

FARMERS' KNOWLEDGE ON ENVIRONMENTAL DEGRADATION DUE TO USE OF AGRO-CHEMICALS

BY

TANVIR AHMED

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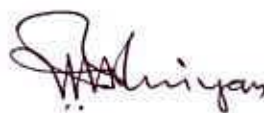
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Approved By:



.....
(Prof. Dr. Md. Rafiquel Islam)
Supervisor



.....
(Prof. Mohammad Hossain Bhuiyan)
Co-supervisor



.....
(Prof. Dr. Md. Rafiquel Islam)
Chairman
Examination Committee



CERTIFICATE

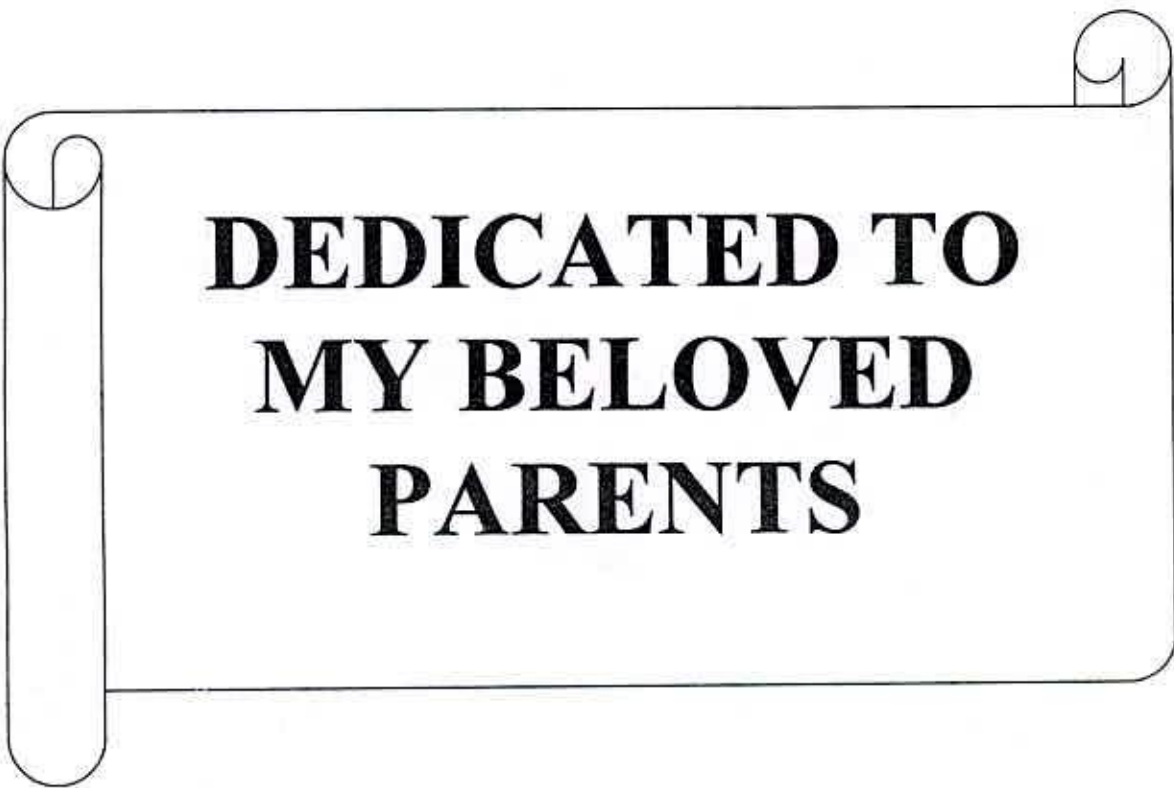
This to certify that the thesis entitled, "**FARMER'S KNOWLEDGE ON ENVIRONMENTAL DEGRADATION DUE TO USE OF AGRO-CHEMICALS**" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in AGRICULTURAL EXTENSION** embodies the result of a piece of *bona fide* research work carried out by **TANVIR AHMED**, Registration No. 04-01458 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:.....
Dhaka, Bangladesh.


.....
(Prof. Dr. Md. Rafiqueel Islam)
Supervisor





**DEDICATED TO
MY BELOVED
PARENTS**

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**FARMERS' KNOWLEDGE ON ENVIRONMENTAL DEGRADATION
DUE TO USE OF AGRO-CHEMICALS**

**BY
TANVIR AHMED
THESIS ABSTRACT**



The purposes of the study were to identify the Farmers' knowledge on environmental degradation due to use of agro-chemicals and to determine their selected characteristics, namely education, farm size, annual income, family size, farming experience, organizational participation, cosmopolitaness, innovativeness, and extension contact. The study also explored the relationship between the selected characteristics of the farmers and their knowledge on environmental degradation due to use of agro-chemicals. The study was conducted among the farmers of three villages of Kashkarara union of Alamdanga Upazila under Chuadanga district. Data were collected from a sample of randomly selected 118 farmers out of a total population of 987. The data were collected through personal interview by using an interview schedule during the period from the 6th April to 5th May, 2010. Appropriate scales were developed in order to measure the variables. Pearson's Product Moment Correlation Co-efficient (r) was computed to examine the relationship between the concerned variables.

Findings revealed that over half (60.17 percent) of the respondents had low level of knowledge on environmental degradation due to use of agro-chemicals as compared to 33.90 percent medium and 5.93 percent high knowledge. Correlation analysis indicated that seven characteristics of the farmers namely education, farm size, annual income, organizational participation; Cosmopolitaness, innovativeness, and extension contact had significant positive relationships with their knowledge on environmental degradation due to use of agro-chemicals. On the other hand, family size and farming

experience of the respondents had no relationship with their knowledge on environmental degradation due to use of agro-chemicals.

ABBREVIATIONS AND ACRONYMS

BBS	=	Bangladesh Bureau of Statistics
DAE	=	Department of Agricultural Extension
FAO	=	Food and Agricultural Organization
FFS	=	Farmers' Field School
GO	=	Government Organization
INM	=	Integrated Nutrient Management
IWM	=	Integrated Weed Management
IPM	=	Integrated Pest Management
NGO	=	Non Government Organization
WWI	=	World Watch Institute

CHAPTER I

INTRODUCTION



1.1 General background

Environment is considered as a composite term for the conditions in which organisms live. Environmental degradation is one of the most important issues of environmental concerns. Wadleigh and Dyal (1970) defined environmental degradation as “The unfavorable alteration of our surroundings, wholly or largely as a by product of man’s action through direct or indirect effects of changes in energy patterns. These may affect man directly, or through his supplies of water and of agricultural and other biological products. His physical objects or possessions, or his opportunities for recreation and appreciation of nature”. Agriculture and environment interact in such a way that agricultural growth depends on the proper functioning of the environment process, the same way that environmental soundness depends upon agriculture (Conway, 1990). Thus, agriculture simultaneously because a ‘victim’ and a ‘cause’ of ecological destruction (Hossain *et al* 1994).

Population boom of the world triggered the people to increase production level for feeding the extra mouth. As a result, technological advancement has been occurring in one part and in another part all out efforts are being made for utilizing those technologies. One of those is use of agrochemicals in agriculture. Environment, the global concern of today, has drawn more attention of many nations throughout the world. As because the global environment is changing more rapidly than any time in the known history, it is difficult to force all the changes that will occur in future. Changes are climatic change, ozone layer depletion, desertification, deforestation, water pollution, air pollution, loss of biodiversity, genetic erosion and so on.

The use of agro-chemicals started with the necessity of increasing agricultural production through increased soil fertility and control of pests and diseases. Of

all the chemicals used for this purpose, the insecticides by far constitute the largest group. Although their use started during the middle of the nineteenth century, until when man was helpless against the mass attack of insect pests, widespread application of the insecticides as pest control measures began only after the World War II. Vermoesen *et al.* (1993) reported that when chemical fertilizers specially urea is applied to soil, nitrogen is lost through denitrification, nitrification, ammonia volatilization and nitrate leaching which leads to environmental problems: nitrous oxide is formed through nitrification and denitrification, damage atmospheric ozone layer and contributes to the green house effect; ammonia volatilization leads to acidification of the environment and the nitrate leaching results in a too high nitrate concentration in surface and ground water.

Another most devastating ecological imbalance is caused due to indiscriminate use of insecticides. Insecticides affect fishes living in the river, tank, pond etc. It is proven that dangerous insecticides 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 that is five times more than their American counterpart. Haphazard use of insecticides also affect in the aquatic organisms. Men heavily depend on fishes and aquatic plants, for their lives. It is very harmful for human health (Sarker 1993).

Indiscriminate use of pesticides also affect fishes living in the river, tank, pond etc. and it is proven that dangerous pesticides are present in the fishes of the Bay of Bengal at an unacceptable level which is very much harmful for human health (Sarker. 1993). Use of improper doses of pesticides makes the pest resistant requiring further stronger doses of chemicals. Consequently, a huge amount of residual chemicals has been causing drastic lethal effects on the consumers. Strong residual effects of DDT, Eldrin, Dieldrin, also cause health

hazards to human and animals and kill other beneficial insects. Besides air and water pollution is also caused due to non-judicious use of agrochemicals.

In Bangladesh, use of agro-chemicals has been increased considerably in recent years due to expansion of irrigation facilities and rapid increase of continuous rice cropping area. Since the farmers are the ultimate users of agro-chemicals it is necessary to know their knowledge about agro environmental pollution in order to reduce the use of agro-chemicals. The extent of knowledge may vary from one farmer to another farmer due to influence of various factors. Because behavior of an individual is greatly influenced by the totality of one's characteristics. It is, therefore, very important to know the relative environmental knowledge of the farmers regarding its degradation in using agro-chemicals.

1.1.2 Status of agro-chemicals use in Bangladesh

Bangladesh is not lagging far behind in using chemicals for agricultural production, which are now considered as major polluters of agricultural or farm environment. Soils of Bangladesh are no doubt fertile compared to other countries of the world. However, it has lost its fertility to a great extent due to over use of chemical fertilizers as well as the soil organic matter status reduced to 0.5 percent and acidity of the land has also increased (Anonymous, 1994). Chemicals fertilizer as an important agro-chemical in Bangladesh was first introduced with limited use in early sixties. Its consumption has increased progressively over the last three decades. Total consumption of fertilizers increased around four folds from 0.87 million tons in 1980-81 to 3.04 million tons in 1996-97 with a growth rate of 8.36% per annum (Roy *et al.*, 1998). However; most of the arable soils are highly depleted due to continuous crop removals, uninterrupted monoculture of rice and excessive soil mining. Compared to other Asian countries, fertilizer use in relation to cropped area in Bangladesh is still inadequate. But nutrient use is not at all balanced. For HYV

rice, 75% of the applied fertilizers in nitrogen, 12% phosphate and only 6% potash, as against the recommended ratio of 100:60:60 (Islam, 2005).

Synthetic insecticides were introduced in Bangladesh in 1956 and were distributed to the farmers free of cost up to 1973. Because of their quick and viable effects, and no cost, the use of insecticides soon became very popular among the farmers for insect pest control of rice and other crops. As a result, the total consumption of insecticides in the country rose from a few tons in 1956 to 5,560 tons in 1973. Insecticides use was plummeted sharply to about 1500 tons in 1974-75 and the trend continued up to 1978-79 due to partial withdrawal of government subsidy from insecticides in 1973-74. Although the subsidy was fully withdrawn in 1980, insecticides consumption started to rise from 1980-81 onwards probably due to frequent pest outbreaks and farmers dependence on insecticidal measures for pest control. Insecticide use increased to 7200 tons in 1992 (Karim, 1994).

Although the use of pesticides declined early years of subsidy withdrawal, their use on the rise again reaching over 11 thousand metric tons in 1996. At present 84 pesticides with 242 trade names has been registered in Bangladesh. The types of pesticides being used in Bangladesh are insecticides, fungicide, herbicide and rodenticide. In Bangladesh insect infestation is more serious in agricultural crops than the attack of diseases. In 1995, the amount of insecticides used was 8416.16 metric tons which is 91.27% of total pesticides used in that year. The amount of fungicide used in the same year was 587.96 metric tons, which is about 6.8% of total pesticide use. On the other hand in that year use of herbicides and rodenticides were 1.52% and 0.83% respectively of the total pesticide use (Islam, 2005).

Of the used pesticides in Bangladesh, 90% was applied for rice pest control through the country, the rate being approximately 0.085 kg/ha. (Karim, 1994). However, the current use of pesticide in the country is much lower than in

many other countries. It is 0.03 kg/ha compared with 0.3 kg/ha in India, 0.4 kg/ha in Srilanka and 0.8 kg/ha in Indonesia. In Developed rice growing countries like China, Korea, and Malaysia pesticide use is well over 1 kg/ha (Karim, 1999). Despite low use of pesticide, its use in Bangladesh is alarming due to a number pesticides, which are banned in other countries for environmental, and health reasons are still in use in the country.

1.2 Statement of the problem

The problem which has been attempted in this research is farmers' knowledge on environmental degradation due to use of agro-chemicals. The discussion focused earlier in the section of general background made it clear that environment is under a serious threat from many corners. Scientists have taken this burning issue into their concern and continuously suggesting remedial measures to achieve an environmentally friendly agro ecosystem. To attain this goal a large number of alternative practices of using agrochemicals have been recommended for the use at the farmer's level. Use of agro-chemicals to protect crops and to supply nutrients is an essential as well as an integral part of modern cultivation. If the farmers are to remain away from using agrochemicals they would require a sound knowledge regarding environmental degradation that is caused by the use of agrochemicals.

Besides, their knowledge regarding environmental degradation need to be improved and more knowledge need to be developed towards alternative use of agrochemicals such as use of IPM, INM etc. Analyzing the issue from farmer's perspective this study was specifically designed to find the answers of the following queries:

1. What is the farmers' knowledge on environmental degradation due to use of agro-chemicals?
2. How do some of the selected characteristics of the farmers relate to their knowledge on environmental degradation due to use of agro-chemicals?

1.3 Justification of the study

Increased use of agrochemicals is seriously causing environmental problems. Particularly the degradation of soil fertility and the scarcity of fuel -wood indicate the graveness of the situation. Referring to the non desert areas, 43% of Africa, 32% of Asia and 19% of Latin America are at risk of desertification (FAO, 1984). According to more recent global data given by the WWI (Brown, 1988) in several populous countries, agricultural production is found to be stagnated whereas population continue to grow.

Bangladesh is no exception of this general trend to environmental degradation. Agriculture in Bangladesh started taking the form of intensification since mid 1960, through Seed -Fertilizer -Water Technology. Since then the country has witnessed dramatic yield increase due to extensive use of agro-chemicals. It was at a compound growth rate of 8.57% and 11.13% per year for nitrogenous fertilizers and pesticides use respectively during 1977 to 1989 (Sarkar, 1999). The size and density of the population in relation to land area and resources for development have already caused a high degree of environmental degradation, as reflected by deforestation, loss of wildlife, destruction of wet-lands and inland fisheries, soil nutrients depletion and inland salinity intrusion. Species and breed development have also taken place in livestock and fisheries sub sectors. But this success has not been without a social and environmental cost. In the absence of such studies very little is known about the forces that help an individual to build a sound perception regarding environmental degradation. The findings of this study are expected to be useful to the extension organizations to provide services toward promoting sustainable agricultural growth in Bangladesh.

High use of insecticides has also substantial negative effect on environment. Effective management of farm is very important in today's farming. Farmers, who have environmental degradation knowledge due to use of agro-chemicals, can change their farms more effectively and can also reduce the negative impacts of agro-chemicals on environment. Therefore, now it has become

necessary to reduce use of agrochemicals in agriculture keeping the production level at increasing rate. There is a wide scope to increase production level by following the technique of organic farming, that is, use of high amount of organic fertilizers, following IPM technique etc. Anyway, considering the above facts the researcher has undertaken the present study entitled, "Farmers' knowledge on environmental degradation due to use of agro-chemicals".

1.4 Specific objectives of the study

The specific objectives of this study were as follows:

1. To determine farmers' knowledge on environmental degradation due to use of agro-chemicals.
2. To determine and describe some selected characteristics of the farmers. The selected characteristics are:
 - i. Education
 - ii. Farm size
 - iii. Annual income
 - iv. Family size
 - v. Farming experience
 - vi. Organizational participation
 - vii. Cosmopoliteness
 - viii. Innovativeness
 - ix. Extension contact
3. To explore the relationship between the selected characteristics of the farmers and their knowledge on environmental degradation due to use of agro-chemicals.



1.5 Statement of hypothesis:

According to Kerlinger (1973), a hypothesis is a conjectural statement of the relation between two or more variables. Hypotheses are always in declarative sentence form and they relate either general or specifically variables to

variables. 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 the selected characteristics of farmers and their knowledge on environmental degradation due to use of agro-chemicals.

1.6 Scope and Limitations of the study

The study was undertaken with a view to have knowledge on environmental degradation due to use of agro-chemicals. In order to conduct the research in a meaningful and manageable way it becomes necessary to impose some limitations in regard to certain dimensions of the study. Considering the limitation of time, money and other resources available to the researcher, the following limitations have been observed throughout the study.

1. The study was confined to three villages of Khashkarara union under Alamdanga upazilla of Chuadanga district.
2. Out of a number of characteristics only nine were selected for investigation in this study.
3. The study was restricted within the farmers who had at least some cultivable land under own cultivation.
4. The population for the study was kept confined to the heads of the family (male and female).
5. In many interview situations, the researcher had to face unexpected interference from the over interested side-talkers of the non target respondents. However, the researcher tried to overcome this problem as far as possible with tact and skill.
6. Collection of all relevant data was limited to the farmers in the study area.

1.7 Assumptions of the Study

An assumption is the supposition that an apparent or principle is true in the light of the available evidence (Goode & Hatt, 1952). The researcher had the following assumptions in mind while undertaking this study:

1. The respondents included in the sample were capable of furnishing proper responses to the questions included in the interview schedule.
2. The responses furnished by the respondents were reliable. They expressed the truth while passing their opinions and providing information.
3. The views and opinions furnished by the respondents included in the sample were the respective views and opinions of the whole population of the study.
4. The researcher who acted as interviewer was well adjusted to the social and cultural environment of the study area. Hence the respondents furnished their correct opinions without hesitation.
5. The respondents selected for the study were competent to satisfy the queries designed by the researcher.

1.8 Definition of terms

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

Knowledge on environmental degradation

It refers to an individual's knowing about the existence of the environmental degradation caused by the use of agrochemicals but lacking detail information about it.

Agro-chemicals

It refers to the chemicals, chemical fertilizers and insecticides of different kinds, which are frequently used in agriculture.

Education: Education of an individual farmer was defined as the formal education received up to a certain level from an educational institute at the time of interview. Education measured in terms of actual years of successful schooling.

Farm size: Farm size of the respondents refers to the area owned by a farmer on which he carries his farming and family business, the area being estimated in terms of full benefit to the farmers. A farms was considered to have full benefit from the cultivated area either owned by him or obtained on lease from others and half benefit from the area which was either cultivated him on barga or given others for cultivation on barga basis.

Annual income: Annual income was defined as total earning of a farmer and the members of his family from farming and other sources (business, services etc) during a year. In fact, it was gross family income and was expressed in taka.

Family size: Family size refers to the number of members including the respondent himself/herself, his /her wife/husband, children and other permanent dependents, who live and eat together.

Farming experience: Farming experience of a respondent was defined as the total time period of he or she involved in farming.

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

Cosmopolitaness: It refers to the degree or the frequency of movement of an individual respondent to outside places from his own working place.

Innovativeness: It is the degree to which an individual is relatively earlier in adopting innovations than the other members of a social system (Rogers,

1983). This was comprehended by the quickness of accepting innovations by individuals in relation to others, and was measures on the basis of time dimension.

Extension contact: The term extension contact was used to refer ones exposure to various extension communication media or extension teaching sources.

CHAPTER II

REVIEW OF LITERATURE

In course of review of literature in home and abroad, the researcher observed that a number of studies have been conducted to explore the relationships of the characteristics of individuals with their knowledge on environmental degradation due to use of agro-chemicals. It is expected that farmers who have favourable knowledge on environmental degradation due to use of agro-chemicals might have positive relationships with their knowledge on environmental; such considerations indicate that studies dealing with the relationship of farmers' characteristics with knowledge on environmental degradation due to use of agro-chemicals, reviews of the literature related to the major study are presented. It may be relevant here to mention that a good number of research activities concerning farmers' knowledge on environmental degradation due to use of agro-chemicals. However, this chapter has been presented under two sections. First section deals with the review of past studies enchaining relationship of the selected characteristics of the farmers. The second section describes the conceptual framework of the study.

2.1 Related literature

2.1.1 Reviews on general context

Now-a-days environmental problem is a threatening concern throughout the world because of the global environment which is changing rapidly. As environment involves the surroundings, where we live and in which a range of development activities are performed for our private and public life, these two can not be separated from one another. Man's relationship with his environment and more particularly with other human beings, animals, plants and inanimate objects is reflected in and interacts with his imagination and aspirations. Thus, environmental issues are directly related with the existing conditions of human life, their options in the use of material resources and

sharing the same with others. It is an inter-linked and inter-locked system mostly directed to ensure a balance between the different components.

An investigation by the United Nations Food and Agriculture Organization (FAO) on the current status of land productivity in Bangladesh revealed that there is a general trend towards declining or stagnating crop yields. These adverse trends are considered to be the result of intensive cropping through indiscriminate use of fertilizers, pesticides, continued use of irrigation water, total removal of biomass from the agricultural fields and some other activities those have generated new set of problems such as soil erosion, loss of soil fertility, deficiencies in sulphur and zinc etc. (Report of the Task Forces, 1991). Sattar (1994) listed many problems, adverse effect or hazardous action of fertilizers in soils, crops, human health, air, water and other environments and some of the major problems are included here:

- I. Decrease the organic matter and iodine content in soils, make soils harder, more acidic or alkaline,
- II. Create some diseases to certain fish species,
- III. Decrease soil organisms, earth worms or other organisms in soils,
- IV. Reduce fertility status in soil,
- V. Changes the test and quality of some fruits, vegetables and other crops,
- VI Pollute the surface as well as ground water, etc.

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

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

Sarker (1999) found in his study that only 6 percent of the farmers' had medium perception as compared to 77 percent high perception and 17 percent very high perception regarding environmental degradation due to use of agro-chemicals.

Karim (1999) reported that all fertilizers contain some hazardous Substances. Nitrogenous fertilizers supply nitrate. It is essential to life, but becomes hazardous if applied in the wrong place at the wrong time.

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

Gundhi and Patel (1997) examined farmer' awareness of the environmental impact of pesticide use. Survey data were collected from a sample of 216 farmers of three districts India, namely Guntur district (Andhra Pradesh), Ferozepur (Punjab) and Ahmadabad (Gujarat). The results revealed that farmer awareness about the impact of pesticides was limited to the immediate surroundings (impact on human and animal health) and did not extend much to the effects on water, air and crop residues. Awareness about when and how to use pesticides was very limited. Use of alternative methods such as biological control was practically nil and awareness almost none. Pesticides use levels were found to be determined significantly by the extent of irrigation, and intensity of use was higher on small farmers.

Hamid (1995) in his study on farmers' perception regarding environmental degradation due to use of agro-chemicals, worked with 133 farmers of two villages (68 from progressive and 65 from less progressive) under two thanas of Mymensing district. He found that farmers of progressive village had more awareness than the farmers of less progressive village with regard to environmental pollution.

Knickel (1993) reported from environmental point of view locally specific trends in the type, extent and intensity of cultivation are of great importance. The question investigated was how the rate of development of the farm was related to awareness of the environment and of differing local conditions. The data analyzed on the type, scale and intensity of farm production were drawn from the research programme on farm structures and pluriactivity funded by the EC and German government. The analysis grouped farm households as expanding, stable or disengaging and then assesses them in environmental term. In some field such as intensity of fertilizer use, significant differences were shown among the three groups. However, the fact that a clear overall judgement was not possible indicated the need for more specific research on agro-environmental questions which takes account of external economic and policy aspect as well as regional and farm structural considerations.

2.1.2 Selected characteristics of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals

2.1.2.1 Education with environmental knowledge

Hanif (2000) found in his study that there was a positive significant relationship between education of the respondents and their awareness on environmental pollution.

Uddin (2001) reported education of the BSs had significant relationship with their opinion on environmental hazards and associated problems due to continuous and intensive rice farming.

Hossain (1999) found that education of the farmers had significant positive relationship with the awareness on environmental degradation.

Islam *et al.* (1988) observed that education of the farmers had significant positive relationship with the awareness on environmental pollution.

Hamid (1997) found that education of the farmers had positive relationship with the awareness on environmental pollution in both cases of the progressive and less progressive village.

Sana (2003) showed that the education of the respondents had positive relationship with their knowledge in shrimp culture.

Sutradhar (2002) revealed that academic qualification of the respondents had a significant positive relationship with their awareness on environmental degradation.

Praveen (1995) found that the level of education of the farm women had a significant positive relationship with their knowledge on the use of fertilizer, pesticides and irrigation water.

Sarkar (1999) revealed that the level of education of the farmer had significant positive relationship with their perception on environmental degradation.

Hossain (2000) found that the education of the respondents had significant positive relationship with their knowledge on Binadhan-6.

Farhad (2003) showed that the education of the rural women farmer had significant and positive relationship with their knowledge in using IPM in vegetable cultivation.

Miah and Rahman (1995) found that the level of education of the farmers had positive significant relationship with the awareness on farming environment.

Hossain (2003) found that with increased level of education of the farmers, there was a corresponding increase in the knowledge level of modern Boro rice farmers.

2.1.2.2 Farm Size with environmental knowledge

Hossain (2003) reported that the farm size of the respondents had a positive and significant relationship with their knowledge on modern Boro rice at 0.05 level of probability.

Farhad (2003) found that farm size of rural women farmer had a positive significant relationship with their knowledge in using IPM in vegetable cultivation.

Sana (2003) reported that farm size of the shrimp cultivators had no relationship with their knowledge of shrimp culture.

Sutradhar (2002) found that the farm size of the respondents had a significant positive relationship with their awareness on environmental degradation.

Hanif (2000) found that there was a negative insignificant relationship between farm size of the respondents and their awareness on environmental pollution.

Hossain (2003) found that farm size of the farmers had no relationship with their knowledge on Binadhan-6.

Hamid (1995) found that area under cultivation of farmers had significant relationship with their awareness on environmental pollution.

Hamid (1997) found that area under cultivation of farmers had significant relationship with their awareness on environmental pollution.

Parveen (1995) revealed that the homestead of the farm women had a positive significant relationship with their knowledge on use of fertilizer, pesticides and irrigation water.

Miah and Rahman (1995) revealed that the farm size of the farmers and awareness regarding farming environment were not significant.

2.1.2.3 Annual Income with environmental knowledge

Hossain (2003) found that the annual income of the respondents had positive and significant relationship with their knowledge on modern Boro rice cultivation practices.

Farhad (2003) found that the annual income of the rural farmer had a positive significant relationship with their knowledge in using IPM in vegetable cultivation.

Sutradhar (2002) found that annual family income of the respondents had a significant positive relationship with their awareness on environmental degradation.

Uddin (2001) reported that annual income of the BSs had no significant relationship with their opinion on environmental hazards and associated problems due to continuous and intensive rice farming.

Hanif (2000) found in his study that there was a negative significant relationship between annual income of the respondents and their awareness on environmental pollution.

Hossain (1999) found that family income of the farmers had a significant positive relationship with their perception on environmental degradation.

Hamid (1997) found that annual income of the farmers had a significant positive relationship with their awareness on environmental pollution in case of less progressive village but it was insignificant in case of progressive village.

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

Khan (1993) found significant relationship between family income of the farmers and their adoption of insecticides. Hossain and Crouch (1992) observed a similar finding in case of improved farm practices in Bangladesh.

Hoque (1993) observed negative trend in his study but relationship between the annual income of the cane growers and their use of recommended dose of fertilizer in sugarcane cultivation.

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

Parveen (1995) stated that the annual income had a significant positive relationship with their knowledge on the use of fertilizer, pesticides and irrigation water.

2.1.2.4 Family Size with environmental knowledge

Hossain (2003) found that family size of the farmers was not significantly related to their knowledge on modern Boro rice cultivation practices.

Farhad (2003) found that family size of rural women farmer had not significantly relationship with their knowledge in using IPM in vegetable cultivation.

Sana (2003) revealed that family size of the farmers was not related to their knowledge of shrimp culture.

Sutradhar (2002) found that the family size of the respondents had a significant positive relationship with their awareness on environmental degradation.

Hanif (2000) found in his study that there was a positive significant relationship between family size of the respondents and their awareness on environmental pollution.

Hossain (2003) found that family size of the farmers had a significant positive relationship with their awareness on Binadhan-6.

Alam (1997) found in his study found that family size of the farmers had a positive and significant relationship with their use of farm practices in rice cultivation.

Rathor and Shsktawat (1990) found that the knowledge about improved agricultural practices of Bajra cultivation by farm women was found to be significant associated with their use.

Parveen (1995) revealed that family size of the farm women had a significant positive relationship with their knowledge on the use of fertilizer, pesticides and irrigation water.

Kashem (1987) in his study, however, did not find any significant relationship between family size and agricultural knowledge of the farmers.

2.1.2.5 Farming experience with environmental knowledge

Kashem (2001) found in his study that there was a negative non significant relationship with their awareness on the effect of insecticides on environment.

Islam (1998) revealed that there was no relationship between farming experience of the farmers and their perception of Binasail.

2.1.2.6 Organizational participation with environmental knowledge

Hossain (2003) reported that the organizational participation of the farmers had positive and significant relationship with their knowledge on modern Boro rice cultivation practices at 0.1 level of probability.

Farhad (2003) reported that organizational participation of the respondents had a positive and significant relationship with their knowledge in using IPM in vegetable production.

Sutradhar (2002) found that organizational participation had no relationship with their awareness on environmental degradation.

Parveen (1995) found that group participation of the farm women had a negative significant relationship with their knowledge on use of fertilizer, pesticides and irrigation water.

Hamid (1995) observed a positive significant relationship between organizational participation of the farmers and their awareness on environmental pollution. Hossain (1999) found similar findings in his study.

Rahman (1995) found in his study that organizational participation of potato growers had no relationship with their knowledge on improved practices of potato cultivation.

Sana (2003) revealed that organizational participation of the farmers had significant relationship with their knowledge in shrimp cultivation.

Uddin (2001) reported that organizational participation of the BSs had significant relationship with their opinion on environmental hazards and associated problems due to continuous and intensive rice farming.

Hossain (2000) found insignificant relationship between organizational participation of the farmers and their knowledge on Binadhan-6.

2.1.2.7 Cosmopolitanism with environmental knowledge

Hossain (2003) found that there was a positive significant relationship between the cosmopolitanism of the farmers and on modern Boro rice cultivation practices.

Farhad (2003) reported that cosmopolitanism of the respondents had a positive significant relationship with their knowledge in using IPM in vegetable cultivation.

Hanif (2000) found in his study that there was an insignificant relationship between Cosmopolitanism of the respondents and their awareness on environmental pollution in case of FFS farmers.

Hossain (1999) found that cosmopolitaness of the respondents had a positive significant relationship with their perception on environmental degradation.

Islam *et al.* (1998) found that cosmopolitaness of the respondents had no significant relationship on farmers' awareness regarding environmental pollution.

Hamid (1997) observed a positive relationship between cosmopolitaness of the farmers and awareness on environmental pollution.

Hoque (1993) observed a positive relationship between cosmopolitaness of the farmers and awareness on environmental pollution.

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

Parveen (1995) reported that cosmopolitaness of the farm women was not related with their knowledge on use of fertilizer, pesticides and irrigation water.

2.1.2.8 Innovativeness and environmental knowledge

Farhad (2003) reported that the innovativeness of the respondents had no relationship with their knowledge in using IPM in vegetable cultivation.

Sutrdhar (2002) revealed that innovativeness of the respondents had a significant positive relationship with their awareness on environmental degradation.

Monsur (1989) found a significant negative relationship between the farmer's innovativeness and their confrontation in feeds and feeding cattle.

Sharma and Sanoria (1983) observed high innovativeness among contact farmers than the non-contact farmer. They also found that knowledge of both the contact and non-contact farmers differed significantly with innovativeness.

However, they only found that contact farmers adoption on innovations differed significantly with their variation in innovativeness.

2.1.2.9 Extension contact with environmental knowledge

Farhad (2003) showed that contact with extension media of the respondents had significant positive relationship with their knowledge in using IPM in vegetable cultivation.

Hossain (2003) found that the communication exposure of the respondents had significant and positive relationship with their knowledge on modern Boro rice cultivation practices.

Sana (2003) reported that media exposure of the farmers had a significant positive relationship with their knowledge on shrimp culture.

Sutradhar (2002) found that media exposure of the farmers had a significant positive relationship with their awareness on environmental degradation.

Hossain (2000) concluded that media exposure of the farmers had a significant relationship with their knowledge on Binadhan-6.

Hamid (1995) observed a positive relationship between media exposure of the farmers and their awareness on environmental pollution.

Pal (1995) found in his study that the extension contact of farmers had a significant relationship with their adoption of sugarcane cultivation practices.

Rahia (1989) found that extension contact of the farmers had no significant relationship with their irrigation problem.

2.2 Conceptual Framework

Knowledge on environmental degradation due to use of agro-chemicals was the dependent variable of the study. Characteristics of the farmers like education, farm size, annual income, family size, farming experience, organizational participation, cosmopolitaness, innovativeness and extension contact were selected as the independent variables. The dependent and independent variables are supposed to be influenced upon each other. It is expected that the knowledge on environmental degradation due to use of agro-chemicals will be increased with the increase of education, annual income, organizational participation, cosmopolitaness, innovativeness and extension contact. A schematic diagram showing relationship among the concerned variables as shown in figure 2.1.

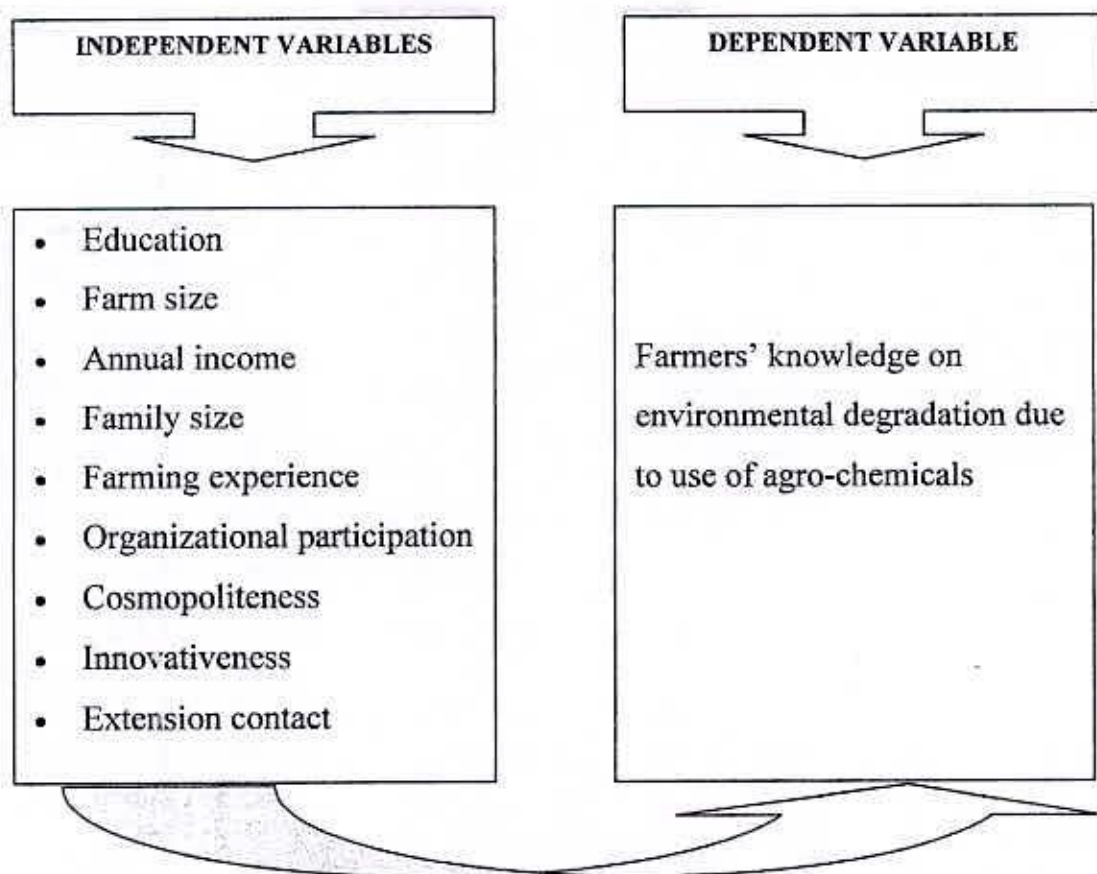


Figure 2.1: A schematic diagram showing relationship among the concerned variables.



CHAPTER III

METHODOLOGY

Methods and procedures used in conducting research need very careful consideration. Methodology should be such that it enables the researcher to collect the valid information and to analyze the same properly to arrive at correct decisions. The methods and procedures followed in conducting this research are described below:

3.1 The locale of the study

The study was conducted among the farmers of three villages of Kashkarara union of Alamdanga Upazila under Chuadanga district. Out of twelve unions of this Upazila, Khashkarara union was purposively selected. From this union three villages (Khashkarara, Nischindopur and Talukkarara) were purposively selected because it is closed to researchers own area. Figure 3.1 and 3.2 are showing the study area.

3.2 Population and sampling of the study

A list of farmers of the study area was prepared by the researcher himself with the help of the local Sub Assistant Agriculture Officer (SAAO) of Alamdanga Upazila Agricultural office. The list comprised a total of 987 farmers in the study area. These farmers constituted the population of this study. To make a respective sample 12 percent of the population was selected following systematic sample technique, thus one hundred eighteen (118) farmers were selected as the sample of the study. The village-wise distribution of the population and sample of farmers are shown in Table 3.1.

Besides this 2 percent of the samples were selected randomly as reserve who was supposed to be interviewed only when a respondent in the original list was unavailable during data collection.



Figure 3.1: A map of Chuadanga district showing Alamdanga Upazila



Figure 3.2: A map of Alamdanga Upazila showing Khaskara Union

Table 3.1 Distribution of the population and sample of the respondents in three Villages of Khashkarara union

Villages	Population (No. of the total farmers)	Sample size (12%)	Reserve list (2%)
Khashkarara	687	82	15
Nischindopur	106	13	2
Talukkarara	194	23	4
Total	987	118	21

3.3 Instrument for collection of data

In a social research, preparation of an interview schedule for collection of information with very careful consideration is necessary. Keeping this fact in mind the researcher prepared an interview schedule carefully for collecting data from the respondents. Objectives of the study were kept in view while preparing the interview schedule.

The initially prepared interview schedule was pre-tested among 15 respondents of the study area. The pretest was helpful to find out gaps and to locate faulty questions and statements. Alterations and adjustments were made in the schedule on the basis of experience of the pretest.

3.4 Collection of data

The researcher collected data from the sample farmers through interview schedule. Before starting collection of data, the researcher met with the Sub assistant agriculture officer of the respected blocks in order to explain the objectives of the study and requested them to provide necessary help and co-operation in collection of data. The local leaders of the area were also approached to render essential help. As a result of all these a good working atmosphere was created in the study area which was very helpful for collection of data by the researcher.

Before going to the respondents for interview they were informed earlier, so that they would be available in their respective area. The interviews were held individually in the house or farms of the respective respondent. The researcher established adequate rapport so that the respondents did not feel hesitant to provide actual information. Whenever any respondent faced difficulty in understanding a particular question, the researcher took care to explain the same clearly.

No serious constraints were faced by the researcher in collecting data. It was not possible to collect data from six farmers from the original sample. Collection of data took 30 days from the 6th April to 5th May, 2010.

3.5 Variables of the study

In social research, the selection and measurement of variables constitute an important task. In this connection, the researcher looked into the literature to widen his understanding about the nature and scope of the variables involved in the research studies. Ezekiel and Fox (1959) defined a variable as any measurable characteristics which can assume varying or different values in successive individual cases. The hypothesis of a research, while constructed properly, contains at least two important elements, an independent variable and a dependent variable. An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationships to an observed phenomenon (Townsend, 1953). A dependent variable is that factor which appears, disappears or varies as the experimenter introduces, removes or varies the independent variables. The dependent variable is often called the criterion or predicted variable, where as the independent variables is called the treatment, experimental or antecedent variable (Dalen, 1977).

3.6 Selection of dependent and independent variables

Farmers' knowledge on environmental degradation due to use of agro-chemicals was the main focus of this study and it was considered as the dependent variable.

For selection of independent variables the researcher went through the past related literature as far as available. He discussed with the teacher, experts in the relevant fields and research fellows in agricultural extension and related disciplines. He also carefully noticed the various characteristics of the farmers of the study. Availability of time, money and other resources were also kept in view in selecting the variables. In considering the resources those variables were selected. Characteristics of the farmers like education, farm size, annual income, family size, farming experience, organizational participation, Cosmopolitaness, innovativeness, extension contact were selected as the independent variables.

3.7 Measurement of variables

In order to conduct the study in accordance with the objectives, it was necessary to measure the selected variables. This section contains procedures for measurement of both independent as well as dependent variables of the study. The procedures followed in measuring the variables are presented below:

3.7.1 Measurement of independent variables

It was pertinent to follow a methodological procedure for measuring the selected variables in order to conduct the study in accordance with the objectives already formulated. The procedures for measuring the independent variables are described below:

3.7.1.1 Education

Education was measured on the basis of a respondent's years of schooling. A score of one (1) was assigned for each year of successful schooling completed. For example, if a respondent passed the S.S.C examination, his education score was given as 10, if he passes the final examination of class six, his education score was given as 6. If a respondent did not know how to read and write, his education score was given as '0' (zero). A score of 0.5 (half) was given to that respondent who could sign his name only. It is shown in the item no. 1 in the interview schedule.

3.7.1.2 Farm size

Farm size was measured for each respondent in terms of hectares by using the following formula:

$$FS = A_1 + A_2 + \frac{1}{2} (A_3 + A_4) + A_5 + A_6$$

Where,

FS = Farm size

A_1 = Homestead area

A_2 = Own land under own cultivation

A_3 = Land given to others on barga

A_4 = Land taken from others on barga

A_5 = Land taken from others on lease

A_6 = Pond area

The data were first recorded in term of local unit i.e. decimal and then converted to hectare. Question of this variable appears in the item no. 2 in the interview schedule.

3.7.1.3 Annual income

Family income of a respondent was measured on the basis of total yearly earning from agriculture and other sources (service, dairy etc.) by the respondent himself and other family members. Annual family income of a



respondent was expressed in 'thousand' taka. Question of this variable is shown in the item no. 3 in the interview schedule.

3.7.1.4 Family size

The family size was measured by the total number of members in the family of a respondent. The family members included the respondent, his/her wife/husband, sons and daughters (if any). The total number of family members was considered as the family size score of a respondent. Question of this variable appears in the item no. 4 in the interview schedule.

3.7.1.5 Farming experience

Farming experience of a respondent was measured in the term of years he or she involved in farming. Question regarding farming experience is shown in the item no. 5

3.7.1.6 Organizational participation

Organizational participation of a respondent was measured according to the nature of his/her involvement and duration of participation in different organizations. Organizational participation score was computed by using the following formula:

$$OP = (A \times D)$$

Where,

OP = Organizational participation

A = Nature of participation score

D = Duration score

Nature of participation	Scores assigned
No participation	0
Participation as ordinary membership	1
Participation as executive committee member	2
Participation as officer of the executive committee	3

The duration of participation was scored by assigning 1 for each year of participation subject to a maximum of 5 for participation for 5 years or more. Finally a total score of all organizations were added together to obtain his total score of organizational participation .It is shown in the item no. 6 in the interview schedule.

3.7.1.7 Cosmopolitaness

Cosmopolitaness refers to the degree to which a respondent's orientation is external to his own social system. Cosmopolitaness of the respondents was measured by the frequency of visit made by the respondent to selected places as shown in item No. 7 of the interview schedule. The following scale was used for computing the Cosmopolitaness score:

Place of visit	Weighing system	
	Nature of visit	Scores assigned
Visit to: • Other villages • Other union • Own Upazila Sadar • Other Upazila Sadar • Own district Sadar • Other district Sadar • Regional Agricultural Research Institute • Capital city • Agril. Exhibition organized in other villages/Upazilla/District • Visit to abroad	Never	0
	Rarely	1
	Occasionally	2
	Regularly	3

The Scores obtained from visit to each of the 9 categories of places were added together to obtain cosmopolitaness score of a respondent. Question regarding cosmopolitaness is shown in the item no. 7.

3.7.1.8 Innovativeness

The term innovativeness refers to the degree to which an individual is relatively earlier in adopting new ideas than the other members of his social system (Rogers, 1983). Innovativeness of a respondent was measured on the basis of adoption 10 selected innovations by the respondents. Score was assigned on the basis of two dimensions (a) how many selected innovations were adopted and (b) how many years have taken to adopt these selected innovations after being informed for the first time. Following formula was used for computing the innovativeness score of a respondent.

$$\text{Innovativeness (I)} = T_n \times Y_1 + T_n \times Y_2 + T_n \times Y_3 + T_n \times Y_4 + T_n \times Y_5$$

Where,

I	=	Innovativeness
T_n	=	No. of innovations
Y_1	=	Adoption after 1 st year of hearing (5 score)
Y_2	=	Adoption after 2 years of hearing (4 score)
Y_3	=	Adoption after 3 years of hearing (3 score)
Y_4	=	Adoption after 4 years of hearing (2 score)
Y_5	=	Adoption after 5 years of hearing (1 score)

However, the innovativeness score of a respondent for a particular innovation could range from 0 to 5. Data obtained in response to item No. 8 of the interview schedule were used to determine the innovativeness score of the respondents.

3.7.1.9 Extension contact

The extension contact of a respondent was measured with fourteen selected extension media. A scale was developed arranging the weights for 0, 1, 2 and 3 for the responses for never, rarely, often and regularly contact with these media respectively. It is shown in the item no. 9 in the interview schedule.

3.7.2 Measurement of the dependent variable

Farmers' knowledge on environmental degradation due to use of agro-chemicals was considered as the dependent variable of this study. The variable was divided into three different aspects; each aspect consisted of six questions. The aspects were knowledge on (a) agriculture, soil and water bodies, (b) health and lives and (c) plant, air and global weather. A score of 2 and 0 was given to each correct answer and each incorrect answer accordingly. Score of 1 was also considered for partially correct answer. Thus, score of all the questions were summed up to get total knowledge on the respected aspect. Finally a total score of all three aspects were added together to obtain his total score of knowledge on environmental degradation due to use of agro-chemicals. It is shown in the item no. 10 in the interview schedule.

3.8 Categorization of the Respondents

For describing the dependent variables, the respondents were classified into three categories, mainly low knowledge, medium knowledge and high knowledge on the basis of their overall knowledge score on environmental degradation due to use of agro-chemicals.

Categories were also developed in respect of each of the selected characteristics for describing the characteristics of the respondents. Nature of the data and mode of categorization prevailing in the social system guided the researcher in developing categories in respect of the selected characteristics. Procedures for categorization have been discussed while describing the grower's characteristics in chapter IV.

3.9 Statistical Treatment

Data collected from the respondents were compiled, tabulated and analyzed in accordance with the objectives of the study. The statistical measures used in describing the selected dependent and independent variables were frequency distribution, range, mean, percentage and standard deviation. Tables were also used in presenting data for clarification of understanding.

In order to explore the relationships between selected characteristics of the respondents and their knowledge on environmental degradation due to use of agro-chemicals, Pearson's Product Moment Correlation Co-efficient (r) was used. One percent (0.01) level of significance was used as a basis for rejecting any null hypothesis. To find out whether the computed value of ' r ' was significantly large to reject null hypothesis, the computed value was compared with the table value of ' r '.

CHAPTER IV

RESULTS AND DISCUSSION

Presented in this chapter are the findings of the study and interpretations of results. This chapter is divided into three sections and presented according to the objectives of the study. First section dealt with the Farmers' knowledge on environmental degradation due to use of agro-chemicals. The second section dealt with the selected characteristics of the respondents. Final section discussed the relationship between the selected characteristics of the farmers and their knowledge on environmental degradation due to use of agro-chemicals.

4.1 The Dependent Variable

In order to make a threadbare discussion, the Dependent Variables, i.e. farmers' knowledge on environmental degradation due to use of agro-chemicals was divided into three different aspects. The aspects were knowledge on agriculture, soil and water bodies; on health and lives and on plant, air and global weather. These three different aspects of knowledge have been discussed in the following section.

4.1.1 Environmental degradation knowledge on agriculture, soil and water bodies due to use of agro- chemicals

The respondents' scores for environmental degradation knowledge on agriculture, soil and water bodies due to use of agro-chemicals ranged from 2 to 11 against possible range from 0 to 12. The respondents were classified into three categories on the basis of knowledge scores. The categories and distribution of the respondents were shown in table 4.1 with their number, percent, mean and standard deviation.

4.1 Classification of the respondents according to their environmental degradation knowledge on agriculture, soil and water bodies due to use of agro-chemicals

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low knowledge (up to 4)	75	63.56	4.50	1.70
Medium knowledge (5-8)	35	29.66		
High knowledge (9-12)	8	6.78		
Total	118	100		

Table 4.1 revealed that the majority of the respondents (63.56 percent) had low knowledge while 29.66 percent and 6.78 percent of them had medium knowledge and high knowledge respectively.

4.1.2 Environmental degradation knowledge on health and lives due to use of agro-chemicals

Environmental degradation knowledge on health and lives due to use of agro-chemicals varied from 2 to 11 against possible range from 0 to 12. On the basis of knowledge score the respondents were classified into three categories as shown in Table 4.2.

4.2 Classification of the respondents according to their environmental degradation knowledge on health and lives due to use of agro-chemicals

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low knowledge (up to 4)	55	46.61	5.17	1.91
Medium knowledge (5-8)	52	44.07		
High knowledge (9-12)	11	9.32		
Total	118	100		

Data furnished in the Table 4.2 indicated that the highest proportion (46.61 percent) of the respondents had low knowledge as compared to 44.07% of them

having medium knowledge and 9.32% of them had high environmental degradation knowledge on health and lives due to use of agro-chemicals.

4.1.3 Environmental degradation knowledge on plant, air and global weather due to use of agro-chemicals

Scores of environmental degradation knowledge on plant, air and global weather due to use of agro-chemicals ranged from 1 to 9 against possible range from 0 to 12. The respondents were classified into three categories based on their environmental degradation knowledge on plant, air and global weather due to use of agro-chemicals, which are as shown in Table 4.3.

4.3 Classification of the respondents according to their environmental degradation knowledge on plant, air and global weather due to use of agro-chemicals

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low knowledge (up to 4)	85	72.03	3.86	1.65
Medium knowledge (5-8)	27	22.88		
High knowledge (9-12)	6	5.09		
Total	118	100		

Data presented in table 4.3 indicated that the majority of the respondents (72.03 percent) had low knowledge while 22.88 percent and 5.09 percent of them had medium knowledge and high knowledge respectively.

4.1.4 Total knowledge score (i.e. knowledge on environmental degradation due to use of agro-chemicals)

Total knowledge of the respondents ranged from 6 to 29. The mean value was 13.57 and standard deviation was 4.91. The respondents were classified into three categories, which are as shown in Table 4.4.

4.4 Classification of the respondents according to their knowledge on environmental degradation due to use of agro-chemicals

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low knowledge (up to 12)	71	60.17	13.57	4.91
Medium knowledge (13-24)	40	33.90		
High knowledge (25-36)	7	5.93		
Total	118	100		

From Table 4.4, it is observed that majority of the respondents (60.17 percent) had low knowledge compared to 33.90% of them had medium knowledge and 5.93% of them had high knowledge on environmental degradation due to use of agro-chemicals. It is evident that most of the respondents had low knowledge on environmental degradation due to use of agro-chemicals. This is why they could not use agro-chemicals effectively. Judicially; ultimately their agricultural practices affect the environment.



4.2 Characteristics of the Farmers

Different farmers possess different characteristics. The selected characteristics of the farmers were education, farm size, annual income, family size, farming experience, organizational participation, Cosmopoliteness, innovativeness and extension contact. Data collected from the respondents were compiled, tabulated and analyzed for describing the characteristics. Characteristics profile of the respondents was presented in the table 4.5.

Table 4.5 Characteristics profile of the respondents

Sl. No	Characteristics	Measured by	Actual value		Mean value
			Minimum	Maximum	
01	Education	Years of schooling	0	12	4.43
02	Farm size	Hectares	0.01	5.08	0.94
03	Annual income	In Taka (1000)	36	680	116.87
04	Family size	No. of members	2	11	4.56
05	Farming experience	Years	3	40	21.70
06	Organizational participation	Scoring	0	50	13.92
07	Cosmopoliteness	Scoring	3	18	11.03
08	Innovativeness	Scoring	8	25	15.24
09	Extension contact	Scoring	3	22	10.44

4.2.1 Education

The educational qualification scores of the respondents ranged from 0 to 15, with the mean value of 4.43 and standard deviation of 3.92. On the basis of observed data the respondents were classified into five categories which are shown in the table 4.6.

Table 4.6 Distribution of the respondents by their education scores

Categories (years of schooling)	Farmers		Mean	Standard deviation
	Number	Percent		
Illiterate (0)	24	20.34	4.43	3.92
Can sign name only (0.5)	19	16.10		
Primary level (1-5)	30	25.42		
Secondary level (6-12)	44	37.29		
Above secondary level (above 12)	1	0.85		
Total	118	100		

Data presented in the table 4.6 indicated that majority (37.29 percent) of the farmers had secondary level of education, while only 0.85 percent had above secondary level of education. Further, 25.42 percent of the farmers passed primary level of education, while 20.34 percent and 16.10 Percent of them were illiterate and sign illiterate accordingly.

Education develops of human mind and it increases the power of observation, analysis, understanding, and decision-making and adopts new ideas and practices. It helps an individual to gather knowledge about his environment for solving various problems. By reading newspapers, books, leaflets, booklets and viewing various media like demonstration, film show, and exhibition etc. One can develop his insight which is difficult without getting proper education. Now a days there is a great scope of being benefited from different kinds of printed materials which can be reached easily to the educated farmers.

4.2.2 Farm size

The total farm size of the respondents varied from 0.01 to 5.08 hectares with a mean of 0.94, standard deviation of 0.85. On the basis of farm size the respondents were classified into three categories as shown in Table 4.7.

Table 4.7 Distribution of the respondents by their farm size scores

Categories (hectares)	Farmers		Mean	Standard deviation
	Number	Percent		
Small (up to 0.51)	35	29.66	0.94	0.85
Medium (0.51-1.36)	63	53.39		
Large (>1.36)	20	16.95		
Total	118	100		

Data presented in the table 4.7 showed that the highest proportion (53.39%) of the respondents belonged to the medium farm category compared to 29.66% of them having small farm size and 16.95% of them had large farm. Thus, most (83.05%) of the farmers possessed small to medium farm.

Land is one of the important factors of production (land, labour, capital, organization) having important roles in many innovation-decision issues including the question of compatibility of a particular innovation. However, it seems that the client system stands on favourable situations on this variable regarding the introduction of low-cost, small-scale technologies well suited to the farm size of the small and medium farmers.

4.2.3 Annual income

Annual family income of the farmers ranged from 36 to 680 thousand taka. The mean value was 116.87 and standard deviation was 86.59. On the basis of annual income, the respondents were categorized into three groups as shown in Table 4.8.

Table 4.8 Distribution of the respondents by their annual income scores

Categories (thousand taka)	Farmers		Mean	Standard deviation
	Number	Percent		
Low (up to 73)	32	27.12	116.87	86.59
Medium(74-160)	69	58.47		
High (>160)	17	14.41		
Total	118	100		

Data furnished in the Table 4.8 revealed that the highest proportion (58.47 percent) of the respondents had medium income that was followed by low (27.12 percent) and high (14.41 percent) income earners. The average income score of the families was 116.87. This might be due to the fact that the farmers of the study area were not engaged only in agriculture. Many of them had other income sources such as service, business and other off farm economic activities. Generally higher income gives an individual better status in the society.

4.2.4 Family size

The number of family members of the respondents ranged from 2 to 11 with an average of 4.56, standard deviation of 1.61. Based on the family size the respondents were classified into three categories as small, medium and large shown in Table 4.9.

Table 4.9 Distribution of the respondents by their family size scores

Categories (No. of members)	Farmers		Mean	Standard deviation
	Number	Percent		
Small (up to 3)	35	29.66	4.56	1.61
Medium (4-6)	55	46.61		
Large (>6)	28	23.73		
Total	118	100		

Data furnished in the table 4.9 indicated that the highest proportion (46.61%) of the respondents had medium family consisting 4 to 6 members, while 29.66% of the respondents belonged to the category of small family compared to 23.73% of them having large family.

The average figure of the family size in the study area were lower than the national average of 5.6 (BBS, 2007). This might be due better adoption of family planning measures by the respondents.

4.2.5 Farming experience

The farming experience score of the respondents varied from 3 to 40 years with a mean of 21.70, standard deviation of 9.73. The respondents were classified into three categories based on their of farming experience, which are as shown in Table 4.10.

Table 4.10 Distribution of the respondents by their farming experience Scores

Categories (years)	Farmers		Mean	Standard deviation
	Number	Percent		
Low (up to 11)	9	7.63	21.70	9.73
Medium (12-31)	94	79.66		
High (>31)	15	12.71		
Total	118	100		

Table 4.10 revealed that the highest proportion (79.66 percent) of the respondents had medium farming experience as compared to 12.71% of them having high farming experience and 7.63% of them had low experience on farming. The average farming experience of the respondents was 21.70 years which could be considered as quite high.

4.2.6 Organizational participation

The organizational participation scores of the farmers ranged form 0 to 50. The mean was 13.92 and standard deviation was 14.51. On the basis of organizational participation, the respondents were categorized into four groups as shown in Table 4.11.

Table 4.11 Distribution of the respondents by their organizational participation scores

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
No participation (0)	25	21.19	13.92	14.51
Low participation (1-6)	17	14.41		
Medium participation (7-21)	49	41.52		
High participation (>21)	27	22.88		
Total	118	100		

Data presented in Table 4.11 indicated that most (41.52 percent) of the respondents had medium participation against 21.19 percent of the respondents who did not participate in any organization; 22.88 percent of them had high organizational participation and 14.41 percent showed low participation in various organizations.

Participation in different organization helps the individual to know his present situation. Organizational participation enables him to take part discussion with others to identify the various socio-economic problems and find out their solutions. Organizational participation thus helps individual to find out solutions to their own problems as well as social problems. Environmental degradation is such a problem which needs collective action. No single man can check environmental degradation by himself alone. Thus, it is necessary that the farmers need to be encouraged to form collective platform for collective action. More participation in organizational activities could create coordinated capability and capacity for improved environmental management.

4.2.7 Cosmopolitaness

The cosmopolitaness scores of the respondents ranged from zero 3 to 18, with the mean value of 11.03 and standard deviation of 2.87. On the basis of observed data the respondents were classified into three categories which are shown in the table 4.12.

Table 4.12 Distribution of the respondents by their cosmopoliteness scores

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Low cosmopoliteness (up to 7)	7	5.93	11.03	2.87
Medium cosmopoliteness (8-14)	79	66.95		
High cosmopoliteness (>14)	32	27.12		
Total	118	100		

From Table 4.12, it is observed that the highest proportion (66.95%) of the respondents had medium cosmopoliteness as compared to 27.12% and 5.93% of them had high and low cosmopoliteness respectively. Cosmopoliteness enhances the opportunity for an individual to expose himself to a variety of outside information sources. It is, therefore, possible that an individual with substantial cosmopoliteness would have an augmented possession of accumulated knowledge, experience and problem solving means. Since the data speak that most of the farmers (72.88 percent) possessed low to medium cosmopoliteness, there is little ground to assume that environment issues will be better appreciated by most of the farmers.

4.2.4 Innovativeness

Computed innovativeness scores ranged from 8 to 25. The mean value of the innovativeness scores was 15.24 with standard deviation of 4.91. Based on the innovativeness scores, the respondents were classified into three categories as shown in Table 4.13.

Table 4.13 Distribution of the respondents by their innovativeness scores

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Very low (up to 9)	3	2.54	15.24	4.91
Low (10-20)	102	86.44		
Medium (>20)	13	11.02		
Total	118	100		

Data contained in Table 4.13 showed that majority (86.44 percent) of the farmers had low innovativeness, while 11.02 percent of them had medium innovativeness. Further, only 2.54 percent of the farmers had very low innovativeness.

4.2.9 Extension contact

Computed extension contact score ranged from 3 to 22 with an average of 10.44 and standard deviation of 5.05. Based on the extension contact scores, the respondents were classified into the three categories shown in table 4.14.

Table 4.14 Distribution of the respondents by their extension contact scores

Categories	Farmers		Mean	Standard deviation
	Number	Percent		
Very low contact (up to 4)	4	3.39	10.44	5.05
Low contact (5-15)	98	83.05		
Medium contact (>15)	16	13.56		
Total	118	100		

Data presented in table 4.14 indicated that the highest proportion (83.05 percent) of the farmers had low extension contact followed by very low extension contact (3.39 percent) and medium contact (13.56 percent).

Extension contact is necessary for adopting any technology. But extension contact of the most respondents in the study area was found to be low to very low. Therefore, it could be assumed that the respondents in the study area carried out their farming activities based on the knowledge inherited from their predecessors and can not take full advantage of different media related to agriculture and environment.

4.3 Relationship between independent and dependent variables

This section deals with relationship between nine selected characteristics of the farmers and their knowledge on environmental degradation due to use of agro-chemicals. The selected characteristics were education, farm size, annual income, family size, farming experience, organizational participation, cosmopolitaness, innovativeness and extension contact. Each of the characteristics of the farmers constituted an independent variable while knowledge on environmental degradation due to use of agro-chemicals was the dependent variable of the study. To explore the relationship between the selected characteristics and their knowledge on environmental degradation due to use of agro-chemicals, Pearson's Product Moment Correlation Co-efficient (r) has been used. One percent (0.01) level of probability has been used as the basis for rejection of a null hypothesis. The relationships of the selected characteristics of the respondents with their knowledge on environmental degradation due to use of agro-chemicals have been showed in Table 4.15.

Table 4.15 Computed co-efficient of correlation (r) between independent and dependent variables (N=118)

Independent variables (Farmers characteristics)	Correlation of co- efficient (r) with knowledge	Tabulated value significant	
		at 0.05 level	at 0.01 level
Education	0.692**	.185	.237
Farm size	0.619**		
Annual income	0.681**		
Family size	0.027 ^{NS}		
Farming experience	0.033 ^{NS}		
Organizational participation	0.708**		
Cosmopolitaness	0.653**		
Innovativeness	0.504**		
Extension contact	0.697**		

NS = Not significant

** = Significant at 0.01 level of probability

Degrees of freedom = 116

A hypothesis was rejected when the observed 'r' value was greater than the tabulated value of 'r' at 0.01 level of probability. As mentioned earlier, the nine selected characteristics of the respondents were the independent variables of the study. The variables were education, farm size, annual income, family size, farming experience, organizational participation, cosmopolitaness, innovativeness and extension contact. The dependent variable was farmers' knowledge on environmental degradation due to use of agro-chemicals. The results of the correlation analysis between the independent and dependent variables are shown in table 4.16. In a bid to achieve the said inter-correlations the correlation coefficients among the variables were arranged in matrix from which in Appendix-B.

4.3.1 Relationship of education with knowledge on environmental degradation due to use of agro-chemicals

The co-efficient of correlation between the concerned variables was found to be 0.692 as shown in table 4.15. This led to the following observations regarding the relationship between the concerned variables.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was medium. Thirdly, the computed value of 'r' (0.692) was found to be greater than the tabulated value 'r' (0.237) with 116 degrees of freedom even at 0.01 level of probability. Hence the relationship was significant.

From the above observations, the formulated null hypothesis was rejected which implied that the educations of the respondents were related to their knowledge on knowledge on environmental degradation due to use of agro-chemicals. The positive trend indicated that the knowledge on environmental degradation due to use of agro-chemicals increased with the increase of education of the farmers.

Education helps individuals to gain knowledge and skill in different cognitive contents and develop positive attitudes. The education levels of farmers ultimately increase their power of observation and decision-making. Also

educated farmers are more likely to come in contact with extension contact, especially printing materials. Thus, they gain knowledge on environment.

4.3.2 Relationship of farm size with knowledge on environmental degradation due to use of agro-chemicals

Computed value of 'r' between the concerned variables was found to be 0.619 as shown in table 4.14. These following observations were recorded on the basis of 'r' value.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was medium. Thirdly, the computed value of 'r' (0.619) was found to be greater than the tabulated value 'r' (0.237) with 116 degrees of freedom at 0.01 level of probability. Hence the relationship was statistically significant.

On the basis of above findings, the null hypothesis was, therefore, rejected. Thus, it may be concluded that farm size of the respondents had a positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals. This implies that the farmers with large farm were more likely to gain knowledge because of more option of technology used in the cultivation.

4.3.3 Relationship of annual income with knowledge on environmental degradation due to use of agro-chemicals

Computed value of co-efficient of correlation between the concerned variables was found to be 0.681 as shown in table 4.15. This following observations were recorded regarding the relationship between two variables on the basis of co-efficient of correlation.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was medium. Thirdly, the computed value of 'r' (0.681) was found to be greater than the tabulated value 'r' (0.237) with 116 degrees of freedom even at 0.01 level of probability. Hence the relationship was significant.

Thus, the null hypothesis was rejected and the researcher concluded that annual income had significant positive relationship with the knowledge on environmental degradation due to use of agro-chemicals. Thus, indicated that high annual income makes strong economic base of family and contributes to the performance of crop production more efficiently which ultimately help in gaining knowledge by the farmers.

4.3.4 Relationship of family size with knowledge on environmental degradation due to use of agro-chemicals

The co-efficient of correlation between the concerned variables was found to be 0.027 as shown in table 4.15. This led to the following observations regarding the relationship under consideration.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was very low. Thirdly, the computed value of 'r' (0.027) was found to be smaller than that of tabulated value 'r' (0.185) with 116 degrees of freedom even at 0.05 level of probability. Hence the relationship was not significant.

Based on the above observations, the null hypothesis could not be rejected and hence, the researcher concluded that annual income of the respondents had no relationship with their knowledge on environmental degradation due to use of agro-chemicals.

4.3.5 Relationship of farming experience with knowledge on environmental degradation due to use of agro-chemicals

Computed value of 'r' between the concerned variables was found to be 0.033 as shown in table 4.15. These following observations were recorded on the basis of 'r' value.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was very low. Thirdly, the computed value of 'r' (0.033) was found to be smaller than the tabulated value 'r' (0.185) with 116 degrees of

freedom at 0.05 levels of probability. Hence the relationship was not significant.

On the basis of above findings, the null hypothesis was, therefore, accepted. Thus, it may be concluded that family size of the respondents was not related with their knowledge on knowledge on environmental degradation due to use of agro-chemicals. That means, family size was not important in gaining environmental knowledge.

4.3.6 Relationship of organizational participation with knowledge on environmental degradation due to use of agro-chemicals

The co-efficient of correlation between the concerned variables was found to be 0.708 as shown in table 4.15. This led to the following observations regarding the relationship between the concerned variables.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was high. Thirdly, the computed value of 'r' (0.708) was found to be greater than the tabulated value 'r' (0.237) with 116 degrees of freedom even at 0.01 level of probability. Hence the relationship was highly significant.

From the above observations, the formulated null hypothesis was rejected which implied that organizational participation of the respondents had a positive significant relationship to their knowledge on environmental degradation due to use of agro-chemicals. This indicates that organizational participation provides opportunity to increase their environmental degradation knowledge experience through mutual interactions and sharing of ideas and opinions among them.



4.3.7 Relationship of cosmopoliteness with knowledge on environmental degradation due to use of agro-chemicals

Computed value of co-efficient of correlation between the concerned variables was found to be 0.653 as shown in table 4.15. The following observations were recorded regarding the relationship between two variables on the basis of co-efficient of correlation.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was medium. Thirdly, the computed value of 'r' (0.653) was found to be greater than the tabulated value 'r' (0.237) with 116 degrees of freedom even at 0.01 level of probability. Hence the relationship was significant.

Based on the above findings, the null hypothesis was rejected and the researcher concluded that cosmopoliteness of the respondents had a positive significant relationship to their knowledge on environmental degradation due to use of agro-chemicals. Cosmopoliteness of the farmers help to acquire various information and knowledge related to farm operations. These information and knowledge drive the farmers to choose their farm practices and agro-chemicals uses for environmental friendly crop production.

4.3.8 Relationship of innovativeness with knowledge on environmental degradation due to use of agro-chemicals

Computed value of 'r' between the concerned variables was found to be 0.504 as shown in table 4.15. The following observations were recorded on the basis of 'r' value.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was medium. Thirdly, the computed value of 'r' (0.504) was found to be greater than the tabulated value 'r' (0.237) with 116 degrees of freedom at 0.01 level of probability. Hence the relationship was significant.

From the above observations, the null hypothesis was, therefore, rejected. Thus, it may be concluded that innovativeness of the respondents had a positive significant relationship with their knowledge on environmental degradation due

to use of agro-chemicals. Innovative farmers are usually willing to take risks and to come toward to use innovation (Rogers, 1983). This study, however, implies that innovativeness of the respondent was important factor to gather environmental degradation knowledge due to use of agro-chemicals.

4.3.9 Relationship of extension contact with knowledge on environmental degradation due to use of agro-chemicals

The co-efficient of correlation between the concerned variables was found to be 0.697 as shown in table 4.15. This led to the following observations regarding the relationship under consideration.

Firstly, the relationship showed a positive trend. Secondly, the degree of relationship was medium. Thirdly, the computed value of 'r' (0.697) was found to be greater than that of tabulated value 'r' (0.237) with 116 degrees of freedom even at 0.01 levels of probability. Hence the relationship was significant.

Based on the above observations, the null hypothesis was rejected and hence, the researcher concluded that extension contact of the respondents had a positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals. The farmers who were having more extension contact had more knowledge on environmental degradation due to use of agro-chemicals. This means extension contact of the farmer's exerted influence for increasing their environmental knowledge.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presented the summary of the findings, conclusions and recommendations of the study

5.1 Summary

5.1.1 Summary of Introduction

Environment is the combination of all things, forces, situations and living organisms which include human beings and their actions that affect the livelihood and well-being of all other things. The major components of environment are human, flora, fauna and inanimate objects. Human includes human behavior, flora includes plant species, fauna includes animals and inanimate objects as air, sunshine, light, rainfall, land, etc. The environmental deterioration is happening in term of air, water, soil, noise pollution and other natural hazards. The pressure of green house gases is increasing on our atmosphere that changes the climate and reduces ozone layer. Popular agricultural practices like land cleaning, burning, ploughing, leveling, irrigation, use of fertilizer and insecticides cause the irregularities of the physical environment.

Since the advent of Green Revolution, chemical fertilizers and pesticides have been widely and extensively use in Bangladesh agriculture. Large quantities of chemical fertilizers and pesticides are being used in this country and their annual use is steadily increasing. The farmers of this country are increasingly using these agro-chemicals in their farming without considering its long run effect, either knowingly or unknowingly. Therefore, it is clear that large scale use of fertilizers, pesticides and irrigation water by the farmers for a long period as well as non judicious use have been damaging the natural resources such as land, fishes, beneficial insects, soil microbes, etc. Though it is possible to boost

up production by using more chemicals and irrigation water but it will gradually reduce the unit production. So, it is urgently needed to reduce the use of fertilizers, pesticides and irrigation water for economic benefit of the country.

Agricultural Extension in Bangladesh renders their services among the farmers to bring desirable changes in their behavior. Since, it is necessary to reduce use of agro-chemicals. Therefore, for an effective planning of extension service regarding this matter, to what extent the farmers are aware of environmental degradation draws research attention. The present study was undertaken, however, to explore some facts which increase knowledge among the farmers.

5.1.2 Summary of objectives

The following specific objectives were formulated to give proper direction to the study:

1. To determine farmers' knowledge on environmental degradation due to use of agro-chemicals.
2. To determine and describe some selected characteristics of the farmers. The selected characteristics are:
 - i. Education
 - ii. Farm size
 - iii. Annual income
 - iv. Family size
 - v. Farming experience
 - vi. Organizational participation
 - vii. Cosmopolitaness
 - viii. Innovativeness
 - ix. Extension contact
3. To explore the relationship between the selected characteristics of the farmers and their knowledge on environmental degradation due to use of agro-chemicals.



5.1.3 Summary of the statement of hypothesis:

The following null hypothesis was formulated and tested.

1. There is no relationship between the selected characteristics of farmers and their knowledge on environmental degradation due to use of agro-chemicals.

5.1.4 Methodology

The study was conducted among the farmers in three villages (Khashkarara, Nischindopur and Talukkarara) of Khashkarara union of Alamdanga Upazila under Chuadanga district. Out of the total 987 household heads in three villages 116 were selected as sample of the study (from Khashkarara 687, Nischindopur 106 and Talukkarara 194) by using systematic sample technique. Data were collected from the 6th April to 5th May, 2010 using an interview schedule. Open ended closed form questions and appropriate scale were constructed in the interview schedule. Data collected from the respondents were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. Farmers' knowledge on environmental degradation due to use of agro-chemicals was the dependent variable of the study. Nine selected characteristics of the farmers such as education, farm size, annual income, family size, farming experience, organizational participation, Cosmopoliteness, innovativeness and extension contact were selected as the independent variables. The statistical measures used in describing the selected dependent and independent variables were frequency distribution, range, mean, percentage, standard deviation. Tables were also used in presenting data for clarification of understanding. In order to explore the relationships between selected characteristics of the respondents and their knowledge on environmental degradation due to use of agro-chemicals, Pearson's Product Moment Correlation Co-efficient (r) was used. One percent (0.01) level of significance was used as a basis for rejecting any null hypothesis.



5.1.5 Findings: The major findings of the study are summarized below:

5.1.5.1 Findings of independent variables

Education

It was found that the education level of the respondents ranged from 0 to 15 with the mean value of 4.43. Majority (37.29 percent) of the farmers had secondary level of education, while only 0.85 percent had above secondary level of education. Further, 25.42 percent of the farmers passed primary level education, while 20.34 Percent and 16.10 Percent of them were illiterate and sign illiterate accordingly.

Farm size

The farm size of the respondents varied from 0.01 to 5.08 hectares with a mean of 0.94. Highest proportion (53.39%) of the respondents belonged to the medium farm category compared to 29.66% of them having small farm size and 16.95% of them had large farm.

Annual income

Annual family income of the farmers ranged from 36 to 680 thousand taka. The mean was 116.87. The highest proportion (58.47 percent) of the respondents had medium income that was followed by low (27.12 percent) and high (14.41percent) income earners.

Family size

The number of family members of the respondents ranged from 2 to 11 with an average of 4.56. The highest proportion (46.61%) of the respondents had medium families consisting 4 to 6 members, while 29.66% of the respondents belonged to the category of small family compared to 23.73% having large family.

Farming experience

The farming experience of the respondents varied from 3 to 40 years with a mean of 21.70. The highest proportion (79.66 percent) of the respondents had medium farming experience as compared to 12.71% of them having high farming experience and 7.63% of them had low experience on farming.

Organizational participation

The organizational participation of the farmers ranged from 0 to 50. The mean was 13.92. Most of the respondents (41.52 percent) had medium participation against 21.19 percent of the respondents who did not participate in any organization; 22.88 percent of them had high organizational participation and 14.41 percent showed low participation in various organizations.

Cosmopolitaness

The cosmopolitaness of the respondents ranged from 3 to 18 with the mean value of 11.03. The highest proportion (66.95%) of the respondents had medium cosmopolitaness as compared to 27.12% and 5.93% of them high and low cosmopolitaness respectively.

Innovativeness

Innovativeness of the respondents ranged from 8 to 25. The mean of the innovativeness scores was 15.24. Majority (86.44 percent) of the farmers had low innovativeness, while 11.02 percent of them had medium innovativeness. Further, only 2.54 percent of the farmers had very low innovativeness.

Extension contact

Extension contact of the respondents ranged from 3 to 22 with an average of 10.44. The highest proportion (83.05 percent) of the farmers had low extension contact followed by very low extension contact (3.39 percent) and medium contact (13.56 percent).

5.1.5.2 Findings of dependent variables

The Dependent variable of the study was farmers' knowledge on environmental degradation due to use of agro-chemicals was divided into three different aspects. The aspects were knowledge on agriculture, soil and water bodies; on health and lives and on plant, air and global weather.

Environmental degradation knowledge on agriculture, soil and water bodies due to use of agro- chemicals

It was observed that the majority of the respondents (63.56 percent) had low knowledge while 29.66 percent and 6.78 percent of them had medium knowledge and high knowledge on this aspect respectively.

Environmental degradation knowledge on health and lives due to use of agro-chemicals

The highest proportion (46.61 percent) of the respondents had low knowledge as compared to 44.07% of them having medium knowledge and 9.32% of them had high environmental degradation knowledge on health and lives due to use of agro-chemicals.

Environmental degradation knowledge on plant, air and global weather due to use of agro-chemicals

The majority of the respondents (72.03 percent) had low knowledge while 22.88 percent and 5.09 percent of them had medium knowledge and high knowledge on this aspect accordingly.

Total knowledge (i.e. knowledge on environmental degradation due to use of agro-chemicals

It is observed that majority of the respondent's (60.17 percent) had low knowledge compared to 33.90% of them had medium knowledge and 5.93% of them had high knowledge on environmental degradation due to use of Agro-chemicals.

5.1.5.3 Results of the hypothesis tests

The results of hypothesis testing on the relationship between the dependent and independent variables have been discussed below:

There was a positive significant relationship between education of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals.

Farm size of the respondents had a positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals.

There was a positive significant relationship between annual income of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals.

There was no relationship between family size of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals.

Farming experience of the respondents had no relationship with their knowledge on environmental degradation due to use of agro-chemicals.

Farmers' organizational participation had positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals.

There was a positive significant relationship between cosmopolitaness of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals.

Innovativeness of the respondents had a positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals.

There was a positive significant relationship between extension contact of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals.

5.2 Conclusions

Conclusions drawn on the basis of the findings of the study, the logical interpretation of findings and other relevant facts were stated below:

1. The average educations of the respondents were found 4.43 years of schooling. Over one third (36.44 percent) of the respondents was illiterate to able to sign only. A positive and significant relationship has been observed between the level of education of the respondents and their knowledge on environmental degradation due to use of agro-chemicals. Educated farmer can read printed materials and they can also retain and use the information for a long time which make them dynamic, active and also make them able to solve their problems themselves. So it may be concluded that education level of the respondents can increase knowledge on environmental degradation due to use of agro-chemicals.
2. Just over half of the respondents (53.39 percent) had medium farm size. This study implied that farmers with large farm were more likely to gain knowledge because of more option of technology used in cultivation.
3. Most of the respondents (58.47%) belonged to medium income category. The annual income of the respondents had positive and significant influence on their knowledge on environmental degradation. This means that the farmers having high income have more knowledge on environmental degradation than the farmers with low annual income
4. Organizational participation of the respondents had positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals. It increases an individual's opportunity to gain new knowledge and experience through mutual interaction, sharing of ideas, opinion and experiences. Besides, organizational affiliation plays a vital role in the foundations of collective thinking and action among the members in a community. This is very important for protecting the

environmental degradation. But in terms of organizational Participation over one third of the respondents (35.60 percent) either did not participate in any organization or had low participation.

5. The highest proportion (66.95%) of the respondents had medium cosmopoliteness in the study area. Correlation test revealed positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals. A cosmopolite farmer is more mobile. When a farmer goes frequently to places other than his own locality, the possibility are that he comes in contact with more and many progressive farmers and gets opportunity to acquire more knowledge on environmental degradation due to use of agro-chemicals.
6. Innovativeness of the respondents had a positive significant relationship with their knowledge on environmental degradation due to use of agro-chemicals. Majority (86.44 percent) of the farmers had low innovativeness in the study area. Innovative farmers are usually willing to take risks and to come toward to use innovation. Innovativeness of the respondents was important factor to gain knowledge on environmental degradation due to use of agro-chemicals.
7. There was a positive significant relationship between extension contact of the farmers' and their knowledge on environmental degradation due to use of agro-chemicals. This leads to the conclusion that the respondents who had more contact with the extension agents were more knowledge on environmental degradation due to use of agro-chemicals.

5.3. Recommendations

5.3.1. Recommendations for policy implication:

On the basis of findings and conclusions, the following recommendations are drawn:

1. It could be said that ecological balanced agro-environment is a must to attain a sustainable agricultural system. Agro-chemicals are the hazardous entity of ecological balanced environment. Department of Agricultural Extension (DAE) and Ministry of Forest and Environment need to take proper steps to delivery adequate knowledge on environmental degradation due to use of agro-chemicals among the farmers.
2. Extension contact is very important for receiving information from various sources. But the maximum respondents in the study area had low extension contact. Therefore it is recommended that more opportunities should be created for group discussion, demonstration meeting, training of farmers, media campaign etc.to promote more media exposure in the study area.
3. Most of the respondents in the study area had low innovativeness. Therefore, it is recommended that extension workers and other relevant personal should maintain closer contact with the respondents to let them receive new ideas and to understand the long term benefit of new ideas more.
4. Most of the respondents' education level in the study area was under secondary level. GOs and NGOs should them aware of different aspects of environmental issues. Education helps an individual to realize the present and future needs at personal, social and national levels. Mass literacy and population education programme are already in operation by many NGOs our country. But government initiative in this connection seems to be inadequate and most of the cases disappointing. Proper care has to be taken to educate the people in order to build a prosperous nation.
5. Cosmopoliteness is found to create favourable impact for use of any kind of new information, innovation or any other technologies. But in the study area major proportion (66.95%) of the respondents had medium cosmopoliteness. Therefore, it is recommended that concerned service

providers should focus to the farmers about the importance of visiting significant places by providing them appropriate opportunities which could have increased their cosmopolite behavior to a certain degree.

6. Steps are necessary by the DAE and other relevant GOs and NGOs to pay more attention to the small and medium farmers so that they become conscious about environmental degradation knowledge caused by indiscriminate use of agro-chemicals. They should provide training to all categories of the farmers on Integrated Pest Management (IPM) and Integrated Weed Management (IWM) for use of pesticides. They should also increase organizational participation of the farmers having no or low organizational participation to receive ideas and facts towards sustainable agricultural development DAE should take steps to advise farmers more particularly to follow cost-effective and mechanical biological methods for controlling diseases, insects and other pest of economic importance.
7. Steps should be taken by the Government to regulate the use of those agro-chemicals, artificial materials and inputs, which diminish the natural fertility and organic properties of the soil and cause adverse impact on man and animals.
8. Considering the harmful effects of chemical fertilizers, it is necessary to develop alternative soil fertility management technique. From a long time both GOs and NGOs have been working in Bangladesh to encourage farmers to adopt organic manures like compost, green manure etc. instead of chemical fertilizers. It is necessary to find out other forms of management techniques that would be harmless to the environment ensure soil health. Therefore, it is recommended that comprehensive research works should be undertaken to find more suitable alternative soil fertility management technique as per the realities of the Bangladeshi farmers.

5.3.2 Recommendations for Further Study

1. The present study conducted in three villages of Kashkarara union of Alamdanga Upazila under Chuadanga district. Findings of the study need to be verified by undertaking similar research in other parts of the country.
2. The study on farmers' knowledge on environmental degradation due to use of agro-chemicals was conducted considering only three dimensions such as agriculture, soil and water bodies ; health and lives ; plant, air and global weather. But such study may also be conducted taking in consideration of other aspects of environmental issues such as irrigation, homestead, sanitation, deforestation, etc.
3. Relationships of nine selected characteristics of the farmers with their knowledge on environmental degradation due to use of agro-chemicals were investigated in this study. It is, therefore, recommended that further study should be conducted involving other characteristics in this regard.
4. In the present study farm size and farming experience had no significant relationship with farmers' knowledge on environmental degradation due to use of agro-chemicals. In this connection, further verification is necessary.
5. Pesticides are occasionally found being used indiscriminately by the farmers. Even banned insecticides are used in the border districts. Hence, it is necessary to undertake a study on the lethal effect of the insecticides in order to protect the environment as well as to achieve sustainable agricultural development.
6. Further research is necessary to find out effective ways and means of providing education including environmental issues of the farmers.

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APPENDIX A

AN ENGLISH VERSION OF THE INTERVIEW SCHEDULE

**Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207**

An interview schedule for a research study entitled
“Farmers’ knowledge on environmental degradation due to use of agro-chemicals”

Serial No:

Name of the respondent :

Village :

Word No. :

Union :

Upazila :

District :

(Please answer the following questions)

1. Education

(a) Do not know reading and writing

(b) Can sign name only

(c) I have passed up to class

2. Farm Size

Please furnish information on land under cultivation

SL. NO.	Types of land use	Land area	
		Local unit	Hectare
1.	Homestead area		
2.	Own land under own cultivation		
3.	Land given to others as barga		
4.	Land taken from others as barga		
5.	Land taken from others as lease		
6.	Pond area		
	Total		

3. Annual Income

Please mention your last year's income with its Sources

SL. NO.	Sources	(In Tk.)
1.	Agriculture	
	(a) Rice	
	(b)Jute	
	(c)Wheat	
	(d)Maize	
	(e)Sugarcane	
	(f)Potato	
	(g) Pulse crops	
	(h) Oil crops	
	(I) Vegetables	
	(j) Fruits	
	(k)Spices	
	(l)Others	
2.	Service	
3.	Dairy	
4.	Poultry	
5.	Fish culture	
6.	Income of other family members	
7.	Others	
	Total	

4. Family Size

How many members are there in your family (including yourself)?

(a) Male

(b) Female

Total

5. Farming Experience

Please mention your farming experience..... Years.



6. Organizational participation

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

SL. NO.	Name of the organization	Not involved	Nature and duration of participation (year)		
			Ordinary member	Executive committee member	Officer of the executive committee
1.	Union council				
2.	NGO activities				
3.	Farmers co-operative society				
4.	Religious Committee (Mosque, Temple etc.)				
5.	Educational institution Committee (School, Madrasha, College etc.)				
6.	Market committee				
7.	Village protection committee				
8.	Youth club				
9.	Others organizations.				

7. Cosmopoliteness

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

SL. NO.	Place of visit	Frequency of visit			
		Regularly	Often	Rarely	Never
1.	Other villages	10 or more times/month	5-9 times/month	1-4 times/month	0 time/month
2.	Other union	6 or more times/month	3-5 times/month	1-2 time/month	0 time/month
3.	Own upazilla Sadar	4 or more times/month	2-3 times/month	1 time/month	0 time/month
4.	Other upazilla Sadar	4 or more times/year	2-3 times/year	1 time/year	0 time/year
5.	Own district Sadar	6 or more times/year	3-5 times/year	1-2 times/year	0 time/year
6.	Other district Sadar	3 or more times/year	2 times/year	1 time/year	0 time/year
7.	Regional Agricultural Research Institute	3 or more times/year	2 times/year	1 time/year	0 time/year
8.	Capital city	1 time/year	1 time/2-3 years	1 time/4-5 years	0 time/5 or more years
9.	Agril. Exhibition organized in other villages/Upazilla/ District	1 time/year	1 time/2 year	1 time/3 more years	0 time/year
10.	Visit to abroad	more than 2 times in life	2 times in life	Once in life	Not even in life

8. Innovativeness

Please mention the degree of use of the following innovations

SL. NO.	Name of the innovations	Degree of innovativeness				
		Adoption after 1 year of hearing	Adoption after 2 years of hearing	Adoption after 3 years of hearing	Adoption after 4 years of hearing	Adoption after >4 years of hearing
1.	Use of IPM					
2.	Use of granular Urea					
3.	Use of organic fertilizer					
4.	Use of Faromen trap					
5.	Use of green manure					
6.	Use of agroforestry					
7.	Rice fish culture					
8.	Vaccine of poultry					
9.	Use of power tiller					
10.	Use of deep tube well					

9. Extension contact

Please indicate the extent of your contact with the following sources.

SL. NO.	Communication media	Frequency of communication			
		Regularly	Often	Rarely	Never
1.	Sub Assistant Agriculture officer(SAAO)	6 or more times/month	4-5 times/year	1-3 times/year	0 time/year
2.	Upazilla Agriculture officer(UAO)	3 or more times/year	2 times/year	1 time/year	0 time/year
3.	Local leader	5 or more times/month	3-4 times/month	1-2 times/month	0 time/month
4.	Model farmer	5 or more times/month	3-4 times/month	1-2 times/month	0 time/month
5.	Researcher	3 or more times/year	2 times/year	1 time/year	0 time/year
6.	NGO worker/month	5 or more times/month	3-4 times/month	1-2 times/month	0 time/month
7.	Participation in Agricultural training Course	4 or more times/life	2-3 times/life	1 time/life	0 time/life
8.	Demonstration meeting(Method & Result)	3 or more times/year	2 times/year	1 time/year	0 time/year
9.	Group discussion	5 or more times/6 months	3-4 times/6 months	1-2 times/6 months	0 time/6 months
10.	Field day	3 or more times/year	2 times/year	1 time/year	0 time/year
11.	Daily newspaper	5 or more times/week	3-4 times/week	1-2 times/week	0 time/week
12.	Farm publications (Leaflet, Poster, Bulletin, Books etc.)	5 or more times/year	3-4 times/year	1-2 times/year	0 time/year
13.	Farm Radio programme	5 or more times/week	3-4 times/week	1-2 times/week	0 time/week
14.	Farm Television programme	5 or more times/month	3-4 times/month	1-2 times/month	0 time/month

10. Knowledge on environmental degradation due to use of agro-chemicals

(Please answer the following questions)

(a) On agriculture, soil and water bodies

SL. NO.	Questions	Full mark	Mark obtained
1.	What are the harmful effects of insecticides on root crops?	2	
2.	How do agrochemicals decrease the quality of crops?	2	
3.	How do Chemical fertilizers reduce organic matter content in soil?	2	
4.	Why is the residual effect of insecticides harmful for good soil health?	2	
5.	How do herbicides and pesticides contaminate groundwater?	2	
6.	What is the effect of washing out of Pesticides into rivers and streams?	2	

(b) On health and lives

SL. NO.	Questions	Full mark	Mark obtained
1.	What are the harmful effects in the person during applying agro-chemicals?	2	
2.	How can you wash your hand after applying agro-chemicals?	2	
3.	How do pesticides destroy wild lives?	2	
4.	How do agro-chemicals harm fishes and other aquatic biota?	2	
5.	What is the effect of insecticides on dairy and poultry?	2	
6.	How may herbicides endanger for bird populations?	2	

(c) On plant, air and global weather

SL. NO.	Questions	Full mark	Mark obtained
1.	How do insecticides harm the plants by killing pollinator?	2	
2.	How do agro-chemicals harm trees and what are its consequences?	2	
3.	How do Pesticides cause to air pollution?	2	
4.	How do pesticides blow in the wind?	2	
5.	How do agro-chemicals lead to a failure in the rainfall?	2	
6.	How do agro-chemicals influence global warming and climate change?	2	

Thanks for co-operation

Name of the interviewer:.....

Date:.....

APPENDIX- B

Meaning of correlation -coefficient

'r' value	Meaning
$\pm 0.00 - 0.19$	Very low correlation
$\pm 0.20 - 0.39$	Low correlation
$\pm 0.40 - 0.69$	Medium correlation
$\pm 0.70 - 0.89$	High correlation
$\pm 0.90 - 1.00$	Very high correlation

Source: Cohen and Holliday, 1982:93

APPENDIX- C

Variables	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	Y ₁₀
X ₁	1									
X ₂	.237**	1								
X ₃	.211*	.912**	1							
X ₄	-.066	-.007	.028	1						
X ₅	-.198*	.010	.082	.195*	1					
X ₆	.585**	.403**	.493**	.089	.021	1				
X ₇	.562**	.333**	.367**	.191*	-.059	.551**	1			
X ₈	.500**	.224*	.156	.095	-.063	.565**	.421**	1		
X ₉	.588**	.413**	.474**	.069	.027	.786**	.535**	.632**	1	

* Significant at 0.05 level of probability;

** Significant at 0.01 level of probability

NS = Non-significant

X₁ = Education

X₂ = Farm Size

X₃ = Annual Income

X₄ = Family Size

X₅ = Farming Experience

X₆ = Organizational Participation

X₇ = Cosmopolitaness

X₈ = Innovativeness

X₉ = Extension Contact

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