

**FARMERS' AWARENESS ON ENVIRONMENTAL POLLUTION DUE TO
EXCESS USE OF PESTICIDES IN WINTER VEGETABLE CULTIVATION**

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JUNE, 2020

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TO EXCESS USE OF PESTICIDES IN WINTER VEGETABLE
CULTIVATION**

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A Thesis
Submitted to the Faculty of Agriculture,
Sher-e-Bangla Agricultural University, Dhaka,
in Partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE (MS)
IN
AGRICULTURAL EXTENSION
SEMESTER: JANUARY-JUNE, 2020

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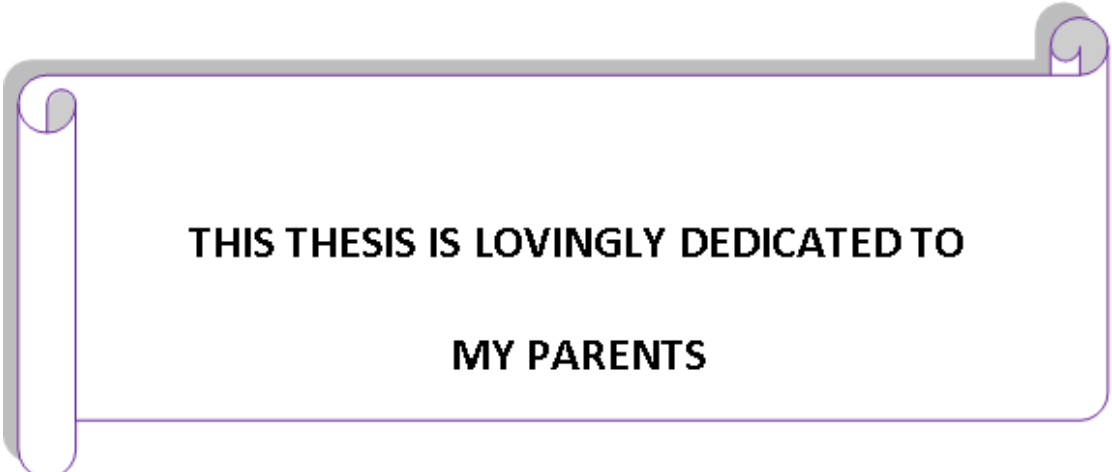
CERTIFICATE

This is to certify that the thesis entitled “**FARMERS’ AWARENESS ON ENVIRONMENTAL POLLUTION DUE TO EXCESS USE OF PESTICIDES IN WINTER VEGETABLE CULTIVATION**” submitted to the department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension**, embodies the result of a piece of bona fide research work carried out by **MD. ZIA UDDIN PAVEL, Registration No. 12-04970** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

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**THIS THESIS IS LOVINGLY DEDICATED TO
MY PARENTS**

ACKNOWLEDGEMENT

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

In particular, the author takes the opportunity to express his deepest sense of gratitude to his honorable **Supervisor Prof. Md. Abul Bashar**, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for his continuous inspiration, valuable suggestions, constructive criticism, constant guidance and intensive supervision through the period of the study and preparation of this thesis without his intense co-operation this work would not have been possible.

The author deems proud privilege to extend his extreme gratefulness and best regards to his venerable **Co-supervisor Prof. M. Zahidul Haque**, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for his keen interest, valuable advice, creative suggestions, co-operation and encouragement to bring this thesis up to its present standard.

The author would like to express his deepest respect and boundless gratitude especially to, **Professor Dr. Muhammad Humayun Kabir**, Chairman, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for his active help and moral support in pursuing the study.

It is also a great pleasure for the author to express hearty appreciation and regard

to all teachers of the Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for their affectionate feelings and valuable suggestions during the research work.

The author deeply acknowledges the cooperation and sincere help of Upazila Agriculture Officer, Agriculture Extension Officer of Gazipur sadar upazila under Gazipur district. The author also expresses his heartfelt gratitude to the respondents of the study area who patiently provided the information during the interview with the author.

The author expresses his grateful thanks to all staff and employees of the Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka for their co-operation and encouragement to prepare this thesis.

Last but not least, the author expresses his deepest sense of gratitude, indebtedness and profound respect to his beloved mother, uncles, brothers, sister, relatives and friends for their blessings, encouragement and moral support in all phases of this academic pursuit from beginning to the end.

The Author

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ABBREVIATIONS USED

GDP	Gross Domestic Product
BBS	Bangladesh Bureau of Statistics
K.Cal	Kilo Calory
DAE	Department of Agricultural Extension
FFS	Farmers' Field School
FS	Farm size
SPSS	Statistical Package for Social Sciences
S D	Standard Deviation
SAAO	Sub-Assistant Agriculture Officer

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ABSTRACT

The objectives of this study were to describe the selected characteristics of the farmers, to assess the extent of farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation and to find out the factors that affecting farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. The study was conducted with randomly selected 105 farmers from four villages of Gazipur sadar upazila under Gazipur districts. A pre-tested interview schedule was used to collect data from the respondents during January 20th to February 20th, 2020. Farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation was the dependent variable and this variable was measured by applying a 4-point rating scale. The highest proportion (56.19 percent) of the farmers had medium awareness on environmental pollution compared to having (26.67) percent high and (17.14) percent low awareness on environmental pollution. Five characteristics of the respondent's viz. education, cosmopolitaness, extension media contact and agricultural organization participation had significant positive contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. Farm size had negative significant contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Bangladesh is an agriculturally important country. It has a total area of 1,47,570 sq. km. with a total population of 160 million and is considered to be one of the most densely populated country in the world (BBS, 2020). Agriculture is the backbone of the economy of Bangladesh. The development of Bangladesh depends largely on the development of agriculture sector, which contributes 13.35 percent of the GDP. About 85 percent of the total population live in rural areas and directly or indirectly depends on agriculture for their livelihood. About 45.1 percent of the labour forces are employed in agriculture of which 57 percent is employed in the crop sector. In Bangladesh vegetable are grown in 23.29 percent where rice in 76.71 percent of cultivable land (BBS, 2020). Vegetables are very important crops in Asia and are cultivated in an area of 37.22 million hectares with annual production of 630.75 mt. It can play an important role in improving the poor nutritional status of human being in Bangladesh. Malnutrition causes considerable human and economic waste, it impairs physical growth, capacity to work, losses energy for work. Malnutrition is now considered both as the cause and effect of under development. In Bangladesh, half of the population are under the poverty line and suffer from various health problems. Severity of malnutrition and iron deficiency (anaemia) is the highest among the female of all age groups and children. Vegetables are the excellent sources of minerals, vitamins and essential amino acids. Vegetables are considered as one of the most important groups of food crops due to their high nutritive value, having, relatively higher yield and higher return. They are considered as a cheap source of natural supplementary food and can be grown within a short duration. The daily per capita availability of vegetables excluding tuber crops is only 36 gm against the required amount of 200 gm (BBS, 2020). This big gap is the main reason for widespread malnutrition.

There is little chance for malnutrition to occur where enough vegetables are taken by the people. In Bangladesh, the average per capita caloric intake is 1850 K.Cal, whereas the recommended intake is 2200 K.Cal (BBS, 2020). Micro nutrient deficiencies are very acute. Blinding due to malnutrition among the pre-school children in Bangladesh is nearly the highest level in the world. But the paradox is that this country is very rich in green leafy vegetables. Vegetables not only minimize the malnutrition but also maximize the financial returns. Vegetable production especially is more profitable than the production of most of the field crops (Table 1.1).

Table 1.1 Production of vegetables as compared to other crops

Vegetables	2017-18		Other crops	2017-18	
	Area (acres)	Production (M.T)		Area '000' (acres)	Production '000' (M.T)
Cauliflower	48083	274297	Aus	2657	2710
Tomato	69509	385038	Aman	14034	13993
Eggplant	80618	355862	Boro	12008	19576
Radish	63066	284090	Wheat	868	1098
Bean	50888	134860	Maize	990	3288
Cabbage	45829	321719	Mustard	760	352
Red Amaranth (Lalshak)	29403	59150	Soyabean	147	99

Source: BBS, 2020

Although vegetable production is profitable than other crop production, the main barrier against increasing vegetable production is the pest infestation. The annual yield loss due to infestation by insect pests alone is 25 percent in case of vegetables. Therefore, for increasing crop production it is imperative to reduce the crop loss caused by pests and diseases. The following methods are used for controlling pest population

- Biological control: Natural enemies and pathogenic micro-organisms.
- Cultural control: Good agronomic practices and use of pest tolerant or resistant crop varieties.
- Mechanical control: For example, hand picking, flooding to minimizing the incidence of insect's pest.
- Chemical control: Selective based on economic thresholds. It is used as a last method but priority is given to botanical and bio-pesticides whenever possible.
- Use of sex pheromones: These chemicals are highly species-specific.

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

Although pesticides use in Bangladesh is relatively lower in comparison to neighboring countries (e.g. India, uses 320 grams of active ingredients per hectare per year), the use of pesticide has been increasing rapidly over the past two decades. A report titled "the impact of pesticides on farmer health: a medical and economic analysis in the Philippines" (Pingali et al. 1995) claimed that the value of crops lost to pests when pesticides are not used is invariably lower than the cost of treating diseases caused by their use. The health costs incurred by farmers exposed to pesticides are 61percent higher than those of farmers who are not exposed, it added. Higher level of pesticides uses also damage our natural resources such as land, fishes, diatoms, beneficial microorganisms, beneficial insects, plants and soon.

Although pesticides may provide temporary relief from pest outbreak in the crop fields, the rapid increase in the use of pesticides in agriculture in recent years has

led to concern about its environmental effects. Two dangers are of particular importance in this context. First, pesticides use can have adverse health effects for farm workers and others exposed to pesticides. Second, it might contaminate ground and surface water, harming downstream users of that water and damaging inland fisheries.

Table 1.2 Consumption of pesticides in vegetable cultivation

Year	Total consumption (MT)
2012	40882.94
2013	37781.06
2014	35801.68
2015	33371.60
2016	33,371.60
2017	35136.28
2018	37213.34
2019	36245.34

Source: BBS, 2020

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

Ecology is the biological discipline that deals with the interactions between organisms and their environment. This environment is a sum total of the physical

environment (including temperature, water availability, wind, soil acidity) and biological or biotic environment. Ecological balance refers to the condition of equilibrium among the components of a natural community such that their relative numbers remain fairly constant and their ecosystem is stable. Gradual readjustments to the composition of a balanced community take place continually in response to natural ecological succession and to alterations in climatic and other influences. Awareness referred to one's consciousness about an object or thing on different situation in her/his surroundings (Parveen, 1995).

Awareness is the state or ability to perceive, to feel, or to be conscious of events, objects or sensory patterns. In this level of consciousness, sense data can be confirmed by an observer without necessarily implying understanding. More broadly, it is the state or quality of being aware of something. In biological psychology, awareness is defined as a human's or an animal's perception and cognitive reaction to a condition or event.

According to Gundhi and Patel (1997) farmers' awareness of the environmental impact of pesticide 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. Farmers' awareness of beneficial and harmful effects of pesticides and factors determining use of pesticides were analyzed using survey data from 21 villages in three agro-ecological regions of Bangladesh. Pesticide cost accounts for about 7.7 percent of the gross value of output in cotton, 3.6 percent in vegetables, 2.5 percent in potato, 1.8 percent in modern rice, 1.6 percent in spices and less than 1 percent in other cereal and non-cereal crops. About 77 percent of farmers (highest 94 percent in Comilla) used pesticides at least once (37 percent applied once and 31 percent applied twice, and the rest applied for 3-5 times) in a crop season. Cultivation of traditional and modern rice varieties, potatoes, spices, vegetables and cotton are the

prime determinants of pesticide use. Farmers seem to treat pesticides as substitutes for fertilizers, indicated by the positive influence of fertilizer prices on pesticide use. Pesticide use is higher in underdeveloped regions. Sharp regional variations also exist in pesticide usage. So from the above discussion it is conspicuous that there is a lack of awareness of the farmer about environment pollution due to use of pesticides. Now-a-days pesticides are extensively used in vegetable cultivation. Although pesticides increased vegetables production but it has a great harmful effect on human health and agro-ecosystem. So it is necessary to know by the farmers about harmful effect of pesticides. Very little research has been done in Bangladesh on this aspect.

Hence, this study was undertaken to investigate awareness of the farmer about environment pollution due to the use of pesticides in the cultivation of vegetables. The findings of the present study may provide valuable guidelines for the researchers, planners, policy makers and other government and non-government organization for future study and programme development for the upliftment of rural people under different rural development programme.

1.2 Statement of the Problem

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

The excess use of pesticides for vegetables production creates a strong nutritional imbalance in soils by the increase of particular nutrient(s) or decreasing the initial status through enhanced uptake by vegetables crops. Pesticides also affect the physical, chemical and biological properties of soil. These adverse soil properties

ultimately create a strong imbalance in soil ecology and affect the crop yields. The pesticides and organic fertilizers, on the other hand, tend to maintain good soil fertility without significant yield decline and also maintain healthy soil environment.

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

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

1. What is the farmers' awareness on environment pollution due to excess use of pesticide in winter vegetable cultivation?
2. What are the characteristics of farmers affecting their awareness on environment pollution due to excess use of pesticide in winter vegetable cultivation?
3. What are the contribution of the farmers and their awareness on environment pollution due to excess use of pesticide in winter vegetable cultivation?

1.3 Specific Objective of the Study

- 1). To describe the following selected characteristics of the farmers:
 - a) Age
 - b) Education
 - c) Family size
 - d) Farm size
 - e) Annual family income
 - f) Farming experience
 - g) Cosmo politeness

- h) Training on winter vegetable cultivation
 - i) Extension media contact
 - j) Agricultural organizational participation
- 2). To assess the extent of farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation; and
- 3). To find out the factors that affecting farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

1.4 Justification of the Study

The size and density of the population in relation to land area and resources development have already caused a high degree of environmental degradation, as reflected by deforestation, loss of wild life, destruction of wet lands and inland fisheries, soil depletion and inland salinity intrusion. Nowadays farmers use pesticides during vegetables production in a large scale. The pesticides which are used in the cultivation of vegetables are very destructive for human health. The vegetables uptake or absorb the chemicals and when these vegetables are eaten/consumed by an individual he swallows the chemicals which make various disorder in the metabolic system. The major cause behind these man made problems is the lack of institutional capacity in integrated planning and environmental management. Many government and nongovernment organizations are working in Bangladesh in the fields of agriculture and rural development. Sustainable agricultural growth and protection of environment are the issues of high priority today. The findings of this research will be useful to those who are concerned with planning, implementation and evaluation of agricultural, rural development and environmental programs. Various pesticides companies and firms also can make use of the findings of this research in determining policies and practices for the marketing of their products. The knowledge and skills gained by the researcher in conducting this research will enable him to conduct other similar studies in this field.

Considering the above findings, the researcher became interested to undertake a study to farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

1.5 Assumption of the Study

The researcher had the following assumptions in mind while undertaking this study:

1. The selected respondents were competent enough to reply the queries made by the researcher.
2. The responses furnished by the respondents were valid and reliable.
3. Information furnished by the respondents included in the sample was the representative opinion of the whole population of the study area.
4. The researcher who acted as interviewer was well adjusted to social and environment condition of the study area. Hence, the data collected by him from the respondents were free from bias.
5. All the data concerning the variables of the study were normally and independently distributed.

1.5 Limitation of the Study

In order to make the study manageable and meaningful from the point of view of research, it was necessary to impose some limitations as stated below:

1. The study was confined to one selected union of Gazipur Sadar upazila under Gazipur district.
2. The characteristics of farmers in the study area were many and varied but only ten characteristics were selected for investigation in this study as stated in the objectives.
3. The researcher relied on the data furnished by the winter vegetable farmers' from their memory during interview.

4. For some cases, the researcher faced unexpected interference from the over interested side-talkers while collecting data from the target populations. However, the researcher tried to overcome the problem as far as possible with sufficient tact and skill.

5. Reluctance of vegetable farmers to provide information was overcome by establishing proper rapport.

1.7 Definition of Related Terms

The terms which have been frequently used throughout the research work are defined and interpreted below:

Age

Age of a respondent was defined as the span of his/her life and was operationally measured by the number of years from his/her birth to the time of interview.

Education

Education referred to the development of desirable change in knowledge, skill, attitude and ability in an individual through reading, writing, working, observing and other related activities. It was operationalized by the formal education of tomato farmers by taking into account of years he/she spent in formal educational institutions.

Family size: Family size is defined as the total number of members including husband, children and other dependent members in the family of a respondent.

Farm size

Farm size referred to the cultivated area either owned by the farmer or obtained from others on barga system, the area being estimated in terms of full benefit and half benefit to the farmer respectively. The self-cultivated owned land and cultivated area taken as lease or mortgage from others was recognized as full benefit.

Annual family income

The term annual family income referred to the total earning by the earning members from agriculture, livestock, fisheries and other accessible sources (business, service, daily labor etc.) during a year. It was expressed in Thousand Taka.

Training exposure

It was used to refer to the completion of an activity by the farmers which were offered by the government, semi-govt. or non-government organization (s) to improve the knowledge and skills of farmers for better performing an agricultural job. It was measured by the number of days of training received by the respondent.

Extension media contact

It referred to an individual's (farmer) exposure to or contact with different communication media, source and personalities being used for dissemination of new technologies.

Farming experience

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

Cosmopolitness: The Cosmopolitness refers to the workers place visit in the year round.

CHAPTER -II

REVIEW OF LITERATURE

Reviews of the literatures relevant with the objectives of this study are presented in this chapter. This study was mainly concerned with farmers' awareness on environmental pollution due to use of pesticides for vegetable cultivation. The researcher attempted to search the literature of studies conducted on the farmers' awareness on environmental pollution due to use of pesticides for vegetable cultivation. Literatures relating to past studies exploring relationship of characteristics of individuals with their awareness on environmental pollution were also searched. However, the reviews are conveniently presented based on the major objectives of the study.

2.1 Farmers' Awareness on Environmental Pollution due to Use of Pesticides for Vegetable Cultivation

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

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

Hamid (1995), in his study on farmers' awareness on environmental pollution caused by the use of agro-chemicals, found that 40 percent of his respondent were

in moderate awareness category whereas 29 percent and 8 percent of his respondents were in poor and high awareness category respectively.

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 and favourable perception respectively.

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

2.2 Selected Characteristics of the Farmer and their Awareness on Environmental Pollution

2.2.1 Age and awareness on environmental pollution

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

Hanif (2000) found that there was a positive significant relationship between age of the respondents and their awareness on environmental pollution in case of Farmer Field School (FFS) farmers. Khan (1993) in his study found that age of the farmers was significantly related with their adoption of insecticides.

Hamid (1995) conducted a study to determine the awareness of farmers on environmental pollution. He found that age of the farmers had significantly negative relationship with the awareness on environmental pollution. Similar findings were

obtained by Islam and Kashem (1997) and Gogoi and Gogoi (1989) in their respective study.

Parveen (1995) conducted a survey to determine the awareness of the farm women on environmental degradation due to use of some selected modern agricultural technologies. She found that the age of respondents had significant negative relationship with the awareness on environmental degradation.

Sutradhar (2002) revealed that the age of the respondents had no significant relationship with their awareness on environmental degradation. Hoque (1993) observed that age of farmer had negative relationship with the adoption of insecticides. Hossain (1999) found that age of the farmers had no relationship with their perception of the adverse effect of agrochemicals.

2.2.2 Education and awareness on environmental pollution

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was significant relationship between education of the respondents and their awareness on environment environmental pollution on his study.

Wahhab (1990) in his study on attitudes of farmers towards use of fertilizers, observed that there was positive relationship between education and attitude towards the use of phosphorus and potash fertilizers while the relationship was not significant in case of use of urea fertilizers and their education.

Baadgaonkar (1984) found that education of the farmers had positive relationship with their adoption behaviour.

Kashem (1987) found that attitude towards community of the small farmers had significant positive correlation with their educational level.

Sarkar (1999) revealed that the level of education of the farmer had significant relationship with the awareness on environmental degradation. Hanif (2000) found that in his study there was a positive significant relationship between education of the respondents and their awareness on environmental pollution.

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

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

2.2.3 Family size and awareness on environmental pollution

There was no available review of literature about family size and awareness on environmental pollution.

2.2.4 Farm size and awareness on environmental pollution

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was significant

relationship between farm size of the respondents and their awareness on environment environmental pollution on his study.

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

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

Islam (1993) in his study found that farm size had a significant and positive relationship with adoption of improved practices. Khan (1993) observed in his study observed that farm size was positively related to the adoption of insecticides.

Muttalab (1995) in his study observed that farm size of the farmers had a positive relationship with the adoption of improved potato farmers and showed positive and significant effect.

Sutradhar (2002) found that farm size of the respondents had a significant relationship with their awareness on environmental degradation. Islam (2003) in his study found that there was a positive and significant relationship between farm size of the farmers and adoption of organic manures.

Hanif (2000) found that there was a negative insignificant relationship between farm size of the respondents and their awareness on environmental pollution and Kasem (2001) found that there was no significant relationship between farm size of the respondents and their awareness on environment on his study.

2.2.5 Annual income and awareness on environmental pollution

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was significant relationship between annual family income of the respondents and their awareness on environment environmental pollution on his study.

Hamid (1995) found a positive relationship between annual income of the farmers and their awareness on environmental pollution. Sutradhar (2002) revealed that annual income of the respondents had a significant positive relationship with their awareness on environmental degradation.

Rahman (1993) reported that income of the farmers was positively related with adoption of improved farm practices in transplanted aman rice cultivation in two selected villages of Mymensingh district.

Muhammad (1994) conducted a study on the adoption of insect control measures in Khamar Union of Rajshahi district. He found a consistent positive trend between income of the farmers and adoption of insect control measures, through the relationship between the two variables was not statistically significant.

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

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

2.2.6 Farming experience and awareness on environmental pollution

There was no available review of literature about farming experience and awareness on environmental pollution.

2.2.7 Cosmopolitanism and awareness on environmental pollution

There was no available review of literature about cosmopolitanism and awareness on environmental pollution.

2.2.8 Training and awareness on environmental pollution

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was significant relationship between training exposure of the respondents and their awareness on environment environmental pollution on his study.

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

Kasem (2001) found that there was significant relationship between Training exposure of the respondents and their awareness on environment on his study.

2.2.9 Extension media contact and awareness on environmental pollution

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was significant relationship between extension media contact of the respondents and their awareness on environment environmental pollution on his study.

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

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

Kasem (2001) found that there was significant relationship between extension media contact of the respondents and their awareness on environment on his study.

Ajore (1989) observed in his study that mass media exposure of the farmers had positive relationship with their attitude towards chemical fertilizers.

Thomas *et al.* (1990) observed that group meetings had significant relationship with the adoption of integrated pest management practices among the cotton growers of Texas.

Juliana *et al.* (1991) found that mass media exposure of the farmers were positively associated with their extent of adoption of integrated pest management practices.

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

Hossain (1999) observed in his study that media exposure of the farmers had no relationship with their perception of the adverse effect of agrochemicals.

2.2.10 Agricultural organizational participation and awareness on environmental pollution

Shanto (2011) conducted a study on awareness on environmental pollution due to use of pesticide in vegetable cultivation and found that there was significant relationship between organizational participation of the respondents and their awareness on environment environmental pollution on his study.

Hossain (1999) found a positive relationship between Organizational participation and their perception on the effect of agrochemicals on environment.

Sarkar (1999) found a positive relationship between Organizational participation and their perception on environmental degradation.

Parveen (1995) conducted a survey determine the awareness of the farm women on environment. She found that Organizational participation of respondents had significant negative relationship with the awareness on environmental degradation.

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

2.3 Conceptual Framework of the Study

The present study would be tried to focus two concepts, first, the farmers' selected characteristics and the second, their awareness on environmental pollution due to excess use of pesticides in vegetable cultivation. Awareness on environmental pollution due to excess use of pesticides in vegetable cultivation of a farmer may be influenced and affected through interacting forces in his surroundings. Awareness on environmental pollution of a farmer may also be influenced by various characteristics. In this study, farmers' characteristics have only been taken into consideration. Moreover, it is deal with all the characteristics in a single study. It is therefore, necessary to limit the characteristics which include: age, education, family size, farm size, annual family income, farming experience, cosmopolitaness, training on winter vegetable cultivation, extension media contact and organizational participation. These characteristics are the independent variables of this study, while farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation being the main focus of the study constituted the only

dependent variable. A simple conceptual framework in this connection has been presented in Figure 2.1.

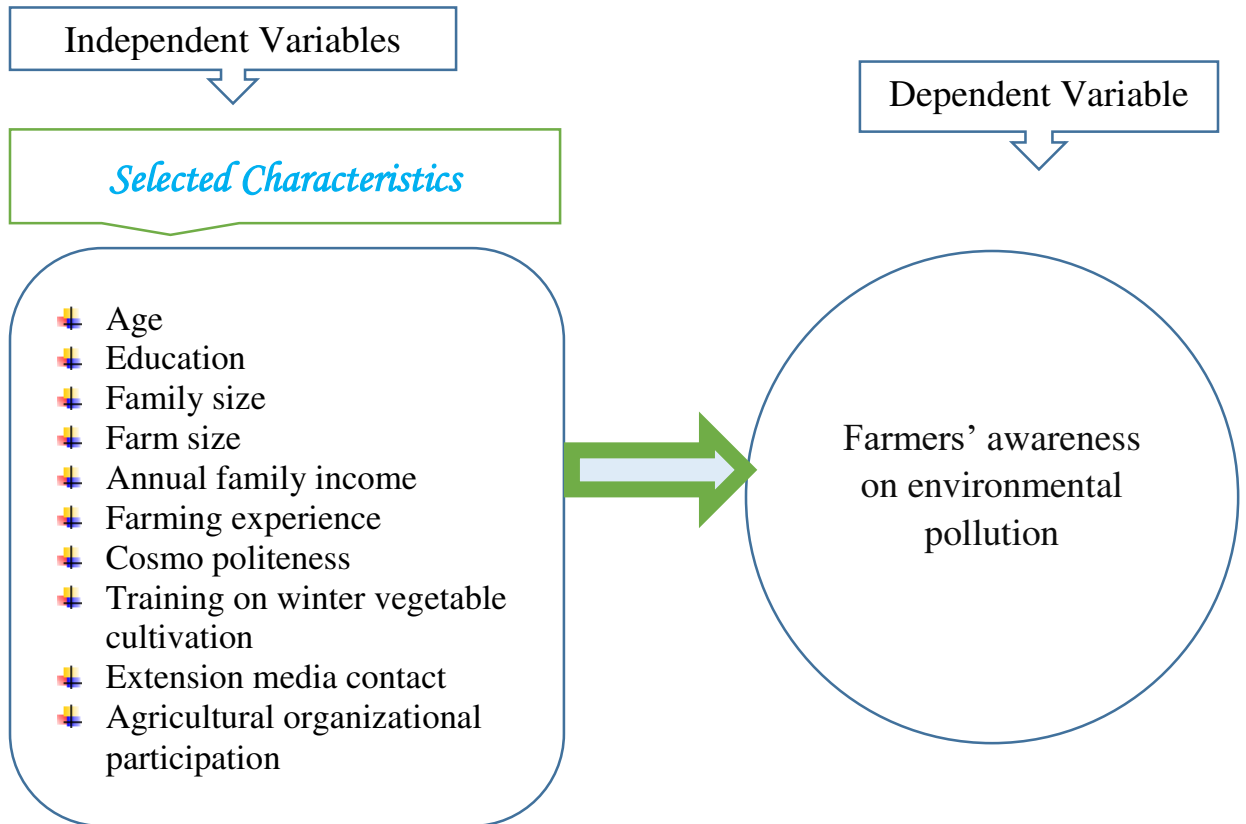


Figure 2.1: The Conceptual Framework of the Study

CHAPTER 3

MATERIALS AND METHODS

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

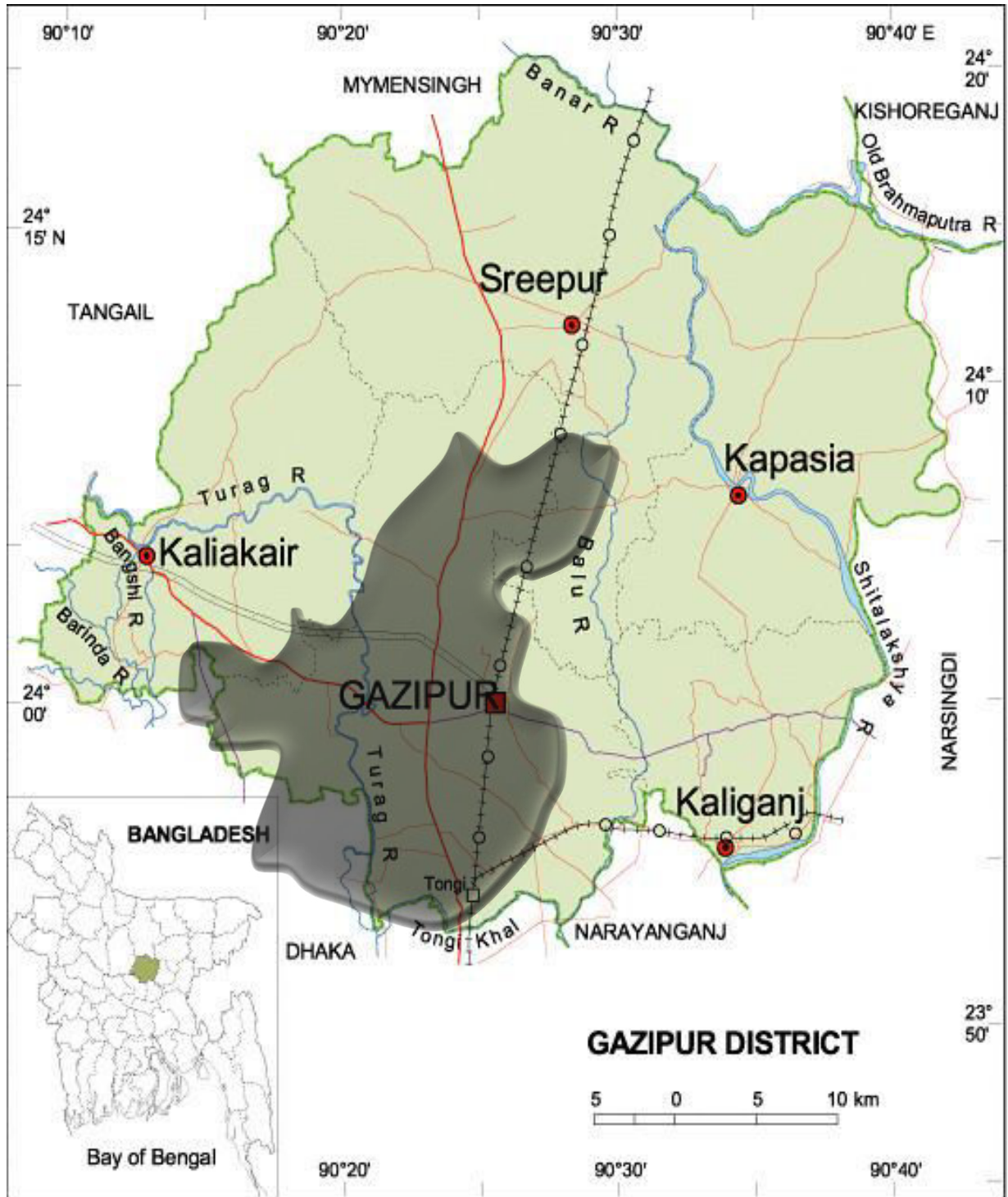
3.1 The Locale of the Study

The study was purposively conducted at Gazipur sadar upazilla under Gazipur district. One union named Bason was also purposively selected. All winter vegetables growers from the selected four villages were constituted as the population of the study. The selected villages were Telipara, Barboika, Jogitola and Bariali. A map of Gazipur district showing Gazipur sadar upazila is presented in Figure 3.1. A map of Gazipur sadar showing the study area is presented in Figure 3.2.

3.2 Population and Sample

The winter vegetable farmers under selected four villages were considered as the population of the study. A list of winter vegetable farmers who are currently cultivating winter vegetable was prepared with the help of Upazila Agriculture Officer and his field staffs. The number of winter vegetable farmers of the selected four villages was 427 which constituted the population of the study. About 25 percent of the population was selected proportionally from the selected villages as the sample by following random sampling method. Thus, the total sample size was

105. Moreover, a reserved list of 10 winter vegetable farmers was prepared for use when the winter vegetable farmers under sample were not available during data collection. The distribution of the selected winter vegetable farmers with reserve list of the selected villages is shown in the table 3.1.



3.1 A map of Gazipur district showing Gazipur sadar upazila



3.2 A map of Gazipur sadar showing the study area

Table 3.1 Distribution of the sampled farmers in the study area

Upazila	Union	Villages	Population	Sample size	Reserve list
Gazipur sadar	Bason	Telipara	121	29	3
		Barboika	96	24	2
		Jogitola	109	27	3
		Bariali	101	25	2
Total			427	105	10

3.3 Measurement of Variables

The various characteristics of the farmers might have influence on their farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. These characteristics were age, education, family size, farm size, annual family income, farming experience, cosmopolitaness, training on winter vegetable cultivation, extension media contact and agricultural organizational participation. Farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation were the main focus of the study. Measurement of all the factors of the farmers and their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation are discussed in the following sub sections:

3.3.1 Age

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

3.3.2 Education

The education of farmers was measured by the number of years of schooling completed in an educational institution. A score of one (1) was given for each year of schooling completed. If a farmers didn't know how to read and write, his

education score was zero, while a score of 0.5 was given to the farmers who could sign his name only. If a farmer did not go to school but studied at home or adult learning center, his knowledge status was considered as the equivalent to a formal school student.

3.3.3 Family size

Family size was measured by computing total number of members in the family. A family normally consists of head of household, wife, unmarried sons and other dependent relations who jointly live together. One score was assigned to each member of the family.

3.3.4 Farm size

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

$$FS=A+B+1/2 (C+D) +E$$

Where,

FS= Farm size

A = Homestead area

B= Own land under own cultivation

C= Land given to others as borga

D= Land taken from others as borga

E= Land taken from others as lease

3.3.5 Annual family income

Annual family income of a farmers was measured in Thousand Taka. The total yearly earning from agricultural (field crops, vegetables, fruits, spices, livestock and

fisheries) and nonagricultural sources (service, business, and others) by the respondent himself/herself and other members of his family was determined. Thus, yearly earning from agricultural and nonagricultural sources were added together to obtain annual family income of a farmers. A score of one was given for each Tk. 1,000 to compute the annual income scores of the respondents.

3.3.6 Farming experience

Farming experience of a respondent was measured by asking questions related to how many years involved in winter vegetables cultivation. It was expressed in year. However, a unit score of one (1 year) was assigned for each one year of time.

3.3.7 Cosmo politeness

Cosmo politeness of a respondent was measured in terms of his nature of visits to the eight (8) different places external to his own social system. The cosmo politeness of a respondent was measured by computing score on the basis of his/her visits with eight selected cosmo politeness. Respondents mentioned the nature on his/her visits by putting a tick mark against any one of 5 responses, not at all, rarely, occasionally, frequently and regularly. The score for each respondent was determined by his/her response to all the items on the basis of his/her frequency of visits with a score of 0, 1, 2, 3 and 4 respectively. The cosmo politeness score of the respondents could range from 0 to 28, where, 0 indicates no cosmo politeness and 28 indicates high cosmo politeness. This variable appears in item number 7 in the interview schedule as presented in Appendix-A.

3.3.8 Training on winter vegetable cultivation

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

3.3.9 Extension media contact

This variable was measured by computing an extension media contact score on the basis of a respondent's extent of contact with 8 selected media as obtained in response to item no. 9 of the interview schedule (Appendix A). Each respondent was asked to indicate the frequency of his contact with each of the selected media. With four alternative responses as 'regularly', 'often', 'occasionally', 'rarely' and 'never' basis and weights were assigned as 4, 3, 2, 1 and 0 respectively. The extension contact score of a respondent was determined by summing up his/her scores for contact with all the selected media. Thus possible extension media contact score could vary from zero (0) to 24, where Zero indicated no extension contact and 24 indicated the highest level of extension contact.

3.3.10 Agricultural organizational participation

Agricultural organizational participation of a respondent was measured by computing agricultural organizational participation score according to his/her nature and duration of participation in three (3) selected different organizations upto the time of interview. Agricultural organizational participation score was evaluated for each respondent on the basis of his/her membership with those organisations. The following scale was used for computing agricultural organizational participation score. Organizational participation score = PX D

Where, P- Participation Score

D- Duration (no. of years)

Following scores were assigned for nature of participation:

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

This variable appears in item number ten (10) in the interview schedule as presented in Appendix-A.

3.4 Farmers' awareness on environmental pollution

After thorough consultation with relevant experts and reviewing of related literature, 10 statements regarding winter vegetable cultivation were selected and those were asked to the respondent farmers to determine their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. The dependent variable of the study was awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. Awareness of farmers on environmental pollution was measured by answers of the farmers against a total of 10 statements. Awareness of farmers was measured by a 4-point Likert scale. Scores were assigned as 3 for strongly agree, 2 for agree, 1 for disagree, 0 for strongly disagree. Finally scores for all the statements were added to obtain the total score (30) expressing the awareness of the respondents. Awareness of a farmer on environmental pollution was computed by adding all scores obtained by him/her in all ten statements. The scores could range from 0 to 30, where zero indicating the lowest level of awareness, while '30' indicating the highest level of awareness on environmental pollution.

3.5 Instruments for Data Collection

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

Before finalization, the interview schedule was pre-tested with 20 winter vegetable farmers of the study area. On the basis of the pre-test experiences necessary corrections, modifications and alterations were made before finalizing the interview

schedule for final data collection. During modification of the schedule, valuable suggestions were received from the research supervisor and relevant experts. The interview schedule was then printed in its final form and multiplied. A copy of interview schedule in English version are placed in Appendix A.

3.6 Collection of Data

Data were collected personally by the researcher himself through face to face interview. To familiarize with the study area and for getting local support, the researcher took help from the local leaders and the field staffs of Upazila Agriculture Office. The researcher made all possible efforts to explain the purpose of the study to the farmers. Rapport was established with the farmers prior to interview and the objectives were clearly explained by using local language as far as possible. Data were collected during the period of January 20 to February 20, 2020.

3.7 Data Processing

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

3.8 Statement of Hypothesis

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

3.8.1 Research hypothesis

The following research hypothesis was put forward to test contribution of the selected characteristics of the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. The research hypothesis was “each of the” selected characteristics of the farmers have significant contribution to their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

3.8.2 Null hypothesis

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

“Each of the selected characteristics of the farmers had no significant contribution to their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation”

3.9 Statistical Analysis

The data were analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative data by means of suitable scoring technique wherever necessary. The statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. To find out the contribution of identified characteristics of the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation, multiple regression was used. Throughout the study, at least five percent (0.05) level of probability was used as basis of rejecting a null hypothesis. The analysis was performed using Statistical Package for Social Sciences (SPSS V 20) computer package.

CHAPTER IV

RESULTS AND DISCUSSION

In this chapter the findings of the study and its interpretation are presented in three sections according to the objectives of the study. The first section deals with the selected characteristics of the winter vegetable cultivation farmers, while the second section deals with the extent of the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation and the third section deals with the contribution to their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

4.1 Selected Characteristics of the Winter vegetable Farmers

In this section the results of the farmers selected characteristics have been discussed. The salient feature of the respondents with their ten selected characteristics has been presented in Table 4.1.

Table 4.1 The salient features of the selected characteristics of the farmers

characteristics	Measuring unit	Rang		Mean	S D
		possible	observed		
Age	Years	-	21-68	41.33	10.63
Education	Year of schooling	-	00-18	5.71	5.27
Family Size	Person	-	3-9	5.79	1.56
Farm Size	Hectare	-	0.17-4.68	1.07	.61
Annual family income	('000' tk)	-	94-955	477.40	202.65
Farming experience	Years	-	5-50	23.38	9.02
Cosmopolitaness	Score	0-32	10-29	16.89	4.06
Training on winter vegetable cultivation	Days	-	0-10	2.74	2.68
Extension media contact	Score	0-24	11-24	18.12	2.97
Agricultural organizational participation	Score	-	0-17	4.61	3.92

4.1.1 Age

The age score of the winter vegetable farmers ranged from 21 to 68 with an average of 41.33 and a standard deviation of 10.63. Considering the recorded age farmers were classified into three categories namely young, middle and old aged following (MoYS, 2012).

Table 4.2 Distribution of the farmers according to their age

Categories (years)	Winter vegetable farmers		Mean	SD
	Number	Percent		
Young aged (up to 35)	40	38.10	41.33	10.63
Middle aged (36-50)	43	40.95		
Old aged (above 50)	22	20.95		
Total	105	100		

Table 4.2 indicates that the majority (40.95 percent) of the respondents were the middle-aged category while 38.10 percent and 20.95 percent were found young and old categories respectively. The mean value (41.33) rightly indicates the reality.

4.1.2 Education

Education of the respondents has been categorized as done by Poddar (2015). Education of the farmers ranged from 0 to 18 years of schooling having an average of 5.71 years with a standard deviation of 5.27. On the basis of their education, the respondents were classified into five categories as shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their education

Categories	Winter vegetable farmers		Mean	SD
	Number	Percent		
Illiterate (0)	35	33.33	5.71	5.27
Can sign only (0.5)	5	4.76		
Primary education (1-5 class)	12	11.43		
Secondary education (6-10 class)	37	35.24		
Above secondary level (above 10)	16	15.24		
Total	105	100		

Data contained in Table 4.3 indicates the 33.33 percent of the farmers were illiterate. It was found that 35.24 percent were secondary level of education, 11.43 percent were primary level of education and 15.24 percent were above secondary level of education. Only 4.76 percent were can sign only categories.

4.1.3 Family size

To describe the family size of the respondents, the category has been followed as represented by Poddar (2015). Family size scores of the fanners ranged from 3 to 9 with an average of 5.79 and standard deviation of 1.56. According to family size, the respondents were classified into three categories (Mean±SD) as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their family size

Categories	Winter vegetable farmers		Mean	SD
	Number	Percent		
Small family (up to 4)	25	23.81	5.79	1.56
Medium family (5 -6)	45	42.86		
Large family (above 6)	35	33.33		
Total	105	100		

Data contained in Table 4.4 indicates that (42.86%) of the farmers had medium family while 33.33 percent of them had large family and 23.81 percent of them had small family. Thus, about above two third (76.19%) of the farmers had medium to large family.

4.1.4 Farm size

Land possession of the respondents varied from 0.17 to 4.68 hectare and the average being 1.07 hectare and standard deviation of 0.61. Depending on the farm size of the respondents were classified into three categories according to DAE (1999) as appeared in table 4.5.

Table 4.5 Distribution of the farmers according to their farm size

Categories (hectare)	Winter vegetable farmers		Mean	SD
	Number	Percent		
Small land (up to 0-1 ha)	56	53.33	1.07	.61
Medium land (1.01-3 ha)	47	44.76		
Large land (above 3 ha)	2	1.91		
Total	105	100		

Similar result was observed Nasreen et al. (2013) where highest respondents were small farm sized. Data contained in table 4.5 indicates the 53.33 percent of the farmers had small land while 44.76 percent of them had medium land and only 1.91 percent of them were large farmer.

4.1.5 Annual family income

The annual family income of the farmers ranged from Tk. 94 thousand to Tk. 955 thousand with an average of Tk. 477.40 thousand and standard deviation of 202.65 thousand. Based on the annual income, the farmers were divided into three categories (Mean±SD) as shown in Table 4.6.

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

Categories ('000' Tk.)	Winter vegetable farmers		Mean	S D
	Number	Percent		
Low (up to 275)	19	18.10	477.40	202.65
Medium (276-679)	68	64.76		
High (above 679)	18	17.14		
Total	105	100		

Reza (2007) found the similar result where highest number of respondents were medium annual income. From the Table 4.6 it was observed that the highest portion (64.76 percent) of the farmers had medium annual family income compared to 18.10 percent having low and only 17.14 percent had high annual family income.

4.1.6 Farming experience

The observed farming experience of the farmers ranged from 11-24 against the possible range of 0 to 32, the mean being 18.12 and standard deviation of 2.97. According to their observed ranged of farming experience scores, the farmers were classified into three categories (Mean±SD) as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their farming experience

Categories	Winter vegetable farmers		Mean	SD
	Number	Percent		
Low (upto 16)	25	23.81	18.12	2.97
Medium (17-20)	24	22.86		
High (above 20)	56	53.33		
Total	105	100		

Similar result was observed Poddar (2015) where highest respondents were large farming experience. Data presented in the Table 4.7 indicated that 53.33 percent of the farmers had high farming experience compared to having 23.81 percent low and 22.86 percent medium farming experience. Findings again revealed that almost all (77.14 percent) of the farmers had low to high farming experience.

4.1.7 Cosmo politeness

The score of cosmo politeness of the farmers ranged from 10 to 29, the mean being 16.89 and standard deviation of 4.06. Based on training exposure, the farmers were classified into three categories (Mean±SD) as shown in Table 4.8.

Table 4.8 Distribution of the farmers according to their cosmo politeness

Categories (scores)	Winter vegetable farmers		Mean	SD
	Number	Percent		
Low (upto 12)	16	15.24	16.89	4.06
Medium (13-20)	77	73.33		
High (above 20)	12	11.43		
Total	105	100		

Data contained in Table 4.8 indicates that 73.33 percent of the farmers had medium cosmopolitanism; while 15.24 percent of the farmers had low cosmopolitanism and 11.43 percent had high cosmopolitanism. Thus, about 88.57% of the farmers had low to medium cosmopolitanism.

4.1.8 Training on winter vegetable cultivation

The score of training on winter vegetable cultivation of the farmers ranged from 0 to 10 days, the mean being 2.74 and standard deviation of 2.68. Based on observed range, the farmers were classified into three categories as shown in Table 4.9.

Table 4.9 Distribution of the farmers according to training on winter vegetable cultivation

Categories (days)	Winter vegetable farmers		Mean	SD
	Number	Percent		
No training (0)	33	31.43	2.74	2.68
Low training (up to 5)	54	51.43		
Medium training (above 5)	18	17.14		
Total	105	100		

Data contained in Table 4.9 indicates that 51.43 percent of the farmers had low training on winter vegetable cultivation; while 31.43 percent of the farmer's had no training on winter vegetable cultivation and 17.14 percent had medium training on winter vegetable cultivation. Thus, about 82.86% of farmers had no to low training on winter vegetable cultivation.

4.1.9 Extension media contact

The observed extension contacts scores of the farmers ranged from 11-24 against the possible range of 0 to 32, the mean being 18.12 and standard deviation of 2.97. According to their observed ranged of extension contact scores, the farmers were classified into three categories (Mean±SD) as shown in Table 4.10.

Table 4.10 Distribution of the farmers according to extension media contact

Categories	Winter vegetable farmers		Mean	SD
	Number	Percent		
Low (upto 16)	32	30.48	18.12	2.97
Medium (17-20)	46	43.81		
High (above 20)	27	25.71		
Total	105	100		

Similar result was observed Poddar (2015) where highest respondents were medium extension contact. Data presented in the Table 4.10 indicated that 43.81 percent of the farmers had medium extension contact compared to having 30.48 percent low and 25.71 percent had high extension contact. Findings again revealed that almost all (74.29 percent) of the farmers had low to medium extension contact.

4.1.10 Agricultural organizational participation

The score of organizational participation of the farmers ranged from 0 to 17, the mean being 4.61 and standard deviation of 3.92. Based on observed range, the farmers were classified into four categories as shown in Table 4.11.

Table 4.11 Distribution of the farmers according to organizational participation

Categories (Scores)	Winter vegetable farmers		Mean	SD
	Number	Percent		
No participation (0)	20	19.05	4.61	3.92
Low participation (1-5)	48	45.71		
Medium participation (6-10)	27	25.71		
High participation (above 10)	10	9.52		
Total	105	100		

Data contained in Table 4.11 indicates that 45.71 percent of the farmers had low participation; while 25.71 percent of the farmer's had medium organizational participation and 19.05 percent had no organizational participation and only 9.52 % of the farmers had high organizational participation. Thus, about 71.42% of

farmers had low to medium organizational participation.

4.2 Farmers' awareness on environmental pollution

The observed farmers' awareness on environmental pollution scores of the farmers ranged from 10-25 against the possible range of 0 to 30, the mean being 17.99 and standard deviation of 2.97. According to their observed ranged of farmers' awareness on environmental pollution scores, the farmers were classified into three categories (Mean±SD) as shown in Table 4.12.

Table 4.12 Distribution of the farmers according to farmers' awareness on environmental pollution

Categories	Winter vegetable farmers		Mean	SD
	Number	Percent		
Low awareness (upto 15)	18	17.14	17.99	2.97
Medium awareness (16-19)	59	56.19		
High awareness (above 19)	28	26.67		
Total	105	100		

Similar result was observed Shanto (2011) where highest respondents were medium farmers' awareness on environmental pollution. Data presented in the Table 4.12 indicated that 56.19 percent of the farmers had medium awareness on environmental pollution compared to having 26.67 percent high and 17.14 percent low awareness on environmental pollution. Findings again revealed that almost all (82.86 percent) of the farmers had medium to high awareness on environmental pollution.

4.3 The Contribution of the selected characteristics of the respondents on their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

In order to estimate the awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation, the multiple regression analysis was used which is shown in the Table 4.13.

Table 4.13 Multiple regression coefficients of the contributing variables related to awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

Dependent variable	Independent Variable	β	P	R^2	Adj. R^2	F
Farmers' awareness on environmental pollution	Age	0.069	0.630	0.430	0.370	7.102
	Educational Qualification	0.344	0.000**			
	Family Size	0.034	0.672			
	Farm Size	-0.299	0.001**			
	Annual family income	0.096	0.282			
	Farming experience	0.054	0.705			
	Cosmopolitaness	0.171	0.043*			
	Training on winter vegetable cultivation	0.064	0.507			
	Extension media contact	0.199	0.035*			
	Involve with agricultural Organizational participation	0.266	0.001**			

** Significant at $p < 0.01$;

*Significant at $p < 0.05$

Table 4.13 shows that education, cosmopolitaness, extension media contact and agricultural organizational participation of the respondents had significant positive contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation and but farm size of the respondents had significant negative contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. Of these, education, farm size and agricultural organizational participation were the most important contributing factors (significant at the 1% level of significant) and cosmopolitaness, extension media contact of the respondents were less important contributing factors (significant at 5% level of significant). Coefficients of other selected variables don't have any contribution on their awareness on environmental pollution due to excess

use of pesticides in winter vegetable cultivation.

The value of R^2 is a measure of how of the variability in the dependent variable is accounted by the independent variables. So, the value of $R^2 = 0.430$ means that independent variables account for 43% of the variation with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. The F ratio is 7.102 which is highly significant ($p < 0$).

However, each predictor may explain some of the variance in respondents their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation simply by chanced. The adjusted R^2 value penalizes the addition of extraneous predictors in the model, but value 0.370 is still show that variance is their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation can be attributed to the predictor variables rather than by chanced (Table 4.13). In summary, the models suggest that the respective authority should be consider the farmers' educational qualification, farm size, cosmopoliteness, extension media contact and agricultural organizational participation of the respondents on their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation and in this connection some predictive importance has been discussed below:

4.3.1 Significant contribution of education on the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

The contribution of education to the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of education to the farmers' awareness on environmental

pollution due to excess use of pesticides in winter vegetable cultivation”.

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- a. The contribution of the education was at 1% significance level (.000)
- b. So, the null hypothesis could be rejected.
- c. The direction between education and awareness was positives.

The b-value of level education is (0.344). So, it can be stated that as education increased by one unit, the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation increased by 0.344 units.

Based on the above finding, it can be said that farmers’ education increased the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, education has significantly contributed to the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. Education plays an important role to reduce problems in winter vegetable cultivation in many cases. Education enhances knowledge on many aspects such as training, participation, extension contact and so on.

4.3.2 Significant contribution of farm size on the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

The contribution of farm size to the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of farm size to the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation”.

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- a. The contribution of the farm size was at 1% significance level (.001)
- b. So, the null hypothesis could be rejected.
- c. The direction between farm size and awareness was negatives.

The b-value of farm size is (-0.299). So, it can be stated that as farm size increased by one unit, the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation decreased by 0.299 units.

Based on the above finding, it can be said that increased the farmers' farm size decreased the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, farm size has significantly contributed to the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

4.3.3 Contribution of agricultural organization participation of the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

From the multiple regression, it was concluded that the contribution of agricultural organization participation to the farmers' awareness on environmental pollution due to excess use of pesticide in winter vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of agricultural organization participation to the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation”.

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- a. The contribution of the agricultural organization participation was significant at 1% level (.001)
- b. So, the null hypothesis could be rejected.
- c. The direction between agricultural organization participation and awareness was positive.

The b-value of organisation participation is (0.266). So, it can be stated that as agricultural organization participation increased by one unit, farmers' awareness increased by 0.266 units.

Based on the above finding, it can be said that farmers had more agricultural organizational participation increased farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, Organizational participation has high significantly contributed to the awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation increased. Organizational participation increase farmer's knowledge about various aspects which helps farmers make enough reduce their problem in winter vegetable cultivation.

4.3.4 Significant contribution of cosmopolitaness on the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

From the multiple regression, it was concluded that the contribution of cosmopolitaness to the farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of cosmopolitanism to the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation”.

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- a. The contribution of the cosmopolitanism was significant at 5% level (0.043)
- b. So, the null hypothesis could be rejected.
- c. The direction between cosmopolitanism and problem was negatives.

The b-value of training exposure was (0.171). So, it can be stated that as cosmopolitanism increased by one unit, farmers’ problems decreased by 0.171 units.

Based on the above finding, it can be said that farmers had more cosmopolitanism increased the awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, cosmopolitanism has high significantly contributed to the farmers’ awareness. Cosmopolitanism helps farmers to gather more knowledge on winter vegetable cultivation which ultimately helps farmers to reduce their problems in winter vegetable cultivation.

4.3.5 Significant contribution of extension contact of the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

From the multiple regression, it was concluded that the contribution of extension contacts of the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of extension contact to the farmers’ awareness on

environmental pollution due to excess use of pesticides in winter vegetable cultivation”.

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

- a. The contribution of the extension contact was significant at 5% level (.035)
- b. So, the null hypothesis could be rejected.
- c. The direction between extension contact and awareness was positive.

The b-value of extension contact was (0.199). So, it can be stated that as extension contact increased by one unit, the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation increased by 0.199 units.

Based on the above finding, it can be said that farmers had more extension contact increased farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, extension contact has high significantly contributed to the farmers’ awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation increased.

CHAPTER V
SUMMARY OF THE FINDINGS, CONCLUSIONS AND
RECOMMENDATIONS

5.1 Summary of the Findings

5.1.1 Individual Characteristics of the Farmers

Age: Age of the respondents ranged from 21 to 68 years with an average of 41.33 years. Majority of the respondents (40.95 percent) were old aged followed by 38.10 percent and 20.95 percent were young and middle-aged respectively.

Education: Education of the farmers ranged from 0 to 18 years of schooling having an average of 5.08 years with a standard deviation of 5.06. Majority of the 33.33 percent of the farmers were illiterate. It was found that 35.24 percent were secondary level of education, 11.43 percent were primary level of education and 15.24 percent were above secondary level of education. Only 4.76 percent were can sign only categories.

Family size: The highest proportion (42.86%) of the farmers had medium family while 33.33 percent of them had large family and 23.81 percent of them had small family. Thus, about above two third (76.19%) of the farmers had medium to large family.

Farm size: Farm size of the respondents ranged from 0.17 to 4.68 with an average of 1.07. Majority of the 53.33 percent of the farmers had small land while 44.76 percent of them had medium land and only 1.91 percent of them were large farmer.

Annual family income: Annual income score of the respondents ranged from 94 to 955 with an average of 477.40. The highest portion (64.76 percent) of the farmers

had medium annual family income compared to 18.10 percent having low and only 17.14 percent had high annual family income.

Farming experience: Farming experience of the farmers ranged from 5 to 50 years with an average of 23.38 and standard deviation of 9.02 years. Most of the 53.33 percent of the farmers had high farming experience compared to having 23.81 percent low and 22.86 percent medium farming experience. Findings again revealed that almost all (77.14 percent) of the farmers had low to high farming experience.

Cosmopolitaness: Cosmopolitaness score of the respondents ranged from 10 to 29 with an average of 16.89. Majority of the respondent's 73.33 percent of the farmers had medium cosmopolitaness; while 15.24 percent of the farmers had low cosmopolitaness and 11.43 percent had high cosmopolitaness. Thus, about 88.57% of the farmers had low to medium cosmopolitaness.

Training on winter vegetable cultivation: Training on winter vegetable cultivation score of the respondents ranged from 0 to 10 with an average of 2.74. Majority of the respondents (51.43 percent) had low training exposure followed by 31.43 percent of the farmer's had no training exposure and 17.14 percent had medium training exposure respectively.

Extension contact: Extension contact score of the respondents ranged from 11-24 with an average of 18.12. Majority of the respondents (43.81 percent) had medium contact followed by 30.48 percent had low and 25.71 percent had high extension contact respectively.

Agricultural organizational participation: Agricultural organizational participation of the farmers ranged from 0 to 17, the mean being 4.61 and standard

deviation of 3.92. The majority of the farmers 45.71 percent had low participation; while 25.71 percent of the farmer's medium organizational participation and 19.05 percent had no organizational participation and only 9.52 % of the farmers had high organizational participation.

5.1.2 Awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

The observed farmers' awareness on environmental pollution scores of the farmers ranged from 10-25 against the possible range of 0 to 30, the mean being 17.99 and standard deviation of 2.97. The highest proportion 56.19 percent of the farmers had medium awareness on environmental pollution compared to having 26.67 percent high and 17.14 percent low awareness on environmental pollution. Findings again revealed that almost all (82.86 percent) of the farmers had medium to high awareness on environmental pollution.

5.1.3 Contribution of the selected characteristics of the farmers and their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation

Among 10 selected characteristics of the farmers 5 characteristics namely, education, cosmopolitaness, extension media contact and agricultural organizational participation had significant positive contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation but farm size had negatively significant contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation and the rest 5 characteristics namely, age, family size, annual family income, farming experience and training on winter vegetable cultivation had no significant contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

5.2 Conclusions

Following conclusions were drawn on the basis of findings, logical interpretation and other relevant facts of the study:

1. The findings of the study revealed that vast majority of the farmers (88.86 percent) had medium to high awareness on environmental pollution. Therefore, it may be concluded that it would be a wise thinking to improve the overall situation of awareness on environmental pollution by taking care of the factors related to the increase of awareness among the farmers.
2. About half (35.5 percent) of the farmers were secondary level of education. There existed a positive significant contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. Therefore, it may be concluded that an appreciable proportion of the farmers will continue to face problems in winter vegetable cultivation, if suitable steps are not taken to remove illiteracy from the farmers.
3. Almost 74.29 % of the farmers had low to medium extension media contact. Findings expressed that extension media contact of the farmers had significant positive contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, it may be concluded that if the farmer come in more contact of extension provider, electronics, and printed media and extends their organizational participation they will face less problems in winter vegetable cultivation.
4. Agricultural organizational participation of the respondents had positive contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. This leads to the conclusion that higher organizational participation enhances the awareness on

environmental pollution due to excess use of pesticides in winter vegetable cultivation.

5. Most of the farmers (88.57%) had low cosmopoliteness to medium cosmopoliteness. Findings expressed that cosmopoliteness of the farmers had significant positive contribution with their problems faced in winter vegetable cultivation. So, it may be concluded that the farmers having higher cosmopoliteness more awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation and vice-versa.
6. Farm size of the respondents had negative significant contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. This tends to the conclusion that higher the farm sizes lower the awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation.

5.3 Recommendations

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

5.3.1 Recommendation for policy implication

1. The findings indicated that an overwhelming majority (82.86%) of the farmers faced medium to high awareness. So, it may be recommended that necessary steps should be taken by concerned authority to increase their awareness so that they can make their winter vegetable cultivation profitable by increasing yield with less production cost.
2. The findings of the study indicated that education had significant positive contribution with awareness on environmental pollution due to excess use of

pesticides in winter vegetable cultivation. Therefore, it may be recommended that the concerned authorities should take the special mass education program for the illiterate and low lettered farmers for increasing their awareness.

3. The findings extension media contact had a significant positive contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, it may be recommended that the extension workers of the concerned authority should increase the contact with farmers personally and motivate them to be connected with electronic and printed media that can help them to exchange related information which will increase their awareness.

4. The findings revealed that the cosmopolitaness had a significant positive contribution with the awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. So, it may be recommended that the concerned authority should increase cosmopolitaness to develop skills of the farmers technologically so that they can maximize their awareness.

5. The findings indicated that organizational participation had a positive significant contribution with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation. Therefore, it may be recommended that the extension provider of concerned authority should select those farmers with priority that has more attraction, eagerness and attention toward new technologies of more yield and income so that they can increase their awareness.

5.3.1 Recommendations for further study

- 1.** The study was conducted on the farmers of only one selected area of Gazipur sadar upazila under Gazipur district. Finding of the study need verification by similar research in other areas of the country including areas where winter vegetable cultivation is yet to get popularity.
- 2.** Contributions of 10 characteristics of farmers with their awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation have been investigated in this study. Further research should be conducted to find out contribution of the other personal characteristics of the farmers with their others issues.
- 3.** In addition to awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation, the farmers also faced other problems such as social, economic, housing, sanitation, nutrition and domestic etc. Therefore, it may be recommended that research should be conducted relation to other issues of the farmer.
- 4.** The research was conducted to find out the awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation of the farmer. Further research should be taken related to other issues like summer vegetable cultivation or another crop.

REFERENCES

- Anonymous, 1994. Soil Fertility Reduced. *The New Nation*, 14 February, 1994: 14.
- Ajore, R. 1989. Attitude of Farmers toward Chemical Fertilizers. *Indian Journal of Extension Education*, XXV (1&2): 112-114.
- Baadgaonkar, S. S. 1984. Measurement of Farmers Knowledge and Factors Affecting the Adoption Behaviour of Groundnut Cultivators of Uttar Kannada District of Karnataka State. *Thesis Abstract*. Directorate of Publications. Haryana Agricultural University, Hisar, India, X (4): 294.
- BBS. 2020. Bangladesh Bureau of Statistics, Statistical division, Ministry of Planning, Government of the People's Republic of Bangladesh.
- DAE. 1999. Agricultural Extension Manual. Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh.
- Gandhi, V. P. and Patel, N.T. 1997. Pesticides and the Environment: A Comparative Study of Farmer Awareness and Behavior in Andhra Pradesh, Punjab and Gujarat. *Indian Journal of Agricultural Economics*, 52(3): 519-529.
- Gogoi, S. K. and Gogoi, D. K. 1989. Adoption of Recommended Plant Protection Practices in Rice. *Indian Journal of Extension Education*, XXV (1 &2): 26-29.
- Goode, C. V. 1945. Dictionary of Education. New York: Mcgrow Hill Company, Inc.

- Goode, W. J., and P. K. Hatt, 1952. *Methods in Social Research*. New York: McGraw-Hill Book Company, Inc.
- Hamid, M. A. 1995. Farmers' Awareness and Environmental Pollution Caused by the Use of Agro-chemicals in two selected villages of BAU Extension Centre. *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, BAU, Mymensingh.
- Hamid, M. A. 1997. Farmer's Awareness on Environmental Pollution: A study in Bangladesh. *Asia Pacific Journal of Rural Development*, VII (2): 107- 117.
- Hanif, M. A. 2000. Comparative Analysis between FFS and Non-FFS Farmers Regarding Environmental Awareness. *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University.
- Hoque, M. M. 1993. Adoption of Improved Practices in Sugarcane Cultivation by the Sugarcane Growers of Shripur Thana under Gazipur District. *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University.
- Hossain, M. M. 1999. Farmers Perception of the Effects of Agrochemicals on environment. *M.S. (Ag. Ext. Ed.) Thesis*. Department of Agricultural Extension Education. Bangladesh Agricultural University.
- Islam, M. M. 1993. Adoption of Improved Practices in Potato Cultivation by the Potato Farmers of Sonatola Union Under Bogra District. *M.Sc. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University.
- Juliana, C. S., R. Annamalai and Somasundaram, S. 1991. Adoption of Integrated Pest Management Practices. *Indian Journal of Extension Education*, XXVII (3&4): 23-27.
- Kashem, M. A. 1987. Small Farmers' Constraints to the Adoption of Modern Rice Technology. *The Bangladesh Development of Studies*, 15 (40): 18-30.
- Kashem, M. A. 2001. Farmers' Awareness on Environmental Degradation Caused by the Use of Modern Agricultural Technologies. *M.Sc. (Ag.Ext.Ed.) Thesis*,

Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.

- Khan, A. H. 1993. Adoption of Insecticides and Related Issues in the Villages of Pachar Union, Madaripur District. M.Sc. (Ag.Ext.Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Khan, M. A. 2006. Attitude of Farmers toward Chemical Fertilizers. *M.Sc. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- MoYS. 2012. The Population Category in Bangladesh. Ministry of Youth and Sports, Government of the People's Republic of Bangladesh.
- Muhammad, A. 1994. A Study on the Farmers' Adoption of Insect Control Measures and Related Aspects. *M.Sc. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh.
- Muttalab, M. A. 1995. Relationships of Selected Characteristics Potato Farmers with their Adoption of Improved Potato Technologies, *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Okoro, F. U. and L. U. Obibuaka, 1992. Factors influencing the Adoption of Improved Oil Palm Management Practices among Small Holder in IMO State, Nigeria. *Bangladesh Journal of Extension Education*, 7(1&2): 45-52.
- Parveen, S. 1995. Awareness of Farm Women on Environmental Degradation due to the Use of Some Selected Modern Agricultural Technologies. *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Poddar, K. K. 2015. Effects of Climate Change on Rural Farmers Livelihood. *M.S. (Ag. Ext. & Info. Syst) Thesis*, Department of Agricultural Extension and Information System, Sher-e-Bangla Agricultural University, Dhaka.

- Rahman, M. M. 1993. An Investigation into the Factors Related to Adoption of Improved Farm Practices in Transplanted Aman Cultivation in Two Villages of Mymensingh District *M.Sc. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh.
- Reza, A. A. 2007. Impact of Information and Communication Technologies (ICTs) use as perceived by the farmers of Bangladesh. MS thesis. Sher-e Bangla Agricultural University, Dhaka.
- Sarkar, R. C. 1999. Farmers' Perception Regarding Environmental Degradation due to the Use of Agro-chemicals. *MS. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Shanto, H. H. 2011. Awareness of the Farmers' on Environmental Pollution due to Use of Pesticides in Vegetable Cultivation. *M.S. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, BAU, Mymensingh.
- Singh, P. K. 1991. Extent of Adoption of Selected Recommended Practices by Kinnow Growers of Ferozepur and Faridkot Districts of Punjab. *Thesis Abstract*, Directorate of Publication, Haiyana Agricultural University, India, XVII (3): 209-210.
- Sutradhar, N. C. 2002. Farmers' Awareness on Environmental Degradation Caused by the Use of Modern Agricultural Technologies. *MS. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- Thomas, J. K., Ladewin, H. and Alex, W. 1990. The Adoption of Integrated Pest Management Practices among Texas Cotton Growers. *Rural Sociology*, 55(3): 395-410.
- Wahhab, A. M. F. 1990. Attitude of Farmers towards the Use of Fertilizers *M.Sc. (Ag.Ext.Ed.) Thesis*, Department of Agricultural Extension and Teachers' Training, Bangladesh Agricultural University, Mymensingh.

APPENDIX-A

(English Version of the Interview Schedule)

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dliaka-1207

Interview schedule of the study on

“FARMERS’ AWARENESS ON ENVIRONMENTAL POLLUTION DUE TO EXCESS USE OF PESTICIDES IN WINTER VEGETABLE CULTIVATION”

(Please answer the following questions)

Sample No:

Name of the respondents:

Village:

Union:

Upazila:

District:

1. Age: What is your present age? Years.

2. Education: Please mention your educational qualifications

a) I cannot read and write

b) I can sign only

c) I can't read in school but read in another institution and my educational qualification class

d) I have studied up to class.....

3. Family size: Please mention your total number of family members.

a) Male

b) Female

c) Total

4. Farm size

Please mention your farm size

Sl. No.	Types of land ownership	Area of land		Total Area (Hectare)
		Local unit	Hectare	
1	Homestead area (Including pond) (A)			
2	Own land under own cultivation (B)			
3	Land given to others as borga (C)			

4	Land taken from others as borga (D)			
5	Land taken from others as lease (E)			
Total=A+B+1/2(C+D)+E				

5. Annual family income

Mention your annual family income from the following sources

Income sources		Income in '000' Tk.
A.	Agricultural sources	
	1)Crop	
	2)Livestock	
	3)Poultry	
	4)Fisheries	
B.	Non-Agricultural sources	
	i) Business	
	ii) Job	
	iii) Laborer	
	iv) Others	
Total Income		

6. Farming experience: Please state the duration of your direct involvement in vegetable farming.years

7. Cosmo politeness: Please indicate the frequency of visit outside of your village

SL. NO.	Name of information sources	Extent of visit				
		Regularly (4)	Frequently (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1.	Visit market or relatives or friends home outside your own village					
2.	Visit union parishad					
3.	Visit own upazila sadar					
4.	Visit own district sadar					
5.	Visit another upazila sadar					
6.	Visit another district sadar					

7.	Visit divisional head quarter					
8.	Visit Capital city					
	Total					

8. Training on winter vegetable cultivation:

Have you any training on vegetable cultivation?

1. Yes

2.No

If yes, then please mention the following information

SL.NO	Name of the training course	Concerned organization	Duration of training
1			
2			
3			
	Total		

9. Extension media contact:

Please mention the extent of your contact with the following source

Sl. No	Sources	Extent of contact				
		Regularly	Often	Occasionally	Rarely	Never
1	SAAO					
2	Pesticide dealer					
3	Union / upazila level agricultural organization					
4	Agricultural program through electronic media (radio/TV)					
5	Agricultural features in printing media (daily newspaper, leaflet, booklet, magazine etc.)					
6	NGO worker					
	Total					

10. Agricultural organizational participation:

Please mention the nature and duration of your participation with the following organization

SL. NO.	Duration/Nature of the participation (yrs)				
	Name of the organizations	No Participation (0)	Ordinary member (1)	Executive Committee Member (2)	President/secretary (3)
1	Farmers' cooperative association				
2	IPM club				
3	CIG				
	Total				

11. Farmers' awareness on environmental pollution due to excess use of pesticides in winter vegetable cultivation:

Sl. No	Statements	Extent of awareness			
		Strongly agree (3)	Agree (2)	Disagree (1)	Strongly Disagree (0)
1	Large amount of pesticide is responsible for degrading soil fertility				
2	Large amount of pesticide application is harmful for winter vegetable production				
3	Excess amount of pesticide application is harmful for environment				
4	Excess amount of pesticide application is harmful for birds, fishes, rats, hens and cows etc				
5	Direction of wind, pesticide should be sprayed				
6	Different types of minor vegetable diseases may be major due to excess application of pesticides				

7	Wash hands and machineries after spraying pesticide				
8	Caution should be taken using of pesticide				
9	Excess use of pesticides in winter vegetable cultivation increase production				
10	Use mask and hand gloves is suitable during spraying				
	Total				

Date.....
interviewer

Signature of the