FARMERS' KNOWLEDGE ON PESTICIDE APPLICATION IN VEGETABLE CULTIVATION

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CERTIFICATE

This is to certify that the thesis entitled **"FARMERS' KNOWLEDGE ON PESTICIDE APPLICATION IN 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 fulfillment of the requirements for the degree of Master of Science (M.S.) in Agricultural Extension, embodies the result of a piece of bona fide research work carried out by **Mst. Shekha Nasrin, Registration No. 15-07005** 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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Dedicatd
To
My Beloved
Parents

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ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
SAAO	Sub-Assistance Agriculture Officer
FAO	Food and Agriculture Organization
GDP	Gross Domestics Product
INFS	Institute of Nutrition and Food Safety
HRDP	Human Resources Development Program
US	United States
BER	Budget Execution Review
et al.	All others
etc.	et cetera, and the other
FFS	Farmer Field School
IPM	Integrated Pest Management
VEO	Village Executive Officer
CIG	Common Interest Group
SAU	Sher-e-Bangla Agricultural University

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ABSTRACT

The main objectives of this study were to assess the extent of farmers' knowledge on pesticide application in vegetable cultivation, to describe some selected characteristics of the farmers and to determine the influences of selected characteristics of the farmers to their knowledge on pesticide use. The study was conducted with randomly selected 109 farmers in Ganna union under Jhenaidah sadar upazila of Jhenaidah district. A pre-tested interview schedule was used to collect data from the respondents during 10th February to 13th March, 2018. Knowledge on pesticide application in vegetable cultivation was the dependent variable and the dependent variable was measured by 15 different questions on knowledge on pesticide application in vegetable cultivation and the nine selected characteristics of the respondents contributed the independent variables of the study. Majority (56.8 percent) of the respondents had medium knowledge while 23.9 percent and 19.3 percent of them had low and high knowledge respectively on pesticide application in vegetable cultivation. Three characteristics of the respondent's viz. education, training in vegetable cultivation and extension media contact had significant positive contribution to their knowledge on pesticide application in vegetable cultivation. But farm size, land under vegetable cultivation, income from vegetable cultivation, organizational participation and time spend in vegetable cultivation had no significant contribution to their knowledge on pesticide in vegetable cultivation.

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Bangladesh is basically an agricultural country. The economy of Bangladesh is largely dependent on agriculture. Sustained government investment in irrigation facilities, rural infrastructure, and agricultural research and extension services has helped Bangladeshi farmers achieve dramatic increases in agricultural production. The process of agricultural production is, however, underpinned by the increasing use of agrochemicals and multiple cropping. And while significant production transformation has been achieved and food production has more than doubled since independence in 1971, these have mostly supported the country‟s large population base rather than uplifting the living standards of the average citizen. Food security still remains a major development issue. Thus, the government of Bangladesh has called for a departure from "rice-led" growth to a more diversified production base that includes several non-rice crops (Hoque, 2000).

Although rice is the dominant crop, vegetable occupy a very important place in rice-based cropping systems and play a distinct role in the crop sub-sector to provide nutrition, enhance food security and uplift economic benefits to the producers. Vegetables are essential in diet, provide fiber, trace minerals, vitamins, carbohydrates and proteins. Vegetables help to prevent various diseases resulting from malnutrition and unbalanced nutrition.

Rice occupies about 77.46 percent of total cropped area and the remainder 22.54 percent of the total cropped area is occupied by other non-rice crops which include vegetables, pluses, oilseeds and spices and condiments (Table 1.2). Monoculture of rice for prolonged periods has led to a number of serious physical and biological problems as formation of plough plan in wet land cultivation, declining bearing power of soils, increasing incidence of pest and diseases and declining soil fertility resulting from sulpher and zinc deficiency, continuous rice cultivation has also nutritional impact i.e it reduces the production of pluses, oilseeds and vegetables which are major sources of protein, minerals and vitamins and it causes nutritional imbalance in human diet as well as in animal diet (Kaul and Rahman 1983).

Table 1.2 Areas irrigated under different crops in 2006

Crops		Area (ha)	Percent
Rice	Aus	1865000	12.50
	Aman	1162000	8.39
	Boro	9560000	69.07
Total rice cropped area		10722000	77.46
Wheat		855000	6.18
Potato		587000	4.24
Vegetables		584000	4.22
Sugarcane		95000	0.69
Cotton		11000	0.08
Others		9888000	7.14
Grand Total		13842000	100

(Sources: BBS, 2007)

Vegetables are the most important component of our food and are rich in vitamins, minerals and fibers essential for human health. A number of vegetables are considered as protective food items which prevent many disease and ailments like, dislipidemea, cardiac disease, diabetes and constipation. Vegetables can be grown round the year utilizing homestead lands which yield high economic return and help in employment and income generation.

Vegetables are cultivated in 4.22 per cent of the total cultivatable land. Besides this, the premises of houses, tin sheds and roof tops are used for vegetable cultivation. Vegetable production has increased five times in the past 40 years. Bangladesh has scored 3rd in global vegetable production, next to China and India (FAO, 2017). The farmers are getting large amount of money from vegetable production which is changing their life (Hossain, 2017). In Bangladesh, vegetables are grown generally in summer and winter seasons. Among them, some vegetables are grown round the year. Most of the vegetables such as sweet gourd, white gourd, bitter gourd, snake gourd, cucumber etc. grown in summer season are indigenous in nature whereas maximum winter vegetables like cabbages, cauliflower, tomato, etc. are exotic in nature and some vegetables such as brinjal, amaranth, bottle gourd, bean, pointed gourd etc, are grown

in both of the seasons. But it is a matter of sorrow that the quality of vegetables intake is very negligible in Bangladesh. Nutrition survey of Bangladesh (INFS, 2013) reported that average intake meet only 80 percent of Calorie, 58 percent of Vitamin A, 50 percent of Riboflavin and 51 percent of Vitamin C requirements. The Production of vegetables in Bangladesh is not sufficient that per capita/day available is hardly 32 gm whereas the requirement is estimated to 220 gm. This gap is probably one of the main reasons for widespread malnutrition in the country. Recent studies have shown that Vitamin A is not only important to prevent blindness but also has effect on digestion of food, child morbidity and mortality. It is estimated that about 80 percent of the population suffers from Vitamin C deficiency (HRDP, 2013). Being a poor nation, it is difficult to overcome such a big malnutrition problem by eating fish, meat, egg, butter, ghee. But vegetables can play a very important role to improve the nutritional level of the rural people in the country which is almost entirely overlooked. In other words, problems related to malnutrition can easily be overcome by eating adequate quantity of vegetables, which require some adjustment in the dietary habit and also by increasing per yield of vegetable (Mahasin, 1996).

The above mentioned discussion simply indicates the importance of vegetable in our daily life from nutritional point of view. From the economic point of view, vegetables should be cultivated for higher farm income, increasing cropping intensity, improvement of socio-economic condition and protection of environmental pollution, development of healthy and efficient manpower; higher export potentials, reducing import and enhancement of industrialization, employment generation, and less consumption of cereals, which leads to overcome food shortage. According to Agricultural Marketing Department, Bangladesh earned Tk. 31 core by exporting 8 thousand tons of vegetable (Mahasin, 1996).

In Bangladesh, millions of farmers earn their living by growing vegetable crops almost throughout the year. To protect the crops from pest damages the farmers incur more than 30% of the cultivation costs to purchasing pesticides only (Karim, 2011). Vegetable farmers, particularly smallholders, confront a number of constraints in the vegetable production. The production risks are high primarily because of considerable production losses caused by pests. These are estimated to be about 30% of the total vegetable output (KAUSHIK, 2009). There are several pests that attack vegetables such

Leaf miner, Aphids, Thrips, Cutworms Armyworms Cabbage looper Beetles Earworms and hornworms Green vegetable bugs Spider mites Stem borers Root-knot nematodes etc (Fores, 2017).

To control pests farmers use high amount of pesticide on vegetable. There are many other negative consequences of using higher doses of pesticides. Most devastating ecological imbalance is caused due to indiscriminate use of pesticides. Pesticides affect fishes, living in the river tank, pond, etc. It is proven that dangerous pesticides are present at an unacceptable level in the fishes of the Bay of Bengal which is too much harmful for human health. Fishes alone contributed to an unacceptable level of insecticides among Bangladeshi people which is five times more than their American counterpart (Sarker1993). Excessive use of chemical fertilizer and pesticide also reduce water conservation capacity of soil (Khaleque, 1993 and Rezauddin, 1994). Pesticide population and fertilizer wastes also caused microbial degradation in soil (Garg et al, 1994).

Since the farmers are the ultimate users of pesticides it is necessary to know their knowledge about pesticide use. Over dose and frequent use of pesticide may be a threat for agro-ecology as well as human body. The farmers of Bangladesh do not use of pesticide judiciously, which may pose a serious threat of the environment. Therefore, there is a need to conduct a research to determine farmers‟ knowledge on pesticide use in vegetable cultivation.

1.2 Statement of the Problem

Pesticides are used to kill the pests and insects which attack on crops and harm them. Different kinds of pesticides have been used for crop protection for centuries. Pesticides benefit the crops protection, however, they also impose a serious negative impact on the environment. Excessive use of pesticides may lead to the destruction of biodiversity. Many birds, aquatic organisms and animals are under the threat of harmful pesticides for their survival. Pesticides are a concern for sustainability of environment and global stability (Hakeem *et al*, 2016). Consumers should consider going to organic because pesticide on foods are far more dangerous than was thought to the human brain (Donnelly, 2017).

Vegetables are the most important ingredients of human diet for the maintenance of good health and prevention of diseases. Cultivation of vegetables is an excellent source of employment for both rural and urban dwellers. As vegetables are generally susceptible to a wide range of pests and diseases, these are major constraints to vegetable production and require intensive effort in their management. The increased demand for food, particularly to feed the growing population, has necessitated an expansion and intensification of agriculture and horticulture and a concomitant increase in the use of synthetic pesticides for food production, particularly for the production of high-value cash crops and vegetables. However, these pesticides are often applied indiscriminately and inappropriately, resulting in adverse environment and health effects, and negative effects on other economic activities such as fisheries and tourism.

Repeated application increases pest resistance, while its effects on other species can facilitate the pest's resurgence. Also, the target pest‟s natural predators are frequently killed off when pesticides are used. It is clear that pesticides have serious effect on ecosystem. Non judicious use of pesticides damage natural resources like land, fishes, beneficial insects, soil, microbes etc. In this regard, sustainable farming system is a prime consideration which encompasses soil and crop productivity, economics and environment. Sustainable agriculture is the integration of agricultural management technology to produce quality food and fiber while maintaining or increasing soil productivity, farm productivity and environmental quality. Goals of achieving success in sustainable agriculture will not be possible if the millions of farmers do not perceive the consequences of the use of pesticides in proper perspectives and behave accordingly.

Thus, the present study intends to investigate the knowledge on doses, frequency and precautionary measures of pesticide use in vegetable cultivation. Analyzing the issues from the farmers' perspectives, the study was specially designed to find out the answers of the following research questions:

1. What are the characteristics of the vegetables farmers?
2. What is the extent of knowledge of farmers on doses, frequency and precautionary measures of pesticide application in vegetable cultivation?
3. What are the contributions of between the selected characteristics of the farmers to their knowledge on pesticide use?

1.3 Specific Objectives

The following objectives were framed out in order to give an appropriate track to the research work.

1. To describe some selected characteristics of the farmers:
    a. Education
    b. Farm size
    c. Land under vegetable cultivation
    d. Off-farm income
    e. Income from vegetable cultivation
    f. Training on vegetable cultivation
    g. Extension media contact
    h. Organizational participation
    i. Time spend in vegetable cultivation
2. To assess the extent of farmers knowledge on pesticide application in vegetable cultivation.
3. To determine the factors that significantly influences farmers knowledge on pesticide use in vegetable cultivation.

1.4 Justification of the Study

Most of the people of Bangladesh live in the villages and they are directly or indirectly involved in agriculture. They are closely related with modern agricultural technologies. In one side use of pesticide controls the pest and thus increases the yield but in other side it affects adversely the whole environment.

In Bangladesh many government and non-government organizations are working in the fields of agriculture and rural development. Sustainable agricultural growth and protection of environment are the issues of high priority to day. The findings of this research will be useful to those who are concerned with planning, implementation and evaluation of agricultural, rural development and environmental protection programs. The knowledge and skills gained by the researcher in conducting this research will help to conduct similar other studies in the future. Various agro-chemical companies and farms can also make use of the findings of this research in determining policies and practices for the marketing of their products.

1.5 Scope of the Study

The present study was designed to have an understanding of use of pesticide in vegetable cultivation by the farmers and to explore its relationship with their selected characteristics. Particularly, the finding of the study will be pertinent to Ganna Union, Sadar upazila under Jhenaidah district. Nevertheless, the findings may also be applicable to other areas of Bangladesh where socio-cultural, economical and the psychological condition do not differ much than those of the study area. The findings of the study will be helpful to the extension workers and planners for preparation of programmers for rapid diffusion of optimum use of pesticide in vegetable cultivation among the farmers. At last, it is assumed that the recommendation of the study will be helpful in formulating extension policy makers to improve their technique and strategy of action.

1.6 Assumptions of the Study

The following assumptions (Goode, 1945) have been taken into consideration for the present following study. The respondents were involved in furnishing proper responses of the questions contained in the interview schedule.

1. Views and opinions furnished by the respondents were representative of the whole population of the study.
2. The respondents gave accurate and current information.
3. The interviewers were able to rate the responses of the farmers with adequate precision.
4. The data collected by the researcher were free from bias and they were normally distributed.
5. The respondents selected for the study were component to satisfy the queries of the researcher.
6. The information sought by the researcher was to satisfy the objectives of the study.

1.7 Limitation of the Study

The present study has been conducted with some sorts of limitations. The limitations of this study are as follows:

1. Data collected from the farmers were furnished by them from their memory during interview.
2. The study was conducted at only selected village under Jhenaidah district.
3. For information about the study the researcher was dependent on the data furnished by the randomly selected respondents during interview with them.
4. The respondents selected for data collection were kept limited within the farmers. Only farmers were considered as respondents of the study.
5. Usually the respondents do not keep records of annual/ daily accounts of their data and the researcher had to rely on memory of the respondents.

1.8 Definition of the Important Terms

A number of terms, concepts and variables have been used throughout the study with specific meaning. In order to avoid the undesired confusions of the meaning, these are defined and interpreted as follows:

Respondents: A person who replies to something, especially one supplying information for a questionnaire or responding to an advertisement. In this study the respondents were the village level vegetable farmers.

Education: Education referred to the ability of the respondents to read and write or having formal education received up to a certain standard. Education was measured on the basis of class a farmer had passed from formal education institution.

Farm size: Farm size referred to the cultivated area either owned by the farmer or obtained from other on borga 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.

Pesticide: Pesticides are substances that are meant to control pests or weed. The term pesticide includes all of the following: herbicide, insecticide, insect growth regulator, nematicide, termiticide, molluscicide, piscicide, avicide, rodenticide, predacide, bactericide, insect repellent, animal repellent, antimicrobial, fungicide, disinfectant (antimicrobial), and sanitizer.

Dose: The measured quantity of a therapeutic agent to be taken at one time.

Frequency: The rate at which something occurs or is repeated over a particular period of time or in a given sample.

Application: An act of putting something to use. Such as- application of new techniques.

Vegetable: a usually herbaceous plant (such as the cabbage, bean, or potato) grown for an edible part that is usually eaten as part of a meal; also: such an edible part.

Vegetable cultivation: Vegetable cultivation includes the different steps of vegetable production, harvesting, processing, conservation and marketing of vegetables.

Extension media contact: Extension media contact referred to one's becoming accessible to the influence of extension contact through different extension teaching methods or refers to the individual exposure to Contact with information sources.

Knowledge: Knowledge is operationally defined for the purpose of this investigation as those behaviors and test situations, which emphasized the remembering either by recognition or recall of ideas, material or phenomenon.

Farmer: Farmer means the principal decision maker involved in the management of a farm, not always be the head of the farm-household (Khan, 2004).

Agriculture: Agriculture is the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products.

Objectives: Objectives are concrete attainments that can be achieved by following a certain number of steps.

Hypotheses: Hypotheses as defined by Goode and Halt (1952) a hypothesis is "a proposition which can be put to test to determine its validity. It may seem contrary to, or in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test." Assumption is a supposition accepted as true to the investigator to be reasonable in the light of available evidence.

Insecticide: Insecticide is a type of chemical used to kill insects, like those that have infested a house or a farmer‟s crops.

Precautionary measures: Precautionary measure is an action taken to prevent something unwanted taking place.

CHAPTER II

REVIEW OF LITERATURE

This chapter is a review of past studies having relevance to the research problem. The investigator extensively went through the literature from various sources, which enriched his knowledge for clear understanding. The review of literature collected for the present study has been presented in the following four sections:

First section: Vegetable farming in Bangladesh

Second section: Farmers knowledge in crop production

Third section: Relationship between selected characteristics and farmer knowledge

Fourth section: The Conceptual framework of the study

2.1 Vegetable Farming in Bangladesh

Vegetables can be identified as a significant one for this economy for its noteworthy contribution in raising the foreign exchange earnings and occupies an important position among the items exported from Bangladesh. Vegetables contribute 3.2% of the agricultural Gross Domestic Product (BBS, 2009). Bangladesh earned US $ 41.11 million from export of agricultural products in 2003-2004, which contributed 0.54% to total export earnings (BER, 2008**).**

Farmers who are engaged in the production of vegetables often earn higher incomes than those engaged in the production of cereal crops alone (Weinberger and Lumpkin, 2005).

Vegetables like egg plant, radish, cabbage, cauliflower, and pumpkin gave returns at least three times higher than rice (Ateng, 1998). In addition, the economic returns in terms of domestic resource cost at export parity also indicate that there is a comparative advantage in the production of vegetables in Bangladesh (Shahabuddin and Dorosh, 2002).

Present situation of vegetable production show that, the country producing 8.75 lakh metric tons of vegetable, from 1.79 lac hectares of land against the total cultivable land of 9.17 million hectares (BBS, 2013). To supply the minimum daily requirement (220g/person/day) of vegetables for the population, the production should be 11.24

million tons. Nutrition survey of Bangladesh (INFS, 2013) reported that average intake of vegetables meet only 80 percent of Calorie, 58 percent of Vitamin A, 50 percent of Riboflavin and 51 percent of Vitamin C requirements.

The production of vegetables in Bangladesh is so low that per capita/day available is hardly 32 gm whereas the requirement is estimated to 220 gm. This gap is probably one of the main reasons for widespread malnutrition in the country. It is estimated that about 80 percent of the population suffers from Vitamin C deficiency (HRDP, 2013).

Being a poor nation, it is difficult to overcome such a big malnutrition problem by eating fish, meat, egg, butter, ghee. However, vegetables can play a very important role to improve the nutritional level of the rural people in the country which is almost entirely overlooked. In other words, problems related to malnutrition can easily be overcome by eating adequate quantity of vegetables, which require some adjustment in the dietary habit and also by increasing per yield of vegetable (Mahasin, 1996).

According to FAO (2017), vegetable production has increased five times in the past 40 years. Bangladesh has scored 3rd in global vegetable production, next to China and India. The land under vegetable cultivation in the country has increased at the rate of 5.0 per cent in the last decade. The rate of increase of vegetable production was 6.0 per cent in the last three years. Land under vegetable cultivation during the current Rabi season has been set at 528 thousand hectares

Many developing countries like Bangladesh can be benefited from the green revolution in cereal production in the past but were not able to substantially reduce poverty and malnutrition. Vegetable production can help farmers to generate income which eventually alleviate poverty. Among the vegetables tomato is one of the most important vegetables in terms of acreage, production, yield, commercial use and consumption. According to BBS (2005) about 6.10% area is under tomato cultivation both in winter and summer. It is the most consumable vegetable crop after potato and sweet potato occupying the top of the list of canned vegetable (Chowdhury, 1979).

Mou (2015) studied on the adoption of improved vegetable cultivation practices by the farmers in selected areas of shajahanpur upazila under bogra district and found that majority (50.00 percent) of the farmers had low adoption while 40.20 percent had

medium adoption and 9.80 percent had high adoption of improved practices in vegetable cultivation.

2.2 Farmers' Knowledge in Vegetable Cultivation

Knowledge recalls or recognizes information, ideas and principles in the approximate form, which were learned previously (Huitt, W. 2004). Bhuiyan (2012) indicated that "knowledge may be defined as the scientific fact of an idea which is experimentally or empirically verified."

Boudreau (1995) indicated "human faculty resulting from interpreted information; understanding that germinates from combination of data, information, experience, and individual interpretation. Variously defined as, Things that are held to be true in a given context and that drive us to action if there were no impediments."

Khan (2005) studied on knowledge of maize cultivation and found that majority (68 percent) of the farmers had relatively low level of knowledge and 32 percent of the farmers possessed relatively high level of knowledge.

Rahman (2004) found in his study that the highest proportion (62.22 percent) of the respondents had medium knowledge compared to 25.56 percent having low knowledge and only 12.22 percent had high knowledge on HYV boro rice cultivation practices.

Hussen (2001) found in his study on farmers‟ knowledge and adoption of modern sugarcane cultivation practices found that highest proportion (84 percent) of the farmers possessed medium knowledge, 13 percent high knowledge and lowest proportion (3 percent) possessed low knowledge.

Hossain‟s study (2000) on farmers‟ knowledge and perception of Binadhan-6. His study at 4 selected upazilas of Sherpur distinct reported that majority of the farmers (62%) had medium knowledge while, 21% had low knowledge and the rest 14% possessed high knowledge on Binadhan-6.

Saha (2001) made an attempt on farmers‟ knowledge on improved practices of pineapple cultivation and found that the majority (62 percent) of the farmers possessed good knowledge, 33 percent poor knowledge and only 5 percent possessed excellent knowledge.

Khan (1996) conducted a research on the effectiveness of a farmer primers‟ on growing rice in knowledge change of the farmers in Shaktipur Thana and found that 67 percent farmers had good knowledge at initial stage, where 21 percent had excellent knowledge and 12 percent had poor knowledge.

Nurzaman (2000) conducted a study on knowledge, attitude and practices of FFS and non-FFS farmers in respect of IPM. His study at sadar upazilla under Mymensingh district revealed that the FFS farmers had a significant higher knowledge on IPM than the non-FFS farmers.

Parveen (1995) in her study found that 58 percent of the farm women had moderate knowledge while 35 percent had high and 7 percent had poor knowledge on the use of fertilizer, pesticides and irrigation water.

Rashid (1998) reported that the total value of vegetables produced in Bangladesh is around Tk. 19400 million, calculated at average retail price. About 70% of the vegetables pass through the marketing channels. If the spoilage is 10%, the loss comes to Tk. 1,462 millions. These losses are due to inadequate knowledge on harvesting, carrying, packaging, transport and storage techniques. In the vegetable marketing channels, traders suffer maximum losses, because they handle and transport more quantities from one place to another than any other intermediaries.

Islam (2007) studied on famers‟ knowledge on ecological practices and found that majority (68 percent) of the farmers possessed medium knowledge compared to 23 percent had high knowledge and only 9 percent low knowledge on ecological agriculture.

Hossain (2001) found in his study on knowledge gained by the participation farmers under crop cultivation programme of care in a selected area of Mymensingh district that majority of the farmers (35 percent) had medium knowledge of crop cultivation, while 32 percent had low knowledge and the rest 33 percent possessed high knowledge of crop cultivation.

2.3 Relationship between Selected Characteristics and Farmers' Knowledge

2.3.1 Education and farmers' knowledge

Roy (2005) in his study found that education level of the farmers had significant and positive relationship with their knowledge on boro rice cultivation.

Rahman (2006) observed in his study that education level of the farmers had significant and positive relationship with their knowledge on prawn culture.

Banerjee (1976) have reported there was a positive relationship between education and knowledge of the farmers on agricultural technology.

Haque (2005) revealed that education of the farmers had a significant and positive relationship with their adoption of modem rice varieties.

Akhter (2003) found in his study that level of education of the farmers had a significant and positive relationship with their knowledge on agricultural activities.

Ali et al. (1986) in their study found that education had highly significant and positive relation with adoption of improved sugarcane production technologies.

Hossain (1991) in his study found a significant and positive relationship of education of the wheat growers with their adoption of improved farm practices.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practices in five villages of Comilla district. He found that education of potato growers had significant relationship with their adoption of improved potato cultivation practices.

Baodgaonkar (1983) and reported in his studies that farmers‟ education was significantly related with their knowledge on adoption Behavior of Groundnut Cultivators.

Islam (2005) in his study explored that education level of the farmers had significant positive relationship with their knowledge on IPM in crop production.

Rahman (2004) in a study found that level of education of the farmers had significant and positive relationship with their knowledge on boro rice cultivation.

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

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

Islam (1993) found that the general education of the Sub Assistant Agriculture Officer had no significant relationship with their knowledge on modern agricultural technologies.

Hossain (2003) found that education of the farmers had significant relationship with modern Boro rice cultivation.

Huda (2001) reported that of education level of the farmers have motivated them to dry the seed and keep in sealed container to keep the moisture low.

Amin (2001) found that education of PETRRA and non-PETRRA beneficiaries had positive significant relationship with their knowledge on organic cocoon and skills on production and storing of rice seeds.

Alam (1997) observed that the level of education of the farmers had a positive and significant relationship with the use of improve farm practices.

Saha (2003), Sana (2003), Sarker (2002), Saha (2001), Hossain (2000) found that education of the farmers was positively and significantly related with their knowledge in their research work.

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

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

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

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

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

Haider (2005) found that there had significant relationship between education of respondents with their knowledge.

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

Farhad (2003) found in his study that the education of the respondents had significant and positive relationship with their knowledge in using IPM in vegetable cultivation.

Nurzaman *et al*. (2001) found that education had a positive significant relationship with IPM knowledge, attitude towards IPM and practice IPM.

Rathore and Shakawat (1990) reported in their studies that farmers‟ education was significantly related with their knowledge on agricultural innovations of Hybrid bajra cultivation.

Kashem (1987) in his study revealed that there was no significant relationship between education of the farmers and their agricultural knowledge on adoption of modern rice technology.

Sharma and Sonoria (1983) found no significant differences of education between that contact and non-contact farmers. But they found significant differences in knowledge of both contact and non-contact farmers with their education. However, adoption of innovations varied significantly with the education in case of non-contact farmers only.

Huda et al. (1992) found that farmers with education and without education had same level of moisture of their seed.

2.3.2 Farm size and farmers' knowledge

Islam (2005) in his study explored that farm size of the farmers‟ had significant positive relationship with their knowledge on IPM in crop production.

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.

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

Rahman (2006) examined in his study that farm size of the farmers had a significant relationship with knowledge on prawn culture.

Islam (1993) in his study found that farm size had a significant positive relationship with adoption of improved practices.

Chowdhury (1997) conducted a research study on adoption of selected BINA technologies by the farmers. He indicated that farm size had strongly positive significant relationship with the adoption of selected BINA technologies. Rahman (1986), Hoque (1993) and Sarkar (1997) observed similar findings.

Alam (1997) studied the use of improved farm practices in rice cultivation by the farmers. The findings of the study showed that the farm size had a significant relationship with their use of improved farm practices in rice cultivation. Hossain (1981) and Mustafi *et al*. (1987) also reported the similar findings.

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

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

Haque (2005) conducted a study to determine the relationship of farmers' characteristics with their adoption of modern rice varieties in Sadar upazila of Mymensing district. He reported that farm size of the rice growers had significant and positive relationship with the adoption of modem rice varieties.

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

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

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

Khan (2005) determined that farm size of the respondent had no significant relationship with their knowledge on maize cultivation.

Hamid (1995) found that area under cultivation of farmers had had no relationship with the awareness on environmental pollution.

Hamid (1997) found that area under cultivation of farmers had no relationship with the awareness on environmental pollution.

Hossain (2000) found that farm size of the farmers had no relationship with their knowledge on Binadhan-6.

2.3.3 Land under vegetable cultivation and farmers' knowledge

Islam (2008) found that vegetable cultivation area had a positive and substantial significant relationship with knowledge on vegetables production activities by woman members in homestead area under world vision project.

Ali (1984) observed that farm size of the contact and non-contact farmers had significant positive contribution to their agricultural knowledge.

Sharma and Sanoria (1983) found that no significant differences in knowledge of both the contact and non-contact farmers with their operational holding size.

2.3.4 Off-farm income and farmers' knowledge

No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.3.5 Income from vegetable cultivation and farmers' knowledge

Islam (2008) found that income from vegetable had a positive and substantial significant relationship with knowledge on vegetables production activities by woman members in homestead area under world vision project.

Nurzaman (2000) found that incomes of the rural women farmers had no relationships with their knowledge of the FFS and non-FFS farmers.

Alam (1997) observed a positive and significant relationship between annual income of the farmers and the use of improved farm practices in rice cultivation.

Chowdhury (1997) found significant positive relationship between annual income and adoption of selected BINA technologies. Rahn1an (1986), Okoro and Obiduaka (1992), Islam (1993), Khan (1993) and Sarkar (1997) observed that similar result.

Pal (1995) in his study found a positive significant relationship between income of the farmers and their adoption of recommended practices in sugarcane cultivation.

Islam (2002) conducted a study on adoption of modem agricultural technologies by the fanners of Sandwip. He observed that he annual income of the farmers had no relationship with their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of in targeted homestead farming technologies by the rural women in RDRS. He found that there was a positive significant relationship between annual income of the respondent and their adoption of integrated homestead farming technologies.

Islam (2003) in his study found that there was a positive and significant relationship between family income of the farmers and adoption of organic manures.

Hossain (2003) revealed that annual income of the farmers had a significant relationship with their adoption at modern Boro rice cultivation practices

Rahman (2003) conducted a study on environmental impacts of modern agricultural technology diffusion in Bangladesh: an analysis of farmers' perception and their

determinations. He found that annual income of the farmers had a positive relationship with their modem agricultural technologies diffusion in Bangladesh.

Hoque (2005) conducted a study to determine the relationship of farmers' characteristics with their adoption or modem rice varieties in Sadar upazila of Mymensing district. Annual income of the rice growers had significant and positive relation with the adoption of modern rice varieties.

Ali and Anwar (1987) categorized farmers as low, medium and high on the basis of their problem confrontation score. Sixty one percent of the respondents were under medium problem confrontation categories, 39 percent were under high problem confrontation categories and no respondent was under low problem sericulture, mushroom culture and fruit preservation might generate extra employment opportunities for the farm women specially female rural youth and gradually they will proceed to these operations.

2.3.6 Training on vegetable cultivation and farmers' knowledge

Islam (2008) found that training on vegetable cultivation had a positive and substantial significant relationship with knowledge on vegetables production activities by woman members in homestead area under world vision project.

Haque (2003) found that training received of the respondent had positive significant relationship with their practices in farmers‟ adoption of modern maize cultivation technologies.

Islam (2002) conducted a study on farmers' knowledge and adoption of ecological agricultural practices under the supervision of Proshika. He found that agricultural training exposure of the farmers had no significant relationship with their adoption of ecological agricultural practices.

Verma *et al.* (1989) found there was significant change in attitude of rural women from before training to after training in improved home making tasks. They said that due to gain in knowledge the attitude became more favorable.

Hossain (1981) showed that proper training raise the knowledge and skill level of participants significantly.

Sana (2003) found that training received of the farmers had a positive significant relationship with their knowledge in shrimp culture.

Hossain (2001) found that the length of the training of the respondents had positive relationship with their knowledge of crop cultivation.

Rayapareddy and Jayaramaish‟s (1989) working on Village Extension Officer‟s (VE06) knowledge on rice production technology revealed that training had significant positive relationship with the knowledge level of VEOs.

Mannan (2001) in his study found that the training received by the farmers had a positive significant relationship with their knowledge on food and nutrition

2.3.7 Extension media contact and farmers' knowledge

Ahmed (1974) found that here was a significant positive relationship between extension contact of the farmers and their agricultural knowledge.

Ali (1984) found that contact and non-contact farmers differed significantly in respect of their media exposure. He observed that media exposure of the contact and non-contact farmers had significant contribution towards their agricultural knowledge.

Kaur (1988) found that extension contact and mass media exposure had significant influence upon opinion and level of knowledge of selected programme of rural women.

Rahman‟s (1995) study on farmers‟ knowledge on improved practices of potato cultivation by the farmers of Kajipur upazilla of Sirajgonj district. The study indicated a significant relationship between extension contact of farmers and their knowledge on improved practices of potato cultivation.

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

Venugopal (1977) found that there was a significant association between the overall knowledge of agricultural extension officers in respect of rice cultivation and type of training received by them.

The findings of the study of Manjunatha (1980) revealed that the trained farmers had higher knowledge level and adopting behaviour compared to untrained farmers.

Sana (2003), Sarker (2002) and Rahman (2001) found in their study that media exposure of farmers were highly positive significant relationships with their knowledge.

Vidyashankar (1987) in his study fund that the contact with extension agencies had contribute favorably to the attitude of the farmers.

Bezbora (1980) studied adoption of improved agricultural technology by the farmers of Assam. The study indicated a positive relationship between extension contact and adoption of improved agricultural technology.

2.3.8 Organizational participation and farmers' knowledge

Ahmad (1974) concluded that there is a relationship between organizational participation of farmers and their agricultural knowledge.

Alam (1997) fond that organizational participation of the rice farmers had no significant relationship with their use of improved farm practices in rice cultivation.

Ali (1984) found that organizational participation of contact and non-contact farmers had significant positive contribution to their agricultural knowledge.

Hamid (1995) found a positive significant relationship between organizational participation of the farmers and their awareness on environmental pollution.

Hoque (1984) concluded that organizational participation of the farmers had a significant relationship with the adoption of improved practices in sugarcane cultivation.

Hossain (1991) reported that organizational participation had a significant and positive relation with the adoption of improved farm practices in wheat cultivation.

2.3.9 Time spending in vegetable cultivation and farmers' knowledge

No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.4 The Conceptual Framework of the Study

2.4 The Conceptual Framework of the Study

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

According to Rosenberg and Hovland (1960) the conceptual framework is kept in mind while framing the structural arrangement for the dependent and independent variables. This study was concerned with farmers‟ knowledge on pesticide use as dependent variable and selected characteristics of the farmers as independent variables.

In view of prime findings of review of literature, the researcher constructed a self-explanatory conceptual model of the study which is presented in Figure 2.1.

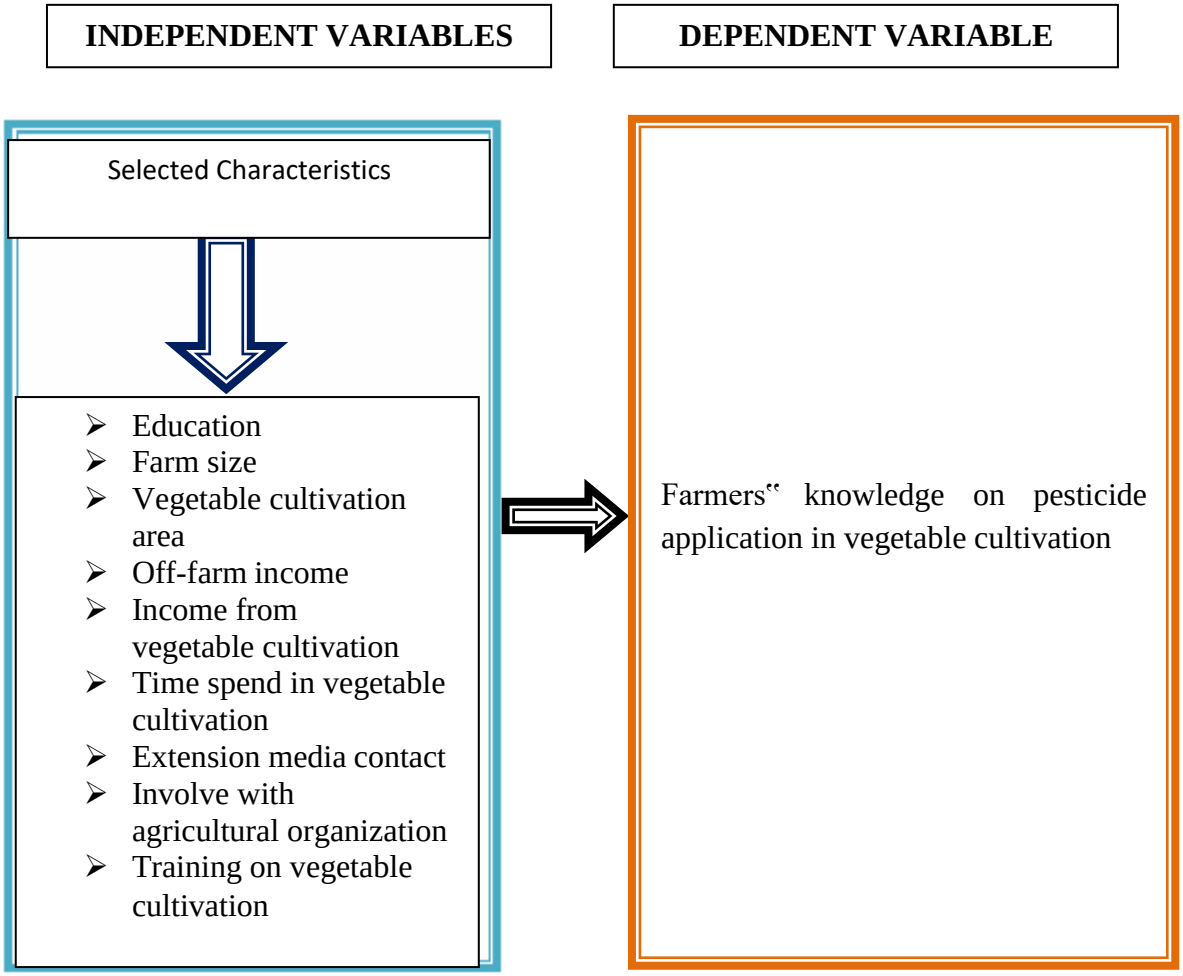

Figure 2.1 The conceptual framework of the study

CHAPTER III

METHODOLOGY

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

3.1 Locale of the Study

Jhenaidah District was purposively selected as the locale of the study. There are 6 upazilas in the district. Among those Jhenaidah Sadar upazila was selected purposively for this study. Jhenaidah is a district in southwestern Bangladesh. It is a part of the Khulna division. It is an area 1964.77 km². It is bordered by the Kushtia district to the north, to the south by Jessore district and West Bengal (India), to the east by Rajbari district and Magura district and to the west by Chuadanga district and West Bengal (India) on the west. The upazila consists of one municipality and 17 union parishads. Average literacy is 49.9 percent; male 53.4 percent, female 46.6 percent. Main sources of income are agriculture 34.57 percent, non-agricultural laborer 4.05 percent, industry 1.01 percent, commerce 19.18 percent, transport and communication 6.68 percent, service 16.54 percent, construction 4.03 percent, religious service 0.24 percent, rent and remittance 0.86 percent and others 12.84 percent. Ownership of agricultural landowner is 45.26 percent, landless 54.74 percent. Main crops are paddy, wheat, vegetables; extinct or nearly extinct crops are mustard, linseed, arahar. Main fruits are mango, jackfruit, banana, papaya, litchi, water-melon (Banglapedia, 2015). For further clarity about the locale of the study, a map of Jhenaidah district showing sadar upazila and another map of sadar upazila showing study area have been presented in Figures 3.1 and 3.2, respectively. However, Ganna union of sadar upazila was finally selected randomly for conducting the study. Four villages of Ganna union namely Kuthidurgapur, Chandipur, Kalohati and Asostholi were selected for the study.

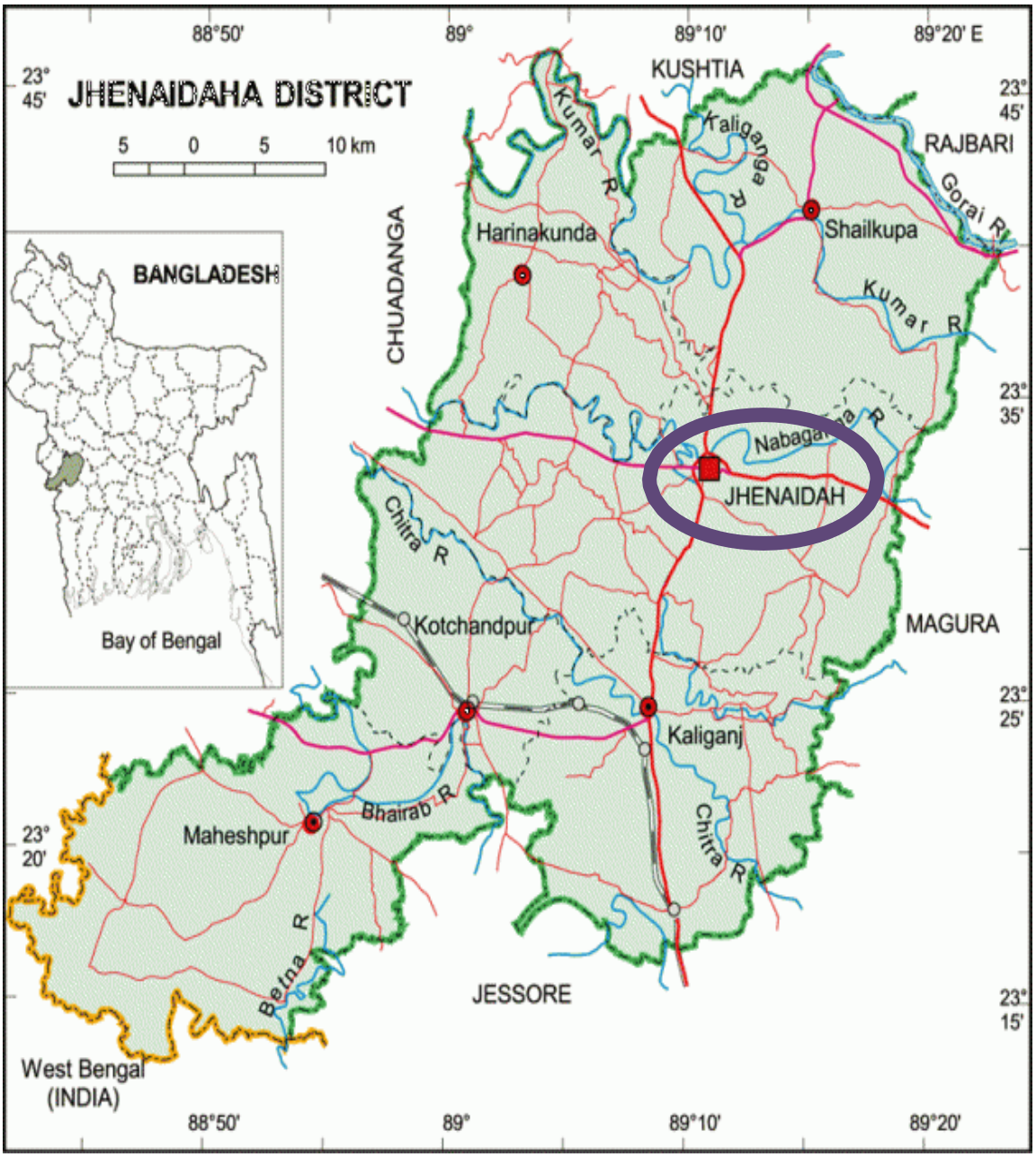

Figure 3.1 A map of Jhenaidah district showing Jhenaidah sadar upazilla

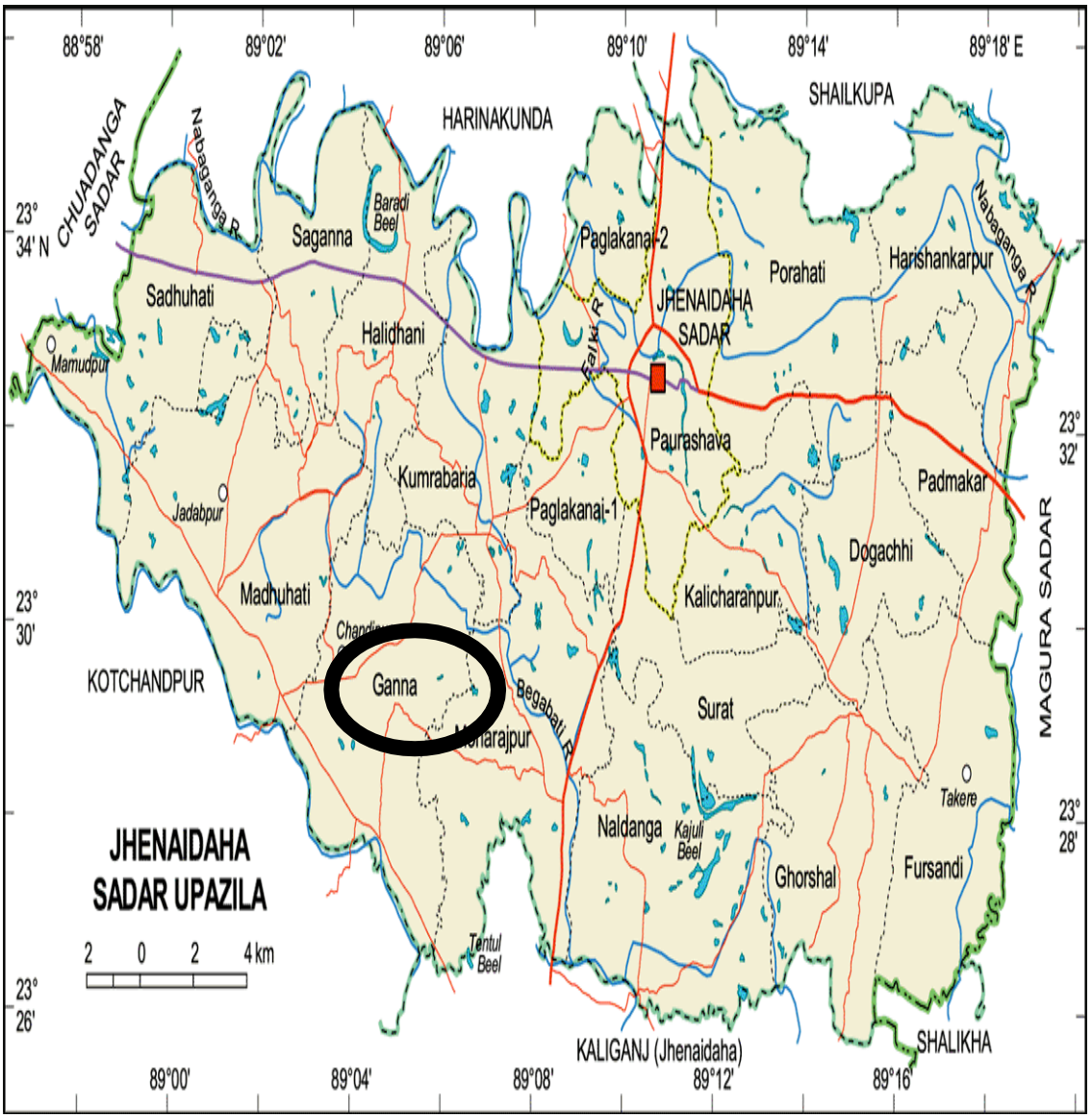

Figure 3.2 A map of Jhenaidah sadar upazila showing Ganna union

3.2 Population and Sampling

A list of vegetable growers of the study area was prepared by the researchers herself with the help of the Sub-Assistant Agriculture Officer (SAAO) of Jhenaidah Sadar upazila Agriculture Office. The list comprised a total 273 vegetable growers in the study area. These farmers constituted the population of this study. To make a respective sample 40 percent of the population was selected proportionately random sampling technique. Thus, one hundred nine (109) vegetable growers were selected as the sample of the study. The village-wise distribution of the population and sample of farmers are shown in Table 3.1. Besides this 10 percent of the samples were selected randomly as reserves who were supposed to be interviewed only when a respondent in the original sample list was unavailable during data collection.

Table 3.1 Distribution of the vegetables farmers constituting the population, sample and reserve list in different villagers in Ganna Union

Name of Villages	No. of farmers		Reserve List
	Population	Sample size	
Kuthidurgapur	80	32	3
Chandipur	60	24	2
Kalohati	75	30	3
Asostholi	58	23	2
Total	273	109	10

3.3 Instrument of Data Collection

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

Simple and direct questions and different scales were used to obtain information. Both open and closed form questions were designed to obtain information relating to qualitative variable which was finally be measured by ranking score.

The initially prepared interview schedule was pre-tested among 15 respondents of the study area. The pretest was helpful to find out gaps and to locate faulty questions and

statements. Alterations and adjustments were made in the schedule on the basis of experience of the pretest. English version of the interview schedule is shown in appendix-A. Questions were asked systematically and explanations were made whenever it is necessary. The respondents were interviewed at their leisure time so that they can give accurate information in a cool mind.

3.4 Data Collecting Procedure

Data were collected through personal interviewing by the researcher herself. The researcher made all possible efforts to establish rapport with the respondent so that they could feel ease and comfort to response the questions in the schedule. Necessary steps were taken to explain the purpose of the study to the respondents and their answers were recorded sincerely. If any respondent felt difficulty in understanding any question, care was taken to help him getting understood. The researcher did not face any serious problem in data collection. The data collection took 31 days from 10th February to 13th march, 2018. The collected data were complied, tabulated and analyzed. Qualitative data were converted into quantitative form by means of suitable scoring whenever needed.

3.5 Variables of the Study

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

3.6 Selection of Dependent and Independent Variables

Knowledge on pesticide application about doses, frequency and precautionary measures in vegetable cultivation farmers was considered as the dependent variable of the study.

For selection of independent variables the researcher went through the past related literature as far as available. She discussed with the researcher, experts in the relevant fields and research fellows in agricultural and related disciplines. She also carefully noticed the various characteristics of the farmers of the study. Availability of time, money and other resources were also kept in view in selected the variables. The researcher selected nine characteristics of the respondent as the independent variables. The characteristics includes education, farm size, land under vegetable cultivation, off-farm income, income from vegetable cultivation, training on vegetable cultivation, extension media contact, involve with agricultural organization and time spends in vegetable cultivation.

3.7 Measurement of Variable

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

3.7.1 Measurement of independent variables

The selected characteristics of the respondent farmers constituted the independent variables of the study. To keep the research within the manageable sphere, 9 independent variables were selected for the study. The procedures of measurement of the selected variables were as follows:

3.7.1.1 Level of education

Education was measured as the ability of an individual vegetable farmer to read and write or formal education (school/college) completed up to a certain standard. It was expressed in terms of year of schooling. A score of one (1) was assigned for each year of schooling completed. For example, if the respondent passed the SSC examination his education score was given as 10, if passed the final examination of class seven, his education score was given as 7, if the respondent did not know how to read and write, his education score was given as „0" (zero). A score of 0.5 (half) was given to that respondent who could signature his name only. This variable appears in item number 1 in the interview schedule as presented in Appendix-A.

3.7.1.2 Farm size

Farm land is the most important capital of a farmer and the farm size has influence on many personal characteristics of a farmer. Farm size of the farmer was measured by the land area possessed by him. Data obtained in response to questions under item No. 3 of

the interview schedule formed the basis for determining the farm size of the respondent. Here, farm size was computed by using the following formula:

Farm size = A1 + A2 + A3 + 1/2 (A4 + A5)

A1 = Homestead Area (A1)

A2 = Own land under own cultivation (A2)

A3 = Land taken from others on borga system (A3)

A4 = Land given to others on borga system (A4)

A5 = Land taken from others on lease (A5)

The unit of measurement was hectares.

The respondent farmers indicated their farm size in local unit. Finally, it was converted into hectare and was considered as the farm size of the respondents.

According to farm size of the respondents were categorized like land less (homestead area only), marginal (0.02-0.20 ha), small (0.20-1.00 ha), medium (1.00-2.5 ha) and large (3 ha and above) (BBS 2001). This variable appears in item number 2 in the interview schedule as presented in Appendix-A.

3.7.1.3 Land under vegetable cultivation

Area under vegetable cultivation was measured by the area of land under her management only for vegetable cultivation. The area was estimated in terms of full benefit to farmers or her family. The unit of measurement was in decimal. This variable appears in item number 3 in the interview schedule as presented in Appendix-A.

3.7.1.4 Off-farm income

Income from off-farm of the respondents was measured in thousand taka on the basis of total annual income from the other sources such as business, services etc. It was expressed in „000“ taka. This variable appears in item number 4 in the interview schedule as presented in Appendix-A.

3.7.1.5 Income from vegetables cultivation

Income from vegetable cultivation of the respondents was measured in thousand taka on the basis of total annual income from agricultural sources. This variable appears in item number 5 in the interview schedule as presented in Appendix-A.

3.7.1.6 Training on vegetable cultivation

Training received was measured by total number of days of agricultural training on vegetable production received by the respondents in his/her life. One score was assigned for each day of training received by the respondent. According to training received the respondents were categorized as no training, low training and medium training. This variable appears in item number 6 in the interview schedule as presented in Appendix-A.

3.7.1.7 Agricultural extension media contact

The agricultural extension media contact of a respondent was measured on the basis of the extent of his contact with selected seven media in a scale ranging from- regularly, frequently, occasionally, rarely, not at all. The responses were scored as 4, 3, 2, 1 and 0 respectively. The use of agricultural extension media contact score of the respondents ranged from 0 to 24 where, 0 indicates no use and 24 indicates very high use. Based on their extension media contact, the respondents were classified into three categories as low contact, medium contact, and high contact. This variable appears in item number 7 in the interview schedule as presented in Appendix-A.

3.7.1.8 Organizational participation

Organizational participation of a respondent was measured by computing an organizational participation score according to his/her nature and duration of participation in five (5) selected different organizations up to the time of interview. The organisational participation score was evaluated for each respondent on the basis of his/her membership with five different types of organisation. The following scale was used for computing the organisational participation score. The nature of participation was the respondent no participation, participation as ordinary member, participation as executive member and participation as secretary/president. The score was 0, 1, 2 and 3 respectively. Organisational participation score of a respondent was determined by adding together the scores obtained from each of the five types of participation. Organisational participation score of the respondents could range from 0 to 15, where, 0 indicating no participation and 15 indicating high participation. This variable appears in item number 8 in the interview schedule as presented in Appendix-A.

3.7.1.9 Time spends in vegetables farming

Time spend in vegetables farming by the vegetables growers was measured hours per week. This variable appears in item number 9 in the interview schedule as presented in Appendix-A.

3.7.2 Measurement of dependent variables

For measuring the knowledge on vegetables production activities of the respondents, 15 questions were included in the interview schedule. Each question contains 2 marks. The questions were asked based on three aspect of pesticide application which are frequency of pesticide application, doses of pesticide application and precautionary measures of pesticide application respectively in the scale in order to assess the knowledge on pesticide application. For correct answer respondents will be given full marks .If respondents are unable to provide the answer than he or she will get zero marks. Finally total marks of 15 questions are calculated and measure knowledge on vegetable production activities.

3.8 Statement of the Hypotheses

As defined by Goode and Hatt (1952) a hypothesis is "a proposition which can be put to test to determine its validity. It may seem contrary to, or in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test."

3.8.1 Research hypotheses

In the light of the objectives of the study and variables selected, the following research hypotheses were formulated to test them in. The research hypotheses were stated in positive form, the hypotheses were as follows: "Each of the selected characteristics of the farmers had contribution to their knowledge on pesticide application in vegetable cultivation".

3.8.2 Null hypotheses

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 contribution to their knowledge on pesticide application in vegetable cultivation".

3.9 Data Processing

3.9.1 Editing

The collected raw data were examined thoroughly to detect errors and omissions. As a matter of fact the researcher made a careful scrutiny of the completed interview schedule to make sure that necessary data were entered as complete as possible and well arranged to facilitate coding and tabulation. Very minor mistakes were detected by doing this, which were corrected promptly.

3.9.2 Coding and tabulation

Having consulted with the research supervisor and co-supervisor, the investigator prepared a detailed coding plan. In case of qualitative data, suitable scoring techniques were followed by putting proper weight age against each of the traits to transform the data into quantitative forms. These were then tabulated in accordance with the objective of the study.

3.9.3 Categorization of data

Following coding operation, the collected raw data as well as the respondents were classified into various categories to facilitate the description of the independent and dependent variables. These categories were developed for each of the variables by considering the nature of distribution of the data and extensive literature review. The procedures for categorization have been discussed while describing the variables under consideration in chapter four.

3.10 Statistical Analysis

The statistical measures such as range, mean, standard deviation, percentage, rank order were used for describing both the independent and dependent variables. Tables were also used in presenting data for clarity of understanding. Initially, multiple regressions (SPSS v 20) were run to determine the contribution to the selected characteristics of the vegetable farmers with their knowledge on pesticide application in vegetable cultivation. To find out the contribution of selected characteristics of the vegetable growers to their knowledge on pesticide application, step-wise multiple regressions was used. Five percent (0.05) level of probability was used as the basis for rejection of a null hypothesis throughout the study. Co-efficient values significant at 0.05 level is indicated by one asterisk (*), and that at 0.01 level by two asterisks (**).

CHAPTER IV

FINDINGS AND DISCUSSION

In this chapter the findings of this study are presented Results have been discussed in relation to the present findings and also to those found in other studies. The study investigated the farmer‟s knowledge on pesticide application in vegetable cultivation. In accordance with the objectives of the study, presentation of the findings has been made in three sections of this chapter.

Section 1: Selected characteristics of the farmers

Section 2: Knowledge on pesticide application in vegetable cultivation

Section 3: Contribution with the selected characteristics of the farmers and their knowledge on pesticide application in vegetable cultivation

4.1 Selected Characteristics of the Farmers

Nine characteristics of the farmers were selected for this research. The characteristics include: education, farm size, land under vegetable cultivation, off-farm income, income from vegetable cultivation, training on vegetable cultivation, extension media contact, organizational participation and time spends in vegetables farming. Some descriptive statistics of these features are given in Table 4.1

Data contained in the Table 4.1 reveal the salient features of the characteristics of the vegetable farmers in order to have an overall picture of these characteristics at a glance. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

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

SL. NO.	Categories	Measuring Unit	Rang		Mean	SD
			possible	observed		
1	Level of education	Year of schooling	-	0-12.0	4.06	3.61
2	Farm size	Hectare	-	0.09-3.31	.73	.41
3	Land under vegetable cultivation	Decimals	-	34-79	44.77	11.52
4	Off-farm income	„000‟taka	-	23-90	52.77	15.33
5	Income from vegetable cultivation	„000‟taka	-	14-45	29.44	7.28
6	Training on vegetable cultivation	No of days	-	0-15	2.65	2.24
7	Extension media contact	Score	0-24	12-22	16.60	2.43
8	Organizational participation	Score	0-9	3-8	4.86	1.26
9	Time spends in vegetable cultivation	Hours of per week	-	24-39	31.06	3.93

4.1.1 Education

The level of education of the respondents ranged from 0-12. Here, the average educational score was 4.06 with a standard deviation of 3.61. On the basis of their education, the fanners were classified into four categories namely illiterate (0.0-.5), primary education (1-5), secondary education (6-10) and above secondary education (above 10). Distribution of the respondents according to their education has been shown in Table 4.2.

Table 4.2 Classification of the farmers according to their education

Categories	Level of Education	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Illiterate	0.0-.5	36	33.0	4.06	3.61
Primary education	1-5	38	34.8		
Secondary education	6-10	32	29.4		
Above secondary education	Above 10	8	2.8		
Total		109	100		

Data presented in the table 4.2 indicate that majority 34.8 percent of the farmers had primary education followed by 33 percent farmers were illiterate, 29.4 percent farmers were secondary educated and 2.8 percent were above secondary educated.

Education helps the farmers to face the adverse condition and adjust with unfavorable condition through reading leaflets, booklets, books and other printed materials in this case. The findings of this study, however, indicate that 34.8 percent of the farmers had primary education and they had low knowledge in adjusting with the unfavorable condition regarding in the vegetable cultivation. Such consideration indicates the need for improving literacy level among the farmers for adjusting the adverse condition in the vegetable cultivation.

4.1.2 Farm size

Farm size of the vegetable farmers was measured in terms of hectare. Farm size of the farmers ranged from 0.09 to 3.31 hectares, with a mean of 0.73 hectares and a standard deviation of 0.41 hectares. On the basis of their farm size, the respondents were classified into three categories which are small, medium and large. Distribution of the respondents according to their farm size has been shown in Table 4.3.

Table 4.3 Classification of farmers according to their farm size

Categories	Farm size in (ha)	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Small farm	Up to 1	87	79.8	0 .73	0.41
Medium farm	Above 1 to 3	16	14.7		
Large farm	Above 3	6	5.5		
Total		109	100		

Data presented in the Table 4.3 showed that the highest proportion of the vegetable farmers (79.8 percent) had small compared to 14.7 percent having medium farm and only 5.5 percent had large farm. The findings indicate that 94.5 percent of the vegetable farmers had small to medium farm size.

The findings indicated that most of the respondents had small household farm size. This is a general trend in Bangladesh that farm size of the people is being decreased day by day due to land fragmentation through generation to generation. In Bangladesh most of the farmers live on below a subsistence level and this is one of the vital reasons for not adopting improved farming practices in their farm as well as having lower knowledge on pesticide application.

4.1.3 Land under vegetables cultivation

Land under vegetable cultivation of the respondents ranged from 34 to 79 decimals with a mean of 44.77 and standard deviation of 11.52. On the basis of their vegetable cultivation area the respondents were classified into three categories. They are: small (up to 34), medium (35 to 55) and large (above 55). Distribution of the respondents according to their farm size has been shown in Table 4.4.

Table 4.4 Classification of the respondents according to their land under vegetables cultivation

Categories	Farm size in (de) (**Mean±SD)**	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Small land	Up to 34	20	18.3	44.77	11.52
Medium land	35 to 55	64	58.8		
Large land	Above 55	26	22.9		
Total		109	100		

Data presented in Table 4.4 indicate that 58.8 percent of the farmers have medium land under vegetable cultivation; while 18.3 percent farmers had small and 22.9 percent farmers had large land for vegetable cultivation. Data revealed that majority (82 percent) of the farmers had medium to large land for vegetable cultivation. Therefore, it could be said that the choice of vegetable production regarding the farming practices in the study area are expected to be considerably influenced by the large and medium land of the farmers.

4.1.4 Off-farm income

Off-farm income of the farmers ranged from 23 to 90 thousand taka. The mean was 52.77 and standard deviation was 15.33. On the basis of off-farm income, the respondents were categorized into three groups which are “low income” (up to 37), “medium income” (38-67) and “high income” (above 67). The distribution of the vegetable farmers according to their annual off-farm income is shown in Table 4.5.

Table 4.5 Classification of the respondents according to their off-farm income

Categories	Off-farm income („000 „ taka) **(Mean±SD)**	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Low income	Up to 37	19	17.4	52.77	15.33
Medium income	38-67	69	63.3		
High income	Above 67	21	19.3		
Total		109	100		

Data presented in a Table 4.5 show that the highest proportion (63.3 percent) of the respondents had medium income that was followed by high (19.3 percent) and low (17.4 percent) income earners. Thus, the majority (82.6 percent) of the vegetable farmers had high to medium income, indicating that vegetable cultivation is usually practiced by the farmers of comparatively medium economic standings.

4.1.5 Income from vegetable cultivation

Income from vegetable cultivation of the farmers ranged from 14 to 45 thousand taka. The mean was 29.44 and standard deviation was 7.28. On the basis of off-farm income, the respondents were categorized into three groups which are "low income" (up to 22), "medium income" (23-36) and "high income" (above 36). The distribution of the vegetable farmers according to their income from vegetable cultivation is shown in Table 4.6.

Table 4.6 Classification of the respondents according to their income from vegetable cultivation

Categories	Income („000 „ taka) **(Mean±SD)**	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Low income	Up to 22	12	11.0	29.44	7.28
Medium income	23 to 36	83	76.2		
High income	Above 36	14	12.8		
Total		109	100		

Data presented in a Table 4.6 revealed that the highest proportion (76.2 percent) of the respondents had medium income that was followed by low (11 percent) and high (12.8 percent) income. Generally higher income gives an individual better status in the society.

4.1.6 Training on vegetable cultivation

Training scores of the respondents ranged from 0 to 15 days. The mean of the respondents was 2.65 and standard deviation was 2.24 respectively. Based on the training exposure scores, the vegetable farmers were classified into four categories based on observation which are as follows, " no training"(0), "low training " (1 to 5),

"medium training" (6 to 10), and "high training" (above 10). The distribution of the vegetable farmers according to their training exposure is presented in Table 4.7.

Table 4.7 Classification of the respondents according to their training in vegetable cultivation

Categories	Scores (days)	Vegetable fanners		Mean	Standard deviation
		Number	Percent		
No training	0	32	29.4	2.65	2.24
Low training	1 to 5	56	51.3		
Medium training	6 to 10	19	17.5		
High training	Above 10	2	1.8		
Total		109	100		

Data presented in Table 4.7 showed that majority (51.5) percent of the vegetable farmers received low duration training, while the rest 29.4 percent of them had no duration training, 17.5 percent had medium duration training and 1.8 percent had high duration training. Training increases knowledge and skills of the vegetable farmers in a specific subject matter area. Individuals who gain high training experiences are likely to be more competent in performing in different farming activities. But the fact that overwhelming majority of the vegetable farmers who did not receive any training or received low training, needs attention of the authorities of extension services (GOs and NGOs) in the country. Providing adequate training on appropriate subject matter is likely to increase the knowledge of pesticide application.

4.1.7 Extension contact

Computed extension contact score ranged from 12 to 22 with an average of 16.60 and standard deviation of 2.43. Based on the extension contact scores, the respondents were classified into the three categories namely low contact (up to 14), medium contact (15 to 18) and high contact (above 18). The distribution of the vegetable farmers according to their training exposure is presented in Table 4.8.

Table 4.8 Classification of vegetable farmers according to their extension contact

Categories	Score **(Mean±SD)**	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Low contact	Up to 14	26	23.9	16.60	2.43
Medium contact	15-18	53	50.4		
High contact	Above 18	28	25.7		
Total		109	100		

Data presented in table 4.8 indicate the highest proportion (50.4 percent) of the farmers had medium extension contact followed by low extension contact (23.9 percent) and high extension contact (25.7 percent).

The findings of this study indicated that the majority (75.9%) of the farmers in the study area had medium to high extension contact. It could be concluded that the extension contact or media of the study area were available to the respondents.

4.1.8 Organizational participation

Organizational participation scores of the respondents ranged from 3 to 8. The average score was 4.86 with a standard deviation of 1.26; the respondents were classified into the following three categories namely low participation (1 to 3), medium participation (4 to 5) and high participation (above 5). The distribution of the vegetable farmers according to their organizational participation is presented in Table 4.9.

Table 4.9 Classification of the vegetable farmers according to organizational participation

Categories	Scores **(Mean±SD)**	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Low participation	1 to 3	11	10.1	4.86	1.26
Medium participation	4 to 5	68	62.4		
High participation	Above	30	27.5		
Total		109	100		

Data presented in Table 4.9 indicate that most 62.4 percent of the respondents had medium participation against 27.5 percent of the respondents had high participation in any social organization and 10.1 percent had low participated in various organizations.

Participation in different organization helps to know his present situation. It also helps him to how know the various technology and other new ideas relating to different agricultural aspects. An overwhelming majority of the respondents (89.9%) had medium to high participation thus indicate a good standing of the respondent groups in terms of organizational participation.

4.1.9 Time spends in vegetable cultivation

Time spends in vegetable farm varied from 24 to 39 hrs per week with an average of 31.06 and standard deviation of 3.93. Based on their time spends in vegetable farm, the farmers were classified into three categories namely less time spend (up to 27), moderate time spend (28 to 35) and high time spend (above 35). The distribution of the vegetable farmers according to their time spend in vegetable cultivation is presented in Table 4.10

Table 4.10 Classification of the respondents according to their time spends

Categories	Score (hrs/week) **(Mean±SD)**	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Less time spend	Up to 27	22	20.2	31.06	3.93
Moderate time	28 to 35	68	62.4		
High time spend	Above 35	19	17.4		
Total		109	100		

Data presented in Table 4.10 indicates that majority (62.4 percent) of the respondents had moderate time spend against 20.2 percent of the respondents had less time spend and 17.4 percent had high time spend in vegetable cultivation. Time spends in vegetable cultivation is helpful to increase knowledge, improve skill and change attitude of the farmers. It also builds confidence of the farmers for making appropriate decisions at the time of need. Above three fourth (82.6 percent) of the farmers had moderate to less time spends in vegetable farming. Generally, time spends in vegetable farming helps to cope up any problematic situation as well as increase skill. Therefore,

the higher experience might be increased the risk bearing ability of the farmers in vegetable cultivation as well as increase their knowledge on pesticide application.

4.2 Knowledge on Pesticide Application

Computed scores of the farmers about Knowledge on pesticide application ranged from 13 to 22 with a mean of 16.28 and standard deviation of 2.24. On the basis of Knowledge on pesticide application, the respondents were classified into three categories namely low knowledge (up to 14), medium knowledge (15 to 18) and high knowledge (above 18) as follows in Table 4.11.

Table 4.11 Classification of vegetable farmers according to their knowledge

Categories	Score (Mean±SD)	Vegetable farmers		Mean	Standard deviation
		Number	Percent		
Low knowledge	Up to 14	22	23.9	16.28	2.24
Medium knowledge	15 to 18	60	56.8		
High knowledge	Above 18	21	19.3		
Total		109	100		

Data presented in Table 4.11 indicate that most 56.8 percent of the respondents had medium knowledge against 23.9 percent of the respondents had low knowledge on pesticide application in vegetable cultivation and 19.3 percent had high knowledge on pesticide application in vegetable cultivation. Thus, a proportion (80.7) percent of the vegetable farmers had medium to low knowledge on various aspects of pesticide application in vegetable application. Knowledge is to be considered as vision of an explanation in any aspect of the situation regarding vegetable cultivation. It is act or state of understanding; clear perception of fact or truth, that helps an individual to foresee the consequence he may have to face in future. It makes individuals to become rational and conscious about related field. To perform optimum production, vegetable growers should have adequate knowledge on different aspects of pesticide application in vegetable cultivation.

4.3 Contributing Factors Related to the Knowledge on Pesticide Application in Vegetable Cultivation

In order to estimate the knowledge on pesticide application in vegetable cultivation from the independent variables, multiple regression analysis were used which is shown in the Table 4.12.

Table 4.12 Multiple regression coefficients of contributing factors related to the Knowledge on pesticide application in vegetable cultivation

Dependent variable	**Independent variables**	**β**	***p***	**R^2**	**Adj. R^2**	**F**
Knowledge on pesticide application in vegetable cultivation	Education	.590	.000**	.576	.564	22.32
	Farm size	-.002	.956			
	Land under vegetable cultivation	.061	.301			
	Off-farm income	-.081	.531			
	Income from vegetable cultivation	-.005	.921			
	Training in vegetable cultivation	.199	.002**			
	Extension media contact	.045	.035*			
	Organizational participation	-.004	.950			
	Time spend in vegetable cultivation	.125	.114			

* Significant at $p < 0.05$;

** Significant at $p < 0.01$

The data in Table 4.12 shows that there is a significant contribution of the selected characteristics (education, training in vegetable cultivation and extension media contact of the farmers. Of these, education and training in vegetable cultivation were the most important contributing factors (significant at the 1% level of significant) and extension media contact (significant at 5% level of significant) while coefficients of other

selected variables don‟t have any contribution on pesticide application in vegetable cultivation.

The value of R^2 is a measure of how of the variability in the dependent variable is accounted for by the independent variables. So, the value R^2 =0.576 means that independent variables accounts for 57% of the variable in knowledge on pesticides application in vegetable cultivation.

The F ratio is 22.32 which is highly significant (p=.000). This ratio indicates that the regression model significantly improved the ability to predict the outcome variable.

4.3.1 Significant contribution of education to the knowledge on pesticide application in vegetable cultivation

The contribution of education to farmers‟ knowledge on pesticide use in vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of education to farmers‟ knowledge on pesticide use in 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 (p= 0.00).
b) So, the null hypothesis could be rejected.
c) The β-value of education is (0.590). So, it can be stated that with the increase of education of the farmers knowledge on pesticide application in vegetable cultivation will also increase their knowledge on pesticide application in vegetable cultivation. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that education plays an important role in pesticide application in vegetable cultivation. By increasing education people are able to know about how pesticide application in vegetable field, learn about its negative side, become conscious, get benefited and so on, which increase the knowledge on pesticide application in vegetable cultivation.

4.3.2 Significant contribution of training in vegetable cultivation to the knowledge on pesticide application in vegetable cultivation

From the multiple regression, it was concluded that the contribution of training in vegetable cultivation to the farmers‟ knowledge on pesticide application in vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of training in vegetable cultivation to the farmers‟ knowledge on pesticide application in vegetable application”.

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 training on pesticide application in vegetable cultivation was significant at 1% level (0.002)

b) So, the null hypothesis could be rejected.

c) The β-value of training on pesticide application in vegetable cultivation is (0.199). This implies that with the increase of training in vegetable cultivation of the farmers will increase their knowledge on pesticide application in vegetable cultivation. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that training helps the farmers to acquire deep knowledge and improve the skills about the respected aspects. Trained farmers can cope with and handle smoothly the adverse situation in their vegetable cultivation. So, they show favorable attitude towards knowledge on pesticide application in vegetable cultivation.

4.3.3 Significant contribution of extension media contact to the knowledge on pesticide application in vegetable cultivation

From the multiple regression, it was concluded that the contribution of agricultural extension media contact to the farmers‟ knowledge on pesticide application in vegetable cultivation was measured by the testing the following null hypothesis;

“There is no contribution of agricultural extension media contact to the farmers‟ knowledge on pesticide application in 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 extension media contact was significant at 5% level (0.035).
b. So, the null hypothesis could be rejected.
c. The β-value of agricultural extension media contact is (0.045). This implies that with the increase of extension media contact of the farmers will increase their knowledge on pesticide application in vegetable cultivation. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that extension media contact lays an important role in knowledge on pesticide application in vegetable cultivation. By continuous contact with different extension media people are concerned about pesticide application in vegetable cultivation, become trained, get benefited and so on, which increase the knowledge on pesticide application in vegetable cultivation of the farmers.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents summary of findings, conclusions and recommendations of the study.

5.1 Summary of Finding

The major findings of the study are summarized below:

5.1.1 Selected characteristic of the respondents

Education: Education score of the respondents ranged from 0 to 12 with an average of 4.06 and standard deviation of 3.61. The highest proportion (34.8%) of the respondents had primary level of education.

Farm size: Farm size of the respondents ranged from 0.09 to 3.31 hectare and the average was 0.73 ha with a standard deviation of 0.41. The highest proportion (79.8%) of the respondents had small farm size.

Land under Vegetables cultivation: The average land under vegetable cultivation of the respondents was 44.77 with a standard deviation of 11.52 de. Farm size ranges from 34 to 79 de. The farm size of the respondents was classified into three categories. Majority (58.8%) of the respondents had medium farm holders.

Off-farm income of the respondents: Off-farm income range from Tk. 30 to Tk. 90.The average off-farm income of the respondents was 52.77 with a standard deviation of 15.33. The respondents were classified into three categories namely low income (less than Tk. 37), medium income (Tk. 38-67) and high income (Tk. above 67). Majority of them (63.3%) fell in the medium income group. A few (19.3%) were classified as high income group and (17.4%) of the respondent had low income category.

Income from vegetables cultivation of the respondents: Income from vegetable cultivation range from Tk. 14 to Tk. 45**.**The average Income from Vegetable Cultivation of the respondents was Tk.29.44 with a standard deviation of Tk. 7.28. The respondents were classified into three categories namely low income

(less than Tk. 22**),** medium income **(**Tk. 23-36**)**and high income (above Tk. 36). Majority of them (76.2%) fell in the medium income group. Only (12.8%) was classified as high income group and (11%) of the respondent had low income from vegetable cultivation category.

Training in vegetable cultivation: The study indicated that 51.3 percent of the respondent had low training on vegetable cultivation whereas only 1.8 percent had high training, 17.5 percent had medium and 29.4 percent had no training in vegetable cultivation with an mean of 2.65 and standard deviation of 2.24.

Extension contact: Extension contact score of the respondents ranged from 12 to 22 against the possible range from 0 to 24, the average was 16.60 with a standard deviation of 2.43. The highest proportion (50.4%) of the respondents had medium extension contact and 23.9% had low media contact.

Organizational participation: Organizational participation scores of the respondents ranged from 3 to 8. The average score was 4.86 with a standard deviation of 1.26. Most 62.4 percent of the respondents had medium participation against 27.5 percent of the respondents had high participation in any social organization and 10.1 percent had low participated in various organizations.

Time spends in vegetable cultivation: Time spends in vegetable farm varied from 24 to 38 per week with an average of 31.06 and standard deviation of 3.93. Most 62.4 percent of the respondents had moderate time spend against 20.2 percent of the respondents had less time spend and 17.4 percent had high time spend in vegetable cultivation.

5.1.2 Farmers knowledge on pesticide application in vegetables cultivation

Computed scores of the farmers about Knowledge on pesticide application ranged from 13 to 22 with a mean of 16.28 and standard deviation of 2.24. It is observed that 80.7 percent of the farmers had medium to low knowledge on various aspects of vegetable cultivation. So, it is strongly recommended that adequate technical support and training facilities should be extended to improve the knowledge of the vegetable cultivation farmers.

5.1.3 Contribution of the selected characteristic of the respondents to their knowledge on pesticide application in vegetable cultivation

Education, training in vegetable cultivation and extension media contact had significant positive contribution to their knowledge on pesticide application in vegetable cultivation

Characteristics of the respondents like farm size, land under vegetable cultivation, off-farm income, income from vegetable cultivation, organizational participation and time spend in vegetable cultivation had no significant contribution to their knowledge on pesticide application in vegetable cultivation.

5.2 Conclusions

"A conclusion presents the statements based on major findings of the study and these statements mostly confirm to the objectives of the research in the shortest form. It presents the direct answers of the research objectives, or it relates to the hypothesis" (Labon and Schefter, 1990).

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

1. The findings revealed that majority (81%) of the respondents had low to medium knowledge on pesticide application in vegetable cultivation at the study area. This fact leads to the conclusion that overall knowledge on pesticide application in vegetable cultivation by the farmers was not satisfactory. There is huge scope for increasing the knowledge on pesticide application in vegetable cultivation by the respondents.
2. Education of the respondents showed the important contributor factor to the knowledge on pesticide application in vegetable cultivation. This means that high literacy and educational level among the farmers might have influenced to increase farmers‟ knowledge on pesticide application in vegetable cultivation.
3. Training in vegetable cultivation had second highest contributor to the knowledge on pesticide application in vegetable cultivation. Training helps

the farmers to acquire deep knowledge on pesticide application in vegetable cultivation. However the most (80%) of the respondents had no to low training in vegetable cultivation. So, it may be concluded that increase in the training in vegetable cultivation will increase the knowledge on pesticide application in vegetable cultivation.

4. Maximum (50.4%) farmers had medium extension media contact on knowledge on pesticide application in vegetable cultivation and the regression analysis revealed that extension media contact of the respondents was a contributing factor to that knowledge on pesticide application in vegetable cultivation by the farmers. Therefore, it may be said that the higher the media contact of the respondents higher the knowledge on pesticide application in vegetable cultivation.

5.3 Recommendations

5.3.1 Recommendations for policy implication

1. Majority (67.8 percent) of the respondent were illiterate or having education up to primary level. Education of the vegetable growers had the important contribution to their knowledge on pesticide application in vegetables. Again education of the respondent had significant positive contribution to the knowledge on pesticide application in vegetable cultivation. Therefore it may be recommended that attempts should be taken to establish adult learning centre to increase educational level as well as pesticide application in vegetable cultivation knowledge of the vegetable growers. Education helps an individual to realize the present and future needs at the personal, social and national levels. Educational facilities especially environmental issues should be provided the farmers.

2. Overwhelming majority (80.7 percent) of the vegetable growers had no to low training on vegetable cultivation. Training on vegetable of the respondent had the second highest contribution to their knowledge on pesticide application in vegetable cultivation. Again training on vegetable cultivation of the respondent had significant positive relationship with their knowledge on postharvest practices of vegetables. Therefore it may be

recommended that attempts should be taken for vegetable growers to arrange necessary training on pesticide application by providing detail pesticide application management guide. Government and non-government organizations may conduct training and awareness programs according to need of vegetable farmers for increasing their knowledge on pesticide application in vegetable cultivation.

3. Extension contact of the farmers had significant positive contribution to their knowledge on pesticide application in vegetable cultivation. More extension contact means more collection of information on various matters and more interaction with different sources of information. So effective extension contact is necessary for the change of farmers‟ knowledge on pesticide application in vegetable cultivation. Therefore it may be recommended that attempts should be taken for vegetable growers to arrange necessary extension contact on pesticide application in vegetable cultivation. Government and non-government organizations may conduct training and awareness programs according to need of vegetable farmers for increasing their knowledge on pesticide application in vegetable cultivation.

5.3.2 Recommendations for further study

A small and limited research work cannot provide unique and universal information related to actual impact of improving socio-economic status of the farmers. Further studies should be undertaken on related matters. On the basis of scope and limitations of the present study and observations made by the researcher, the following recommendations are made for further study:

1. The present study was carried in only one upazila of a particular district. Similar studies should be conducted in other parts of the country, which could be helpful for more understanding and generalization.

2. Contribution of nine selected characteristics of Jhenaida farmers with their knowledge on pesticide application in vegetable cultivation have been investigated in this study. Further research should be conducted to explore the contribution of other characteristics of the respondents with their knowledge on pesticide application in vegetable cultivation.

3. Researches on other aspects of ecological vegetable cultivation etc. such as farmers‟ adoption, problems in adoption, farmers‟ attitude towards pesticide use in vegetable cultivation should be undertaken.

4. In the present study education, farm size, vegetable cultivation area, income from vegetable cultivation, off-farm income, organizational participation, time spends in vegetable cultivation had no significant relationship with their knowledge on pesticide use vegetable cultivation. In this connection, further verification is necessary.

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APPENDIX – A

English Version of the Interview Schedule

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University

Dhaka –1207

An interview schedule for data collection of the research study entitled

"FARMERS' KNOWLEDGE ON PESTICIDE APPLICATION IN VEGETABLE CULTIVATION"

Serial No ……

Name of the respondent:

Village: ……

Union: ……

Upazila: ……

District: …….

(Please answer the following questions)

1. Education:

Please mention your educational status from the following

a. Cannot read and write

b. Can sign only

c. I read up to…….

d. I have passed …….. class

2. 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			

3. Percentage of land under vegetable cultivation (decimal):

Ans. …….

4. Off-farm income:

Have you any alternative source to agriculture for income?

1. Yes 2. No

If yes, then how much you earn (Tk. /Annually)

Ans. ……

5. Income from vegetable cultivation:

Please mention your annual income in taka from the following sources

SL. NO.	**Sources of income**	**Total production Kg/unit**	**Price per kg/unit**	**Total price (Tk.)**
1	Tomato			
2	Brinjal			
3	Beans			
4	Radish			
5	Pumpkin			
	Total			

6. Training on 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		

7. 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	AEO/UAO					
4	Neighbours					
5	Ideal farmers					
6	NGO workers					
	Total					

8. 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)	Executive Committee Officer (3)
1	Farmers cooperative association				
2	IPM club				
3	CIG				
4	Bazar committee				
5	School committee				
	Total				

9. Time spends in vegetable farming:

How much time you spend in vegetable cultivation (Hours/week)?

Ans……..

10. Knowledge on pesticide application in vegetable cultivation:

Sl. No	**Question**	**Full marks (2)**	**Marks obtained**
	Dose of pesticides		
1	How much pesticide will you need to spray the area?		
2	How much area can you spray with one full tank?		
3	How much pesticide should you add to one full tank?		

4	How much spray mix (pesticide plus water) will you need for the part tank to finish spraying the field?		
	Frequency of pesticides		
1	How often should you use pesticides in brinjal?		
2	How open should you use pesticides in tomato?		
3	How open should you use pesticides in potato?		
4	How open should you use pesticides in pumpkin?		
	Precautionary measures		
1	In what direction of wind, pesticide should be sprayed?		
2	What time do you like best for using pesticide?		
3	Where do you wash your hands and machineries after spraying pesticide?		
4	What caution should be taken using of pesticide?		
5	Please mention two methods of pest control in our country?		
6	Do you use mask gloves at the time of spraying?		
7	Mention two negative effects of using pesticide?		
	Total		

Thank you very much for your co-operations

_____

Signature of the Interviewer