual family income of the farmers had no significant relationship with their perception towards harmful effects of agro-chemicals on environment.

4.3.4 Farming experience and perception towards harmful effects of agro-chemicals on environment

The computed value of 'r' (.191) was greater than the tabulated value (r=0.185) with 106 degrees of freedom at 0.05 level of probability as shown in Table 4.12. Hence, the concerned null hypothesis was rejected. The findings indicated that experience of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment.

- ✓ The relationship showed a positive trend between the concerned variables.
- ✓ The observed value of "r" (0.191) between the concerned variables was found to be greater than the tabulated value (r = 0.185) with 106 degrees of freedom at 0.05 level of probability.
- ✓ The null hypothesis could be rejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.05 level of probability.

Based on the findings, it could be concluded that farmers' having large farming experience need to work hard to manage their farm efficiently. As a result they might perceive higher perception towards harmful effects of agro-chemicals on environment in managing their farm.

4.3.6 Training exposure and perception towards harmful effects of agro-chemicals on environment

Relationship between training exposure and perception towards harmful effects of agro-chemicals on environment was determined by Pearson's product moment

correlation coefficient.

The coefficient of correlation between training exposure and perception towards harmful effects of agro-chemicals on environment was presented in Table 4.12. The coefficient of correlation between the concerned variables was found to be 0.258. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- ✓ The relationship showed a positive trend between the concerned variables.
- ✓ The observed value of "r" (0.258) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 106 degrees of freedom at 0.01 level of probability.
- ✓ The null hypothesis was rejected.
- ✓ The relationship between the concerned variables was statistically highly significant at 0.01 level of probability.

Based on the above findings, it was concluded that training exposure of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment. So, it could be said that higher was the training exposure, higher was the perception towards harmful effects of agro-chemicals on environment. Training exposure helps the farmers to take the right decision. It guides the farmers to take action for that which is best for them.

4.3.7 Extension contact and perception towards harmful effects of agro-chemicals on environment

The computed value of 'r' (0.066) was smaller than that of tabulated value (r=0.185) with 106 degrees of freedom at 0.05 level of probability as shown in Table 4.12. Hence, the concerned null hypothesis was accepted and it was concluded that extension contact of the farmers had no significant relationship with their perception towards harmful effects of agro-chemicals on environment.

4.3.8 Problem faced in good agricultural practice by the farmers and their perception towards harmful effects of agro-chemicals on environment

Relationship between problem faced in good agricultural practice by the farmers and their perception towards harmful effects of agro-chemicals on environment was determined by Pearson's product moment correlation coefficient. The coefficient of correlation between problem faced in good agricultural practice by the farmers and their perception towards harmful effects of agro-chemicals on environment was presented in Table 4.12. The coefficient of correlation between the concerned variables was found to be 0.323. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration.

- ✓ The relationship showed a negative trend between the concerned variables.
- ✓ The observed value of 'r' (0.323) between the concerned variables was found to be greater than tabulated value (r = 0.241) with 106 degrees of freedom at 0.01 level of probability.
- ✓ The null hypothesis was rejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.01 level of probability.

Based on the above findings, it was concluded that problem faced in good agricultural practice by the famers had significant negative relationships with their perception towards harmful effects of agro-chemicals on environment. Therefore, it could be said that higher was the problem faced in good agricultural practice, lower the perception towards harmful effects of agro-chemicals on environment.

4.3.9 Knowledge on good agricultural practices and perception towards harmful effects of agro-chemicals on environment

Relationship between knowledge on good agricultural practices of the farmers and their and perception towards harmful effects of agro-chemicals on environment was determined by Pearson's product moment correlation coefficient.

The coefficient of correlation between knowledge on good agricultural practices of the farmers and their perception towards harmful effects of agro-chemicals on environment is presented in Table 4.12. The coefficient of correlation between the concerned variables was found to be 0.258. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables of the study under consideration:

- ✓ The relationship showed a positive trend between the concerned variables.
- ✓ The observed value of 'r' (0.258) between the concerned variables was found to be greater than the tabulated value (r = 0.241) with 106 degrees of freedom at 0.01 level of probability.
- ✓ The null hypothesis was rejected.
- ✓ The relationship between the concerned variables was statistically significant at 0.01 level of probability.

The findings indicated that knowledge on good agricultural practices of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment.

Based on the above findings, it can be summarized that a farmers had more knowledge on good agricultural practices increased the capabilities to reduce problems of environment friendly farming practices. Knowledge makes individuals to become rational and conscious about related field. It enhances the abilities of the farmers at short time than other to reduce constraints. So, knowledge has significant positive relationship with their perception towards harmful effects of agro-chemicals on environment.

CHAPTER V
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMNDATIONS

This chapter presents summary of major findings, conclusion and recommendation of the study. The main purpose of the study was to determine farmers' perception towards harmful effects of agro-chemicals on environment and to determine the relationship between selected characteristics of the farmers and their perception towards harmful effects of agro-chemicals on environment. The location of the study was two unions of Thakurgoan Sadar Upazila under Thakurgoan district.

5.1 Summary of Findings

5.1.1 Farmers' perception towards harmful effects of agro-chemicals on environment

The observed farmers' perception towards harmful effects of agro-chemicals on environment scores of the farmers ranged from 20-43 against the possible range of 0 to 45 with the mean of 33.17 and standard deviation of 4.34. Highest proportion (76.85 percent) of the farmers had medium perception towards harmful effects of agro-chemicals on environment compared to 16.67 percent had high and 6.48 percent had low perception towards harmful effects of agro-chemicals on environment.

5.1.2 Selected characteristics of the farmers

The major findings of the study are summarized below:

Age: Highest proportion (40.74 percent) of the farmers were middle aged while 32.41 percent of them were old aged and 26.85 percent of the farmers were young.

Education: Majority (40.74 percent) of the farmers had secondary level of education compared to 16.67 percent of them had above secondary level of education. About 4.6 percent of the farmers were illiterate, 23.15 percent had primary level of education and 14.8 percent of them could sign their name only.

Farm size: More than half (56.48 percent) of the farmers possessed small farm size

compared to 39.81 percent of them had medium farm size, 2.78% of the farmers had large farm size and 0.93% of the farmers had marginal farm size.

Annual family income: Highest proportion (63.9 percent) had medium annual family income while 32.4 percent of them had low annual family income and only 3.7 percent had high annual family income.

Farming experience: Majority (62.04 percent) of the farmers had medium farming experience, whereas only 16.67 percent had low farming experience and 21.30 percent had high farming experience.

Training exposure: Highest proportion (62.04 percent) of the farmers had low training exposure compared to 16.67 percent had no training exposure, 18.52 percent of the farmers had medium training exposure and only 2.78 of the farmers had high training exposure.

Extension contact: Highest proportion (74.10 percent) of the farmers had medium extension contact compared to 10.20 percent of them had low extension contact and 15.70 percent of the farmers had high extension contact.

Problem faced in good agricultural practice: Majority (75.93%) of the farmers faced medium problem as compared to 11.11% and 12.96% faced low and high problem respectively in good agricultural practices.

Knowledge on good agricultural practices: Highest proportion (70.4 percent) of the farmers had medium knowledge on good agricultural practices, compared to 15.7 percent had low knowledge and 13.9 percent had high knowledge on good agricultural practices.

5.1.3 Relationship between selected characteristics of the respondents and their perception towards harmful effects of agro-chemicals on environment

To explore the relationships between the selected characteristics of farmers and their perception towards harmful effects of agro-chemicals on environment, Pearson

Product Moment correlation was run. It was found that education, farming experience, training exposure and knowledge on good agricultural practices of the farmers had positive significant relationship with their perception towards harmful effects of agro-chemicals on environment but problem faced in good agricultural practice by the farmers had negative significant relationship with their perception towards harmful effects of agro-chemicals on environment. Beside these five (5) characteristics, rest four (4) characteristics of the farmers (age, farm size, annual family income and extension contact) had no significant relationship with their perception towards harmful effects of agro-chemicals on environment.

5.2 Conclusions

Conclusions were drawn on the basis of the findings of this study and their logical interpretation in the light of the other relevant factors which are furnished below:

1. The majority 76.85 percent of the farmers had medium perception towards harmful effects of agro-chemicals on environment compared to having 16.67 percent high and 6.48 percent low perception towards harmful effects of agro-chemicals on environment. Therefore, it may be concluded that all the farmers of the study area had perception towards harmful effects of agro-chemicals on environment from low to high level.

2. There existed a positive significant relationship between education of the farmers and their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be concluded that, high educated farmers had more perception towards harmful effects of agro-chemicals on environment vice-versa.

3. Overwhelming majority (83.33 %) of the farmers had medium to high farming experience, while there had positive significant relationship between farming experiences of the farmers with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be concluded that farmers having low experiences in farming had low perception towards harmful effects of agro-chemicals on environment and with the increase of experiences in farming of the farmers tends to increase their extent of perception towards harmful effects of agro-chemicals on

environment.

4. Majority (62.04%) of the farmers had low training exposure, while there had a positive significant relationship between farmers training exposure with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be concluded that with the increase in training exposure of the farmers tends to increase their rate of perception towards harmful effects of agro-chemicals on environment.

5. Three-fourth (75.93%) of the farmers faced medium problem in good agricultural practices. There existed a negative significant relationship between problems faced by the farmer with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be concluded that with the increase of problems faced by the farmer tends to decrease their perception towards harmful effects of agro-chemicals on environment.

6. Overwhelming (86.1 percent) of the farmers had low to medium knowledge on good agricultural practices, while there had a positive significant relationship between farmers knowledge on good agricultural practices with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be concluded that farmers who had higher knowledge on good agricultural practices had more perception towards harmful effects of agro-chemicals on environment.

5.3   Recommendations

5.3.1 Recommendations for policy implications

Recommendations based on the findings and conclusions of the study are presented below:

1. Overwhelming (83.33 percent) of the farmers had low to medium perception towards harmful effects of agro-chemicals on environment. So, their perception towards harmful effects of agro-chemicals on environment was not satisfactory. Therefore, it may be recommended that necessary steps should be taken to increase their awareness on environment friendly farming practices.

2. Education of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be recommended that adult education should be provided to the farmers so that they could increase their educational level which might be helpful to increase their perception towards harmful effects of agro-chemicals on environment.

3. Farming experience of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be recommended that there should be conducted more contact with them for educating and training them which will be supportive to increase their perception towards harmful effects of agro-chemicals on environment.

4. Training exposure of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be recommended that government and NGOs should provide training facilities to the farmers to increase their perception towards harmful effects of agro-chemicals on environment.

5. Overwhelming majority (88.89%) of the farmers faced medium to high problem in good agricultural practices. So, it may be recommended that necessary steps should be taken by concerned authority to minimize these problems as priority basis so that they could increase their perception towards harmful effects of agro-chemicals on environment.

6. Knowledge on good agricultural practices of the farmers had significant positive relationship with their perception towards harmful effects of agro-chemicals on environment. Therefore, it may be recommended that necessary technical support to be provided to the low and medium experienced farmers for increasing their perception towards harmful effects of agro-chemicals on environment.

5.3.2 Recommendation for further study

This study investigated farmers' perception towards harmful effects of agro-chemicals on environment of Thakurgoan Sadar upazila under Thakurgoan district. As a small

and limited research has been conducted in the present study cannot provide much information related to this aspect. Further studies should be undertaken to cover more information in the relevant matters. So the following suggestions were put forward for further research:

1.   It is difficult to determine the extent farmers' perception towards harmful effects of agro-chemicals on environment. Measurement of farmers' perception towards harmful effects of agro-chemicals on environment is not free from questions. More reliable measurement of concerned variables is necessary for further study.

2. The present study was conducted only in four villages of Thakurgoan Sadar upazila under Thakurgoan district. Findings of the study need further verification through similar research in other parts of the country.

3.   The study investigated the relationship of nine characteristics of the farmers with their perception towards harmful effects of agro-chemicals on environment. So, it is recommended that   further study would be conducted with other variables.

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ENGLISH VERSION OF THE INTERVIEW SCHEDULE

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University Dhaka-1207

An Interview Schedule for the Study Entitled

FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF AGRO-CHEMICALS ON ENVIRONMENT

Serial No:…………………………………………..

Name of the respondent:……………………………..

Village:…………………………….…..Union: ....

Upazila:………………………………..District:……………………………..

Mobile No:…………………………………………..

(Please answer the following questions . Put tick wherever necessary)

1.   **Age:** How old are you?

2.   **Education:** Please mention your educational status

  (a) 1 can't read or write----

  (b) I can sign only-------------

  (c) I read up to class -----------

  (d) Others (specify)...............

3. Farm size: What is your total farm size according to use?

Sl. No.	Use of land	Land possession	
		Local unit	Hectare
1	Homestead farm area (A_1)		
2	Own land under own cultivation (A_2)		
3	Land taken from others as borga system(A_3)		
4	Land given to others as borga system (A_4)		

5	Land taken from others as lease (A_5)		
Total			

Total farm size = $A_1 + A_2 + 1/2 (A_3 + A_4) + A_5$

4. Annual family income: Please indicate your annual income (TK) from following different sources (last year)

Sl. No.	Source of Income	Total price (Tk)
1.	Cereal crops (Wheat, Rice, Maize etc)	
2.	Pulse crops (Lentil ,Beans, Peas etc)	
3.	Vegetables	
4.	Livestock	
5.	Poultry	
6.	Fisheries	
7	Business	
8	Service	
9	Labor	
10	Others(If any)	

5.   Experience in cultivation

How many years are you involved in cultivation?

----------------------------years

6. Training Exposure

Do you have participated any training (Please Put a Tick mark)

i)   Yes   ii) No

If Yes, Then mention the name the following ones:

Sl. No.	Name of the training course	Organization	Days
01.			
02.			
03.			
04.			

7. Extension contact: Please indicate the nature of your contact with the following information media.

Sl. No.	Media/ Sources	Nature of visit				
		Regularly(4)	Often (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1.	Model farmers					
2.	Dealers (fertilizer, pesticide)					
3.	Sub- Assistant Agriculture extension officer					
4.	Agriculture extension officer					
5.	Neighbor					
6.	Group discussion					
7.	News paper					
8.	Radio					
9.	Television					

8. Problem faced in good agricultural practice

Please state the extent of the following problems faced in good agricultural practices

Sl. No.	Problem	Extent of Problems			
		Severe (4)	Medium(2)	Low (1)	Not at all (0)
1	Lack of HYV (High Yielding Variety) seed				
2	Inadequate training facilities				
3	Poor communication system				
4	High production cost				
5	Heavy rainfall & high temperature				
6	Lack of personal interest				
7	Lack of loan facility				
8	Lack of contact with communication media				
9	Disease attack				
10	Lack of technical help				

9. Knowledge on good agricultural practices:

Please answer the following questions

Sl. No	Questions	Total Marks	Marks Obtained
1.	Mention two function of Urea in cultivation	2	
2.	Mention two function of TSP in cultivation	2	
3.	Mention two function of MP in cultivation	2	
4.	What types of organic fertilizers are to be used in your farm?	2	
5.	Mention the name of two botanical pesticides	2	
6.	Why we need crop rotation?	2	
7.	Mention two benefits of mixed cropping	2	
8.	Mention two benefits of intercropping	2	
9.	Name two green manuring crops	2	
10.	Mention the benefits of mulching	2	
11	Mention four materials used in compost preparation	2	
12	What is IPM?	2	
13	Mention two benefits of Faromane trap	2	
14	Mention two uses of vermicompost	2	
15	Mention two benefits of Rice-cum- Fish cultivation	2	
	Total	30	

10. Perception towards harmful effects of agro-chemicals on environment

Sl. No	Statements	Extent of awareness			
		Strongly agree (3)	Agree (2)	Disagree (1)	Strongly Disagree (0)
1	Large amount of pesticide application is harmful for health.				
2	Large amount of pesticide application is harmful for production.				
3	Excess amount of pesticide application is harmful for environment .				
4	Excess amount of pesticide application is harmful for birds, fishes, rats, hens and cows etc .				
5	Chemical fertilizers reduce organic matter content in soil.				
6	Excess use of pesticides in cultivation decrease production.				
7	Herbicide and Pesticide contaminate ground water.				
8	Pesticides destroy wild lives				
9	Excess use of pesticides in cultivation increase production.				
10	Pestcides should be sprayed in direction of wind.				
11	Hands and machineries should be washed after spraying pesticide.				
12	Caution should be taken using of pesticide.				
13	Use of mask and hand gloves is suitable during spraying.				
14	Unauthorized use of pesticide causes air pollution.				
15	Agrochemicals influence global warming and climate change.				
	Total				

……………………………….

Date………………………   signature of interviewer

Appendix-B

Correlations matrix between explanatory and focus variables

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	Y
X_1	1									
X_2	-.297**	1								
X_3	-.005	.114	1							
X_4	.141	.106	.180	1						
X_5	.798**	-.285**	-.024	.192*	1					
X_6	-.210*	.489**	.236*	.039	-.203*	1				
X_7	-.203*	-.062	.120	-.096	-.097	-.077	1			
X_8	-.075	-.163	.048	-.159	-.052	-.214*	.008	1		
X_9	-.201*	.219*	.208*	-.111	-.140	.311**	.033	-.236*	1	
Y	.064	.279**	.016	.014	.191*	.258**	.066	-.323**	.256**	1

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

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

X_1= Age	X_8= Problem faced in good agricultural practice
X_2= Education	
X_3= Farm size	X_9= Knowledge on good agricultural practices
X_4= Annual family income	
X_5= Experience in cultivation	Y=Famers' perception towards harmful effects of agro-chemicals on environment
X_6= Training exposure	
X_7= Media exposure	