ATTITUDE TOWARDS PESTICIDE RISK REDUCTION OF THE MANGO GROWERS

A Thesis
By

Mst. Asmaul-Husna

MASTER OF SCIENCE
IN
AGRICULTURAL EXTENSION

Department of Agricultural Extension
Hajee Mohammad Danesh Science and Technology University
Dinajpur

June 2014

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Mst. Asmaul-Husna
Student No. 1305038
Session: 2013-2014
Semester: January-June

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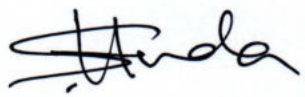
Supervisor



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ABSTRACT

Attitude Towards Pesticide Risk Reduction of the Mango Growers

The purpose of the study was to assess the attitudes towards the pesticide risk reduction of the mango growers. The study was conducted in Sadar upazila under Dinajpur district. Eighty four (84) respondents were selected as sample from a recent list of 335 mango growers using multi-stage random sampling method. Data were collected by a pre-tested interview schedule during 23th April to 26th May 2014. Two-thirds (66.2 percent) of the respondents had less favorable attitude followed by 21.3 percent had medium favorable and only 12.5 percent had high favorable attitude towards pesticide risk reduction. Among the independent variables educational qualification, information transfer and knowledge on pesticide use of the respondents showed positive significant relationship with their attitude towards pesticide risk reduction. Continuous education program and training might promote awareness and minimize the risk of pesticide exposure. Better sanitation facilities and personal hygiene would improve the attitude of the mango growers towards pesticide risk.

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CHAPTER 1

INTRODUCTION

1.1 General Background

Bangladesh is predominantly an agricultural country and about 25.7 percent of her population is engaged in agriculture for their livelihood (BBS, 2012). The population density of Bangladesh is 1015 persons per square kilometer and per capita income is about US dollar 923 (BBS, 2013). Agriculture is the backbone in the economy of Bangladesh. It plays a vital role in ensuring food security, rising standard of living and increase export earnings. Agriculture and environment has a close relationship and interact with each other. The health of agriculture depends on the proper functioning of environmental process and the health of environment depends upon a respectful agriculture.

Likewise, fruits are an important agricultural wealth of our country. There are many kinds of fruits grow in Bangladesh. It is the most important source of food for humans on the earth. The economic value of fruits can never be underestimated. They help us to nurture our health and meet essential nutritional requirement. A large number of people of our country earn their living by selling and cultivation different kinds of fruits.

Moreover, mango is the king fruits and proud of the country. It is grown in all over the country especially in the greater Rajshahi and Dinajpur district, due to the suitable climatic condition for quality mango production. It is opined that Bangladesh is the 12th largest mango producing country in the world, while about 7, 67,000 tones of mangos are produced in the country every year. The mango growers of this region use various types of pesticides for increasing mango production.

Undoubtedly, pesticides are substances meant for attracting, seducing, destroying or mitigating any pest. The most common use of pesticides is as plant protection products, which in general protect plants from damaging influences such as weeds, plant diseases or insects (Carolyn, 2013). In general, a pesticide is substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit (FAO, 2002).

Consequently to increase yields, many farmers spray pesticides overly, frequently and use excessive amounts of chemical fertilizers. In particular, over use of pesticides is known to harm vital ecosystem services and put sustainable agricultural production at risk. Furthermore, intensive use of highly hazardous chemicals causes frequent poisonings and chronic health problems, particularly for mango growers. Women and small children in rural communities are often directly or indirectly exposed to toxic pesticides.

Although pesticide come in various formulations are used differently. Some are to be used directly from the package, while others need to be diluted with water, oil or other carriers. The reason for mixing the active ingredient with other substances is to make handling and application safer, easier and more accurate. These pesticides are usually synthetic pyrethroids, organophosphates and coumarins on the other hand some pesticides are classified as restricted use pesticide product containing cypermethrin. The methods of application of pesticides are different. The choice depends on the pest, the site, and the properties of the pesticide, the suitability of the application equipment and the cost and efficacy of alternative methods (Al-Haddad and Al-Sayyad, 2013).

The mango growers are regularly involved in pesticide mixing, loading or application of these chemicals at work. The activities involved in pesticide handling might be a risk for growers health. Special precautions have to be taken during preparation, transport, storage and handling of pesticides. People who work with these chemicals should receive proper training on their safe use and personal protective equipments (PPE) to minimize exposure and reduce health risks (Al-Haddad and Al-Sayyad, 2013).

Risk is defined as the product of hazard (i.e. chemical property) and exposure (i.e. intensity and duration). Risk reduction is therefore achieved by reducing hazard and/or reducing exposure.

$$\text{Risk} = \text{Hazard} \times \text{Exposure}$$

The use of personal protective equipment (PPE) when spraying can reduce contact with and inhalation of pesticides, thereby potentially reducing the acute and chronic health hazards of pesticides to the sprayers. Mango growers attitudes towards the pesticides risk reduction have not been well assessed in Bangladesh. There is a great concern that mango growers should be aware of the adverse effects of pesticide use if not handled properly. Little or no formal study has been done to look at attitude of the mango growers towards pesticide risk reduction so far. For smooth sailing of future programs regarding pesticide risk reduction, it is necessary to document the problem being faced by the pesticide handlers.

1.2 Statement of the Problem

Modern agriculture and public health are closely associated with the use of pesticides. It is used for controlling insect pests and diseases. Although pesticide use is an integral part of the modern agriculture to protect crops, but unfortunately it showed high level of adverse effect on environment (Altieri, 1992). The economic output from mango orchard increased quickly in Bangladesh because of using proper pesticides with recommended doses. But, few mango growers are using pesticide in mango orchard in indiscriminate quantity due to lack of knowledge and awareness about bad effect of pesticide. Over use of pesticide will cause adverse effects on health. There are different routes in which pesticides can enter in the human body including dermal, oral, eyes and respiratory (Safiqul, 2000).

Pesticides are used to control the harmful organisms but the inadequate dose will make pest resistance and human health hazard. A proper, adequate and environmentally safe dose of pesticide use is very necessary (Ali *et al.*, 2006). Control and safety behavior practices that reduce exposure to pesticide were more prominent among individuals with greater knowledge about pesticide risks (Arcury *et al.*, 2002; McCauley *et al.*, 2002 and Vaughan, 1993).

However, many pesticide handlers were not knowledgeable about the hazardous nature these chemicals and most of them could not read or understand the pesticide information because of different language comprehension. To promote safe pesticide use the majority felt that medical check-up, training and proper use of PPE was important. It would be useful to implement continuous education and training programs for pesticides handlers in order to promote awareness and minimize the risk of occupational pesticide exposure (Sam *et al.*, 2008).

The use of PPE including gloves, respirators and goggles reduce the risk of pesticide health hazard. The majority uses safety shoes; some handlers did not wear gloves, mask, aprons, safety goggles and respirators during summer time. Very few pesticide handlers use aprons. Most handlers did not take shower after pesticides exposure; many do not change clothing before and after pesticide exposure. To improve the attitude of the handlers towards personal hygiene and sanitation, there is a need for better sanitation facilities and hygiene at work place. Therefore, attitude towards pesticide risk reduction of the mango growers is very essential for their health as well as environment.

1.3 Justification of the Study

More than seventy percent people of Bangladesh live in rural areas and their main livelihood is agriculture. In recent years, it is too denying fact that in agricultural sector and in rural areas exposure of pesticides is occupational risk among mango growers in developing countries (Wesseling *et al.*, 2001; Konradsen *et al.*, 2003 and Coronado *et al.*, 2004). Occupational exposure to pesticides is of great interest in order to identify the hazards of pesticide use and the establishment of safe methods of pesticide handling. This is because pesticide misuse in various sectors of the agriculture often has been associated with health problems and environmental contamination worldwide (Soares *et al.*, 2003; Mancini *et al.*, 2005 and Remor *et al.*, 2009).

Misuse of highly toxic pesticides, coupled with a weak or a totally absent legislative framework in the use of pesticides, is one of the major reasons for the high incidence of pesticide poisoning in developing countries (Konradsen *et al.*, 2003). Pesticide poisoning can lead to acute reactions that can cause immediate illness and injury and may require medical treatment. The health impact of chronic low-level exposure is less well known, although studies indicate that possible effects include cancer, birth defects, neurological deficits, and reproduction and fertility problems (Austin *et al.*, 2001).

1.4 Specific Objectives of the Study

In view of the above circumstances, the present study was carried out to fulfill the following specific objectives:

1. To determine and describe the selected characteristics of the mango growers.
2. To assess the attitude towards pesticide risk reduction of the mango growers.
3. To explore the relationship between selected characteristics of mango growers and attitude towards pesticide risk reduction.

1.5 Assumptions of the Study

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

- The respondents included in the sample were capable of furnishing proper responses to the questions included in the interview schedule.
- The views and opinions furnished by the respondents included in the sample were the representative and opinions of the whole population of the study area.
- The responses furnished by the respondents were valid and reliable. They sincerely expressed all information regarding environmental pollution by pesticides.
- The researcher acting as the interviewer was well adjusted to the society and environment of the study area. Hence, the data collected from the respondents were free from bias.
- The findings of the study will have general applications to other parts of the country with similar personal, socio-economic and cultural conditions of the study area.

1.6 Limitations of the Study

Considering the time, money and other necessary resources available to the researcher and to make the study manageable and meaningful it became necessary to impose certain limitations. The limitations were as follows:

- The study was confined to two unions namely Chehelgazi and Auliapur of Dinajpur Sadar upazila.
- Attitude of the mango growers could be measured directly by observation in the field but it would be very much costly and time consuming. In this study, attitude of the mango growers was thus measured on the basis of their responses through some selected statements.
- Population for the present study was kept confined within the heads of farm families in the study area, because they were the major and high user of pesticides.

- There were many characteristics of the farmers in the study area but only nine of them were selected for investigation.
- For information about the study, the researcher dependent on the data furnished by the selected respondents during their interview.

1.7 Definition of important terms

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

Information transfer: It refers to the frequency of exposure of different individual sources, group sources and mass media of information.

Attitude: Attitude means one's feelings, beliefs and actions towards an object and concept. This variable was operationalizing by developing an attitude scale, following Likert method of summated ratings.

Knowledge on pesticide use: It refers to the understanding of the farmers about different aspect of scientific use of pesticides, such as right time of use, recommended doses etc.

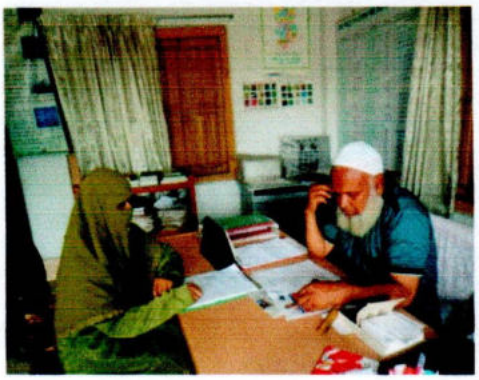
Personal Protective Equipment (PPE): PPE is defined as specialized clothing or equipment for protection against health and safety hazards. It is designed to protect many parts of the body, i.e. eyes, ears, face, head, hands and feet of the growers.

Personal hygiene and sanitation practices: The conditions and practices that serve to preserve health is personal hygiene and sanitation is the hygienic means of promoting health through prevention with the hazards of wastes.

Practice of pesticide: Safety measures taken against potential risks of pesticides exposure were inadequate is practice of pesticide.

Pesticide risk reduction: Pesticide risk reduction is achieved by reducing hazard and or reducing exposure.

Consultative meeting with AEO



Consultative meeting with SAAO

Meeting with pesticide dealer

Data collection

Pesticide mixing without any safe guard

Few growers use traditional safe guard

Figure 1.1 Overall research in pictorial view

CHAPTER 2

REVIEW OF LITERATURE

The present study deals with mango growers attitude towards pesticides risk reduction. The purpose of the study is to review previous studies, opinions and observation of experts having relevance to this research. Reviewed materials included books, publications, journals, reports, magazines etc. The researcher therefore, made exhaustive effort to review the previous research works directly or indirectly related to the present study by different research in home and abroad. Findings of past studies indicate certain relationships between the attitude towards pesticide risk reduction and related individual characteristics of the mango growers.

2.1 Concept of Attitude

Concept of attitude arises from attempt to account for observed regularities in behavior of individual persons. The quality of one's attitude is judged from the observable, evaluative responses he tends to make (Encyclopedia Britannica, 1960). Different persons have defined attitude which he show in different ways. Some of these are given below:

The classic, tripartite view offered by Rosenberg and Hovland (2012) is that an attitude contains cognitive, affective, and behavioral components. Empirical research, however, fails to support clear distinctions between thoughts, emotions, and behavioral intentions associated with a particular attitude.

Whitley (2010) referred that a criticism of the tripartite view of attitudes is that it requires cognitive, affective, and behavioral associations of an attitude to be consistent, but this may be implausible. Thus some views of attitude structure see the cognitive and behavioral components as derivative of affect or affect and behavior as derivative of underlying beliefs.

Baldwin (2005) referred that an attitude as the readiness for attempt or purpose, involving expectancy of certain kind of experience with appropriate kind of response.

Dillard (1994) suggests that message features such as source non-verbal communication, message content, and receiver differences can impact the emotion impact of fear appeals. The characteristics of a message are important because one message can elicit different levels of emotion for different people. Thus, in terms of emotion appeals messages, one size does not fit all.

McGrath (1966) referred attitude as the teamed orientations towards objects, or predisposition to behave in certain ways towards a given object or a class of objects. An attitude has always an object, person, thing or concept, and it may be general or specific.

Barnard (1965) defined attitude as a predisposition to act in a certain way. It is a style of readiness that influences a person to act in a given manner.

While defining attitude, Doob (1948) stated that attitude affects behavior since it implicit drive producing response considered socially significant in the individual crisis.

Thurstone (1946) define an attitude as the degree of positive or negative affect associated with some psychological object like symbol, phrase, slogan, person, institution, ideal or ideas towards which people can differ in varying degrees.

2.2 Review of Literature Related to Attitude

Akanda (2001) found that majority of the farmers (66.25 percent) had moderately favorable attitude while 12.5 and 21.25 percent had highly favorable and slightly favorable attitude respectively towards Rice-Fish cultivation program of CARE respectively.

Mannan (2001) found that the majority of Proshika farmers (57.3 percent) had moderately favorable attitude and 30.0 percent had slightly and highly favorable attitude respectively towards the EAP.

Paul (2000) observed that the majority of the farmers (59.52 percent) had moderately favorable attitude towards the use of USG while 25.00 percent had slightly favorable attitude and 15.48 percent had highly favorable attitude towards the use of USG.

Bari (2000) conducted a study on attitude of farmers towards hybrid rice AALOK 6201. He found that the highest proportion (45.0 percent) of rice growers had moderate, 27.0 percent unfavorable and 28.0 percent had favorable attitude towards hybrid rice AALOK 6201.

Habib (2000) conducted a study and found that 14.0 percent of the BSs had highly favorable attitude towards agro-chemicals while 43.0 percent had slightly as well as moderately favorable attitude.

Nurujjaman (2000) observed that around half (48.33 percent) of the IPM farmers had highly favorable attitude compared to 40.0 percent had moderately favorable and only 11.67 percent had slightly favorable attitude.

2.3 Review of Literature Related to Selected Characteristics and Attitude

2.3.1 Age and attitude

Rahman *et al.* (2007) found that there was negatively significant relationship between age of the farmers and their attitude towards organic farming.

Chowdhury *et al.* (2006) reported in their study that age of the farmers had no significant relationship with their attitude towards sustainable agriculture.

Parveen (2004) found that age of the modern village women influenced their attitude towards homestead agricultural production. But in case of the women of the traditional village, age was not associated with their attitude towards homestead agricultural production.

Mannan (2001) found that age of Proshika farmers had no significant relationship with their attitude towards the Ecological Agriculture Programs.

Hoque (1993) observed that age had negative relationship with the adoption of insecticides.

Khan (1993) in his study found that age of the farmers was significantly related with their adoption of insecticides. He also found that with the increase of age of the farmers the adoption of insecticides reduces i.e. age was negatively related with adoption.

Singh (1991) conducted a study to determine the extent of adoption selected recommended practices by Kino growers of Ferozepur and Faridkot districts of Punjab. He found no relationship between age of the farmers and their level of adoption of plant protection measures.

Kashem (1987) in his study found that there was no relationship between the age and attitude towards community of the farmers.

2.3.2 Educational qualification and attitude

Rahman *et al.* (2007) found that there was positively significant relationship between academic qualification of the farmers and their attitude towards organic farming.

Chowdhury *et al.* (2006) reported in their study that academic qualification of the farmers had positive significant relationship with their attitude towards sustainable agriculture.

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

Khan (1993) in a study found that education had positive relationship with the adoption of insecticides.

Singh (1991) observed that education of the farmers was not associated with the level of adoption of plant protection measure.

Rahim (1961) observed in his study in a village of Comilla on the diffusion and adoption of agricultural practices among the farm family heads, reported that adoption of practices insecticides were positively related to literacy except the agricultural practice.

2.3.3 Farm size and attitudes

Chowdhury *et al.* (2006) reported in their study that farm size of the farmers had positive significant relationship with their attitude towards sustainable agriculture.

Habib (2000) observed in his study that farm size of the Block Supervisors (BSs) had no relationship with their attitude towards the use of agro-chemicals.

Hossain (1999) also found that the farm size of farmers had no significant relationship with their perception of the effects of pesticide on environment.

Hamid (1995) however, reported that the area under cultivation of farmers had no significant relationship with their awareness on environmental pollution.

Gogoi and Gogoi (1989) found in their study on adoption of insecticides and related issues that farm size was positively related to the adoption of insecticides.

Rahim (1961) in his study on diffusion and adoption of agricultural practices observed that farm size had positive relationship with the adoption of pesticides.

2.3.4 Annual income and attitude

Chowdhury *et al.* (2006) reported in their study that annual family income of the farmers had no significant relationship with their attitude towards sustainable agriculture.

Rahman (1974) found that income of the small farmers has no significant relationship with their attitude towards community of the farmers.

Mannan (2001) observed in his study that there was positive significant relationship between the family annual income and their attitude towards the ecological and agriculture programs.

Paul (2000) reported that animal family income of the farmers had positively significant relationship with their attitude towards use of USG.

Bari (2000) found that there was significant negative relationship between family income and attitude of farmers towards hybrid rice AALOK 6201.

Nurjjaman (2000) observed in his study that there was no significant relationship between family income of the FFS and non-FFS farmers with their attitude.

Habib (2000) observed in his study that income of the BSs has significant negative relationship with their attitude towards agro-chemicals.

2.3.5 Information transfer and attitude

Mannan (2001) observed in his study that extension media contact of proshika farmers had a positive significant relationship with their attitude towards the ecological agriculture.

Nurjjaman (2000) revealed that mass contact of the women farmers had significant relationship with their attitude on IPM but in case of non-FFS farmers, there was no significant relationship with their attitude on IPM.

Habib (2000) observed in his study that media exposure of the BSs had no significant relationship with their attitude towards agro-chemicals.

Paul (2000) observed in his study that media contact of the farmers had a positively significant relationship with their attitude towards use of USG.

Bari (2000) concluded that extension media contact had no significant relationship with their attitude towards hybrid rice AALOK 6201.

Singh (1991) observed in his study that media exposure of the farmers had significant relationship with their level of adoption of plant protection measure.

2.3.6 Knowledge on pesticide use and attitude

Chowdhury *et al.* (2006) reported in their study that knowledge of environment friendly farming of the farmers had positive significant relationship with their attitude towards sustainable agriculture.

Mannan (2001) observed in his study that there was a positive significant relationship between the agricultural knowledge of Proshika farmers and their attitude towards the Ecological Agricultural Program.

Nurjjaman (2000) in his study reported that agricultural knowledge of the FFS and non-FFS farmers were positively correlated with their attitude on DM.

Bari (2000) concluded that agricultural knowledge of rice grower had no significant relationships with their attitude towards hybrid rice AAlOK 6201.

2.3.7 Personal hygiene and sanitation practices and attitude

Gaber and Latif (2012) found that, it would be useful to implement continuous education and training programs for pesticides handlers in order to promote awareness and minimize the risk of occupational pesticide exposure. They also reported that, most handlers ate or drank at workplace, most handlers did not take shower after pesticides exposure, many do not change clothing before and after pesticide exposure and 89 percent have their cloths laundered at home. To improve the attitude of the handlers towards personal hygiene and sanitation, there is a need for better sanitation facilities and hygiene. Sam *et al.* (2008) reported that educational intervention among pesticide handlers improved the knowledge and practice score for safe pesticide handling. Many handlers considered windy and sunny weather as the major problem. According to WHO (1990), many pesticide handlers were not knowledgeable about the hazardous nature of these chemicals, and most of them could not read or understand the pesticide information because of different language comprehension.

2.3.8 Use of Personal Protective Equipment (PPE) and attitude

Pratt (2007) highlighted the health and safety implications of PPE provision and the associated educational needs were emphasized. They identified studies showing that both a lack of knowledge of guidelines and non adherence to guideline recommendations are widespread and that ongoing in-service education and training is required. The guidelines laid down a series of standards for personal protective equipment.

Ayliffe *et al.* (2000) even in protective isolation, suggest that evidence to support the use of caps remains unsubstantiated.

ICNA (1999) published that personal protective equipment (PPE) includes a variety of items such as gloves, gowns, aprons, eye protection, face protection, masks, theatre footwear and caps. The rationale for using protective equipment is to protect both patient and healthcare worker from any potential cross contamination following exposure to microorganisms contained in blood and body fluids.

2.3.9 Practice of pesticide use and attitude

Sam *et al.* (2008) reported that educational intervention among pesticide handlers improved the KAP score for safe pesticide handling. Many handlers considered windy and sunny weather as the major problem.

Gaber and Latif (2012) revealed that unsafe practices of pesticide among pesticide handlers in their study.

2.4 The Conceptual Model of the Study

The assessment of attitude towards pesticide risk reduction requires a sound and symmetric conceptual model. Presently attitude of human is essential for effective rural development issues and it results a sound benefit to all sections of the society. In this connection the present study was concerned with the attitude towards pesticide risk reduction by the growers. In this study the characteristics of the growers divided into three major independent variables such as personal variable, social variable and attitude objects. The personal variable includes growers age, educational qualification, farm size, annual income, knowledge on pesticide use. Social variable includes information transfer means the extent of information receives. The attitude object reflect the growers present conditions like use of personal protective equipment (PPE), personal hygiene and sanitation and practice of pesticide. These all are the stimuli of the attitude. These stimuli influence the attitude of the growers towards pesticide risk reduction. The attitude component is knowledge, belief and action. To understand the mango growers knowledge, belief and action on pesticide risk our aim or target is to improve the growers health as well as sustainable eco friendly environment.

In view of the prime theme of the study the researcher constructed a conceptual framework which presented in the Figure 2.1.

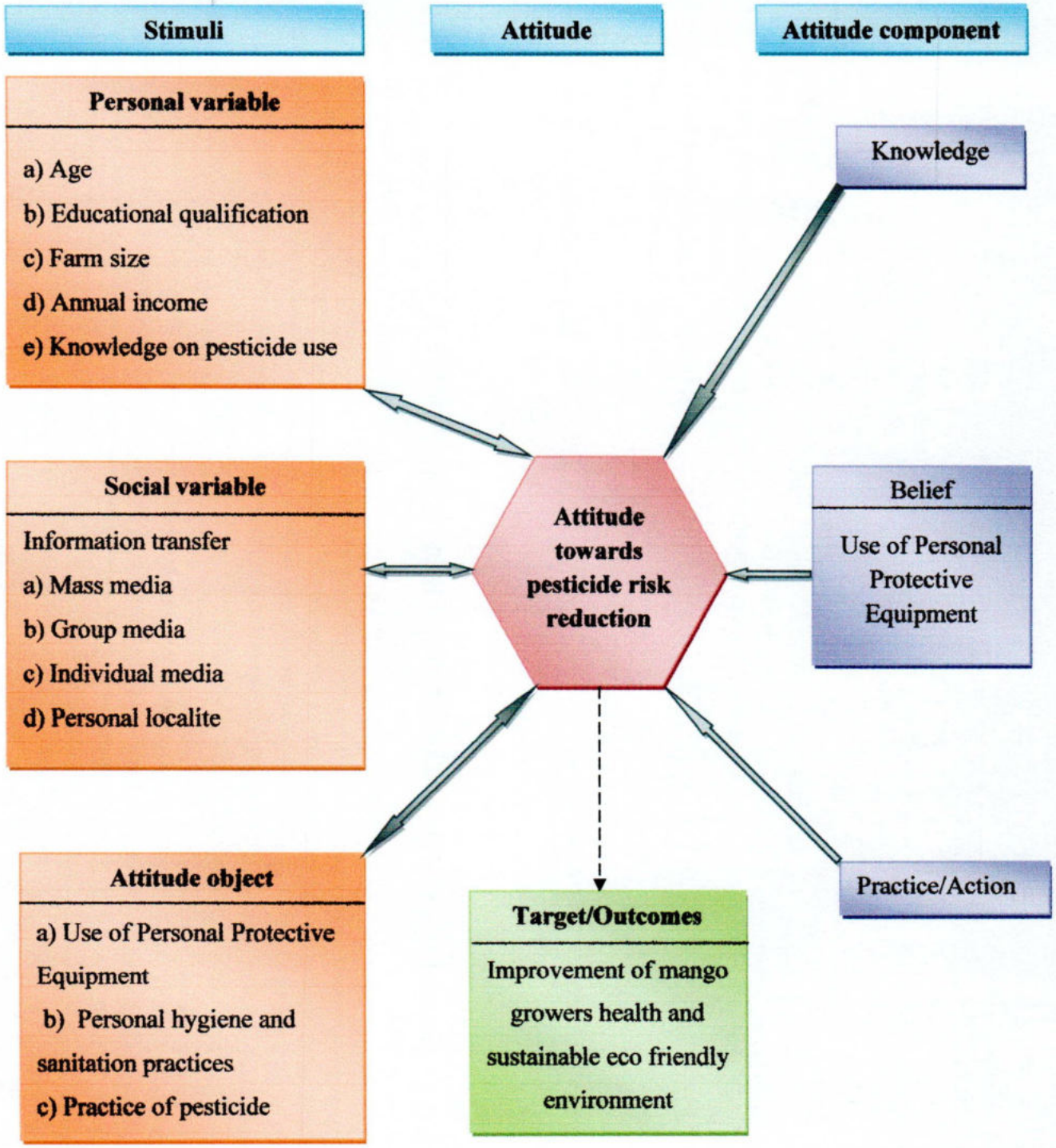


Figure 2.1 The conceptual framework of the study

(Modified form of Rosenberg and Hovland, 1960)

CHAPTER 3

METHODOLOGY

Methods and procedures are key factor in conducting a research. Methodology of any study should be such as to enable the research to collect valid and reliable information, to analyze the same, properly interpret those, to arrive at appropriate decisions. It deserves a very careful consideration in any scientific research. A benefiting methodological support was essential to make the investigation systematically guided. The method and procedures to be followed in conducting this study have been described below.

3.1 Locale of the Study

Dinajpur is rich in quality mango production especially at the Sadar upazila due to the suitable soil and climatic conditions. In this connection the researcher conducted the research as Sadar upazila under Dinajpur district which was selected purposively as a study area. Sadar upazila consists of 10 unions in which two unions namely Chehelgazi and Auliapur were selected randomly. Map of Dinajpur district and Sadar upazila indicating the study area have been presented in Figure 3.1 and Figure 3.2 respectively.

3.2 Population and Sample

Out of 10 unions, two unions of Sadar upazila namely Chehelgazi and Auliapur were randomly selected as the locale of the study. The total number of mango growers i.e. 335 under these two unions was considered as the population of the study. A list of mango growers was collected from upazila office. Out of this population, a sample of 84 mango growers (about 25 percent) was selected by random sampling method. The union wise distribution of population and sample of the growers is presented in Table 3.1.

Table 3.1 Union wise distribution of the population and sample

Name of the union	Number of mango growers		
	Population	Sample	Reserve list
Chehelgazi	196	49	5
Auliapur	139	35	4
Total	335	84	9

Figure 3.1 Map of Dinajpur district showing the study area (Bangladesh inset)

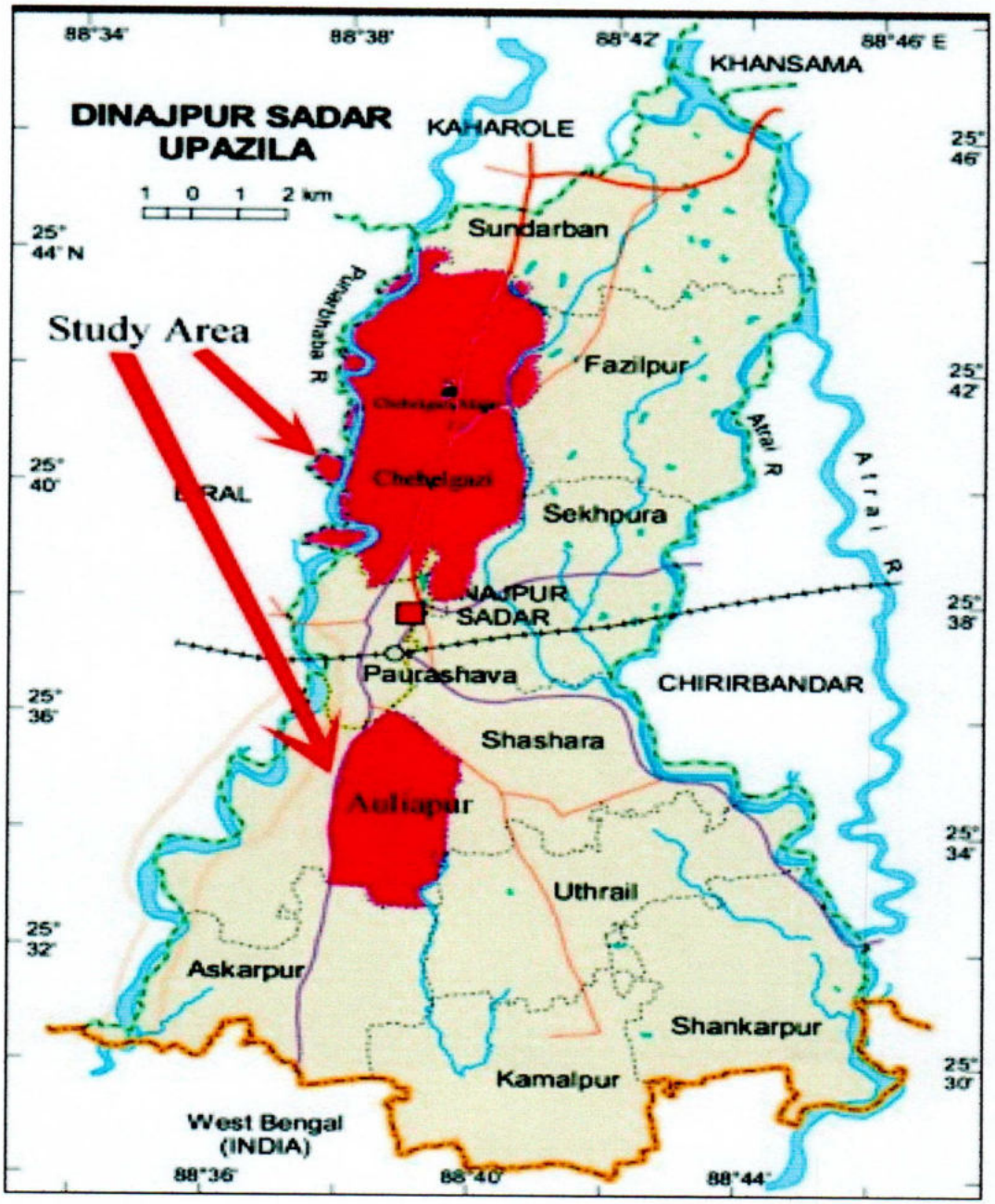


Figure 3.2 Map of Sadar upazila showing the locale of the study

3.3 Instrument for Collecting Data

In order to collect valid, reliable and relevant information, a structured interview schedule was carefully prepared. It contained closed and open form of questions. Simple and direct questions and different scale were included and arranged systematically so that these could easily be understood. Direct questions were included to collect information like age, educational qualification, farm size, annual income, information transfer, knowledge on pesticide use, personal hygiene and sanitation practices, use of personal protective equipment (PPE) and practice of pesticide etc. Scales were used to measure information transfer. An open form question was designed to obtain information like knowledge on pesticide use which was measured by rating scores. Five point Likert scale was used for ascertaining attitude towards pesticide risk reduction.

3.4 Pre-Testing of the Interview Schedule

The English version of interview schedule was converted in Bangla. Pre-test was done with 20 mango growers in the study area. Based on the pre-test result necessary correction and modification were made in the interview schedule. The modified, corrected and adjusted interview schedule was printed in the final form in English (Appendix A). Finally data were collected from the study area during 23th April to 26th May 2014.

3.5 Data Collection

Data were collected through face-to-face interview by the researcher herself. Before starting data collection, the researcher met the respective Agriculture Extension Officer (AEO), Sub Assistant Agriculture Officer (SAAO) and pesticide dealers also. To get valid and relevant information the researcher made all possible efforts to explain the purpose of the study to the respondents. Appointments with the interviewees were made in advance. While starting the interview with any respondent, the researcher took all possible care to establish rapport with them so that they did not feel any hesitation to furnish proper responses to the questions and statements in the schedule.

3.6 Measurement of Variables

In order to conduct the study, in accordance with the objectives, it was necessary to measure the selected variables. A well organized piece of research usually contains at least two important variables, viz. independent and a dependent variable.

3.6.1 Measurement of independent variables

3.6.1.1 Age

Age of the respondents was measured in terms of actual years from his birth to the time of interview. A score of one (1) was assigned for each year of age.

3.6.1.2 Educational qualification

Educational qualification was defined as the ability of an individual to read and write or formal education received up to a certain standard. A score of zero (0) was given to a respondent who did not know how to read and write and 0.5 was assigned who could sign his name only. Besides this, a respondent was given actual score of one for every year of schooling i.e. 1 for class one, 2 for class two and so on.

3.6.1.3 Farm size

It refers to the area owned by a farmer on which he carries his farming and family business, the area being estimated in terms of full benefit to the farmer. It included the total cultivated area owned by a respondent and his family members, land obtained from others and land taken from others on lease. The farm size of the respondent was computed in hectares, using the following formula:

$F_S = A_1 + ½ (A_2 + A_3) + A_4 + A_5$

Where,

F_S= Farm size

A_1= Land under own cultivation

A_2= Land taken from others on borga

A_3= Land given to others on borga

A_4= Land taken from others on lease

A_5= Homestead area

3.6.1.4 Annual income

Total yearly earnings from agriculture especially from mango orchard and other socially acceptable regular means such as services/business by the respondent's family were considered in measuring this variable. A score of one was given for every one thousand taka.

3.6.1.5 Information transfer

In this study, the information transfer score was computed for each respondent on the basis of his extent of information receives with 12 selected extension media.

Types of media	Name of Information sources	Extent of contact	Weight
Mass media	Watching agricultural TV program/ month	Not even once 1-2 times 3-4 times 5 or more times	0 1 2 3
	Reading agriculture related newspaper/week	Do	Do
	Reading agriculture related poster/week	Do	Do
	Reading agriculture related leaflet/season	Do	Do
Group media	ICM club meeting/year	Do	Do
	Farmers' training/season	Do	Do
	Farmers field day /year	Do	Do
Personal media	Sub-Assistant Agriculture Officer/ month	Do	Do
	Pesticide dealer /week	Do	Do
Personal localite	Neighbor/ month	Do	Do
	Ideal farmer/week	Do	Do
	Varsity staff/week	Do	Do

Information transfer score was determined by summing the scores of all the 12 information media. Information transfer score could range from 0 to 48, where zero (0) indicated no information transfer and 48 indicated the highest information transfer.

3.6.1.6 Knowledge on pesticide use

Knowledge on a respondent was measured by asking 10 questions on different aspects. It was measured in scores. The total marks assigned for all the questions were 20. Some of the questions had three marks, some had two marks and some had one mark for depending upon question pattern. A respondent answering a question correctly obtained the full marks, while for wrong answer he obtain zero. For partial correct answer one was given marks proportionately. The total score obtained by a respondent was taken as the knowledge score of the respondent. This score could range from 0 to 20, zero indicating no knowledge and 20 indicating very high knowledge.

3.6.1.7 Personal hygiene and sanitation practices

Six questions related to personal hygiene and sanitation practices were asked to the respondents. The response was collected against "yes" and "no". If response is given 'yes' then score given '1' and for 'no' response '2' is given. Finally, personal hygiene and sanitation practice was measured by counting the frequency of 1 and 2.

3.6.1.8 Use of Personal Protective Equipment (PPE)

According to pre-test, six types of Personal Protective Equipment (PPE) were used by the respondents. The PPE which is mostly used is measured by collecting responses against "yes" and "no". If response is given 'yes' then score given '1' and for 'no' response '2' is given. Finally, by counting the frequency of 1 and 2 use of personal protective equipment was measured.

3.6.1.9 Practice of pesticide

Five questions related to practices of pesticide exposure were asked to the respondents. The response was collected against "yes" and "no". If response is given 'yes' then score given '1' and for 'no' response '2' is given. Finally, by counting the frequency of 1 and 2 practices of pesticide was measured.

3.6.2 Measurement of dependent variable

The dependent variable of the study was attitude towards pesticides risk reduction. Attitude of a respondent was used to refer to his feeling, belief and action tendency towards pesticides risk reduction. The attitude of the mango growers towards pesticide risk reduction was measured by using 12 statements (6 positive and 6 negative). The positive and negative statements were arranged alternately in the interview schedule so that the respondents' real attitude could be reflected. The respondent was firstly asked to indicate his agreement about each statement with the help of a 5-point Likert scale.

Following score was assigned to each positive opinion and reverse was assigned to each negative opinion:

Opinion	Score for positive statement	Score for negative statement
Strongly Agree	4	0
Agree	3	1
Undecided	2	2
Disagree	1	3
Strongly Disagree	0	4

The attitude score of a respondent was computed by adding the scores for responses to all the 12 statements. The possible attitude scores could range from 0 to 48, where 0 indicating highly unfavorable attitude and 48 indicating highly favorable attitude towards pesticides risk reduction.

3.7 Statement of Hypothesis

According to Karlinger (1973), a hypothesis is a conjectural statement of the relation between two or more variables. A null hypothesis states that there is no relationship between the concerned variables. The following null hypothesis was undertaken for the present study: "There is no relationship between the selected characteristics of mango growers' and their

attitude towards pesticide risk reduction". Nine characteristics of the respondent were stated as independent variables. Out of nine characteristics, three i.e. "personal hygiene and sanitation practices", "use of personal protective equipment (PPE)" and "practice of pesticide" were measured only by "yes" and "no" method. For this reason they were excluded from relationship test. So the selected characteristics which included in the hypothesis were:

1. Age
2. Educational qualification
3. Farm size
4. Annual income
5. Information transfer
6. Knowledge on pesticide use

3.8 Data Processing and Analysis

The data collected for the study were coded and tabulated for processing and analysis in accordance with the objectives of the study. Local units were converted into standard units and qualitative data were converted into quantitative data by means of suitable scoring whenever necessary. And then quantitative data were transferred to a master sheet to facilitate tabulation. For describing the different characteristics, the respondents were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible scores system. The analysis was performed using Statistical Package for Social Sciences (SPSS) computer package. Descriptive statistics such as range, number, percentage, mean and standard deviation were used whenever possible. For clarity of understanding, tables were also used for presenting the data. Pearson's Product Moment Correlation Co-efficient were used in order to assessment of the relationship between the concerned variables.

CHAPTER 4

RESULTS AND DISCUSSION

Findings of the study and interpretation in this Chapter the results as well as discussion have been presented according to the objective of the study in three sections. In the first section, the selected characteristics of the mango growers have been discussed. The second section deals with the growers attitude towards pesticide risk reduction. The third section deals with the relationships between mango growers selected characteristics and their attitude towards pesticide risk reduction.

4.1 Selected Characteristics of the Mango Growers

4.1.1 Age

The age of the mango growers scores ranged from 22 to 68 with a mean of 40.20 and standard deviation of 11.05. The respondents were classified into three categories as young, middle aged and old.

Table 4.1 Distribution of the respondents according to their age

Observed range	Age category (year)	Respondents		Mean	SD
		Number	Percent		
22-68	Young (Up to 37)	43	51.2	40.20	11.05
	Middle (38-52)	29	34.5		
	Old (about 52)	12	14.3		

Data contained in Table 4.1 revealed that the slightly more than half (51.2 percent) of respondents were in the young aged category followed by 34.5 percent middle aged and 14.3 percent under old category. As mango is a horticultural crop, so it requires intensive care which is a laborious job compare to other agricultural crops. It has been observed that young aged are generally industrious and energetic. Therefore, maximum of the respondents belonged to young aged group having hard working ability and take intensive care of mango orchard. Shahin (2012), Meshram *et al.* (2006), Nurjjaman (2000) and Habib (2000) found similar result in their respective studies.

4.1.2 Educational qualification

The observed scores of educational qualification ranged from 0 to 12. The mean and standard deviation were 4.77 and 3.90 respectively. Based on the educational qualification scores obtained the levels of educations of the mango growers were grouped into five categories which as illiterate, can sign only, primary education, secondary and above secondary.

Table 4.2 Distribution of the respondents according to their education

Observed range	Farm size category	Respondents		Mean	SD
		Number	Percent		
0-12	Illiterate (0)	10	11.9	4.77	3.90
	Can sign only (0.5)	18	21.4		
	Primary education (1-5)	19	22.6		
	Secondary (6-10)	35	41.7		
	Above secondary (>10)	2	2.40		

The Table 4.2 showed that the highest proportion (41.7 percent) of mango growers had secondary education compared to 22.6 percent having primary education, 21.4 percent respondents can sign only, 11.9 percent illiterate and only 2.40 percent had above secondary level of education. There are various schools and colleges in the study areas. Education helps the respondents obtaining useful information related to agricultural practice, especially about the pesticide risk reduction through reading leaflets, booklets, books and other printed materials provided by different pesticide companies. Singh *et al.* (2014), Sharma *et al.* (2012), Shahin (2012), Meshram *et al.* (2006), Nurjjaman (2000) and Habib (2000) found similar result in their respective studies.

4.1.3 Farm size

Farm size scores varied from 0.21 to 1.77. The mean value of farm size was 0.86 with a standard deviation of 0.35. The respondents were classified into the following categories as small, medium and large.

Table 4.3 Distribution of the respondents according to their farm size

Observed range	Farm size category	Respondents		Mean	SD
		Number	Percent		
0.21-1.77	Small (up to 0.51)	13	15.5	0.86	0.35
	Medium (0.52-1.21)	55	65.5		
	Large (>1.21)	16	19.0		

Data presented in Table 4.3 showed that near about two-thirds (65.5 percent) of the respondents had medium sized farms followed by 19.0 percent had large and 15.5 percent had small sized farm respectively. The most important production factor of a farmer is the land. It is a scarce resource in Bangladesh. The farm size is the main indicator of holding farming status by the respondents. The overall farm size of the farmers of the study area was comparatively higher. In might be an indication that the medium farm holders were more interested to receive latest agricultural information. Shahin (2012) and Akanda (2001) found similar result in their respective studies.

4.1.4 Annual income

Annual income of the respondents ranged from 35 to 90 with the mean value of 58.76 and standard deviation of 18.71. On the basis of their annual income scores, the farmers were classified into three categories as low, medium and high income.

Table 4.4 Distribution of the respondents according to their annual income

Observed range	Categories	Respondents		Mean	SD
		Number	Percent		
35-90	Low income (<47)	24	28.6	58.76	18.71
	Medium income (48-69)	31	36.9		
	High income (>69)	29	34.5		

Data furnished in Table 4.4 revealed that 36.9 percent of the respondents had medium annual income, while 34.5 percent had high and 28.6 percent had low annual income. This may be due to that most of the respondents got a considerable income from their mango orchard. But, the respondents whose orchard age and size is less they got less income from the same. Nurjjaman (2000) found similar result in his study.

4.1.5 Information transfer

The observed information transfer scores of the respondents ranged from 16 to 36 against the possible range of 0 to 48 with a mean and standard deviation of 23.15 and 4.35 respectively. On the basis of their information transfer scores, the respondents were classified into three categories as low, medium and high.

Table 4.5 Distribution of the respondents according to their information transfer

Range		Categories	Respondents		Mean	SD
Possible	Observed		Number	Percent		
0-48	16-36	Low (up to 18)	8	9.5	23.15	4.35
		Medium (19-27)	62	73.8		
		High (>27)	14	16.7		

Table 4.5 showed that near about three-fourths (73.8 percent) of the respondents had medium 16.7 percent of the respondents had high and 9.5 percent of the respondents had low information transfer respectively. Information transfer refers to aim an individual's contact with different extension communication channels for receiving modern agricultural information. Most of the respondents are progressive and mango orchard size is medium that is why they got medium information from different information sources. Nurujjaman (2000) found similar result in his respective studies.

4.1.6 Knowledge on pesticide use

Knowledge on pesticide use is one of the major variables of this study. The observed knowledge scores of the respondents ranged from 10 to 18 against the possible range of 0 to 20 with a mean and standard deviation of 13.55 and 1.66 respectively. On the basis of their knowledge on pesticide use, the respondents were classified into three categories as low, medium and high.

Table 4.6 Distribution of the respondents according to their knowledge on pesticide use

Range		Categories	Respondents		Mean	SD
Possible	Observed		Number	Percent		
0-20	10-18	Low (up to 11)	6	7.1	13.55	1.66
		Medium (12-15)	66	78.6		
		High (>15)	12	14.3		

It is revealed from the Table 4.6 that more than three-fourths (78.6 percent) of the respondents had medium, 14.3 percent of the respondents had high and 7.1 percent of the respondents had low knowledge on pesticide use respectively. Mango growers do not give attention to the written information on pesticide packages and they don't know what amount of pesticide should be used that is why risk is increasing. If knowledge and awareness is increased among the mango growers then the risk of pesticide use will be reduced. Shahin (2012), Akanda (2001) and Nurrujjaman (2000) found similar result in their respective studies.

4.1.7 Personal hygiene and sanitation practices

The conditions and practices that serve to preserve health is personal hygiene and sanitation is the hygienic means of promoting health through prevention with the hazards of wastes.

Table 4.7 Personal hygiene and sanitation practices by the mango growers during pesticide exposure

Sl. No.	Questions	Number (Percentage)	
		Yes	No
1.	Do you change clothes before and after pesticide exposure?	26 (30.95)	58 (69.05)
2.	Do you wash your hands after pesticide exposure?	27 (32.14)	57 (67.86)
3.	Do you shower after pesticide exposure?	34 (40.48)	50 (59.52)
4.	Do you eat or drink at the workplace?	55 (65.48)	29 (34.52)
5.	Do you take medical check-up and proper training before pesticide application?	7 (8.33)	77 (91.66)
6.	Do you avoid any windy and sunny weather before using of pesticides?	23 (27.38)	61 (72.62)

Note: Figure in the parentheses indicate percentage of mango growers

The good proportion of the mango growers i.e. 91.66 percent who handle pesticide reported they did not do training and check-up health before pesticide exposure. However, Most of the mango growers that means 65.48 percent handle pesticide ate or drank at workplace. After pesticide use 40.48 percent take shower while 69.05 percent do not change cloths before and after pesticide exposure (Table 4.7). To improve the attitude of the mango growers towards personal hygiene and sanitation, there is a need for better sanitation facilities and hygiene. Similar behavior was reported by Gaber and Latif (2012). Such behavior contributes to the mango growers increased exposure to pesticides.

4.1.8 Use of Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is defined as specialized clothing or equipment for protection against health and safety hazards. It is designed to protect many parts of the body, i.e. eyes, ears, face, head, hands and feet of the growers. Most of the mango growers i.e. 70.24 percent use safety shoes, 60.71 percent use cap, 23.81 percent use gloves, traditionally 22.62 percent use towel as mask, 11.90 percent use safety glasses and only 4.76 percent use shirt as apron during pesticide application (Table 4.8).

Table 4.8 Type of Personal Protective Equipment (PPE) used during pesticide exposure

Sl. No.	Type of PPE	Number (Percentage)	
		Yes	No
1.	Gloves	20 (23.81)	64 (76.19)
2.	Safety shoes	59 (70.24)	25 (29.76)
3.	Mask	19 (22.62)	65 (77.38)
4.	Apron	4 (4.76)	80 (95.24)
5.	Safety glasses	10 (11.90)	74 (88.10)
6.	Cap	51 (60.71)	33 (39.29)

Note: Figure in the parentheses indicate percentage of mango growers use PPE

Good proportion of the mango growers reported that the use of PPE including safety shoes; cap and gloves etc. however, some complained that they were not aware about PPE. They were also not instructed for the use of PPE. Majority of the mango growers uses safety shoes and cap and very few mango growers use aprons. Similar results of unsafe practices among pesticide handlers were also reported in other studies (Gaber and Latif, 2012).

4.1.9 Practice of pesticide

Safety measures taken against potential risks of pesticides exposure were inadequate is practice of pesticide.

Table 4.9 Practice of pesticide of the mango growers

Sl. No.	Questions	Number (Percentage)	
		Yes	No
1.	Are you aware of pesticide exposure level?	8 (9.52)	76 (90.48)
2.	Did you read information written on pesticide packages?	23 (27.38)	61 (72.62)
3.	Could you understand the information written on pesticide packages?	18 (21.43)	66 (78.57)
4.	Do you give attention to the written information on pesticide packages?	28 (33.33)	56 (66.67)
5.	Have you been instructed or suggested about safe pesticide handling methods?	16 (19.05)	68 (80.95)

Note: Figure in the parentheses indicate percentage of mango growers

Most of the mango growers i.e. 90.48 percent were unaware about pesticide exposure level, 80.95 percent were not instructed or suggested to use safe pesticide handling methods, 72.62

percent did not read the written information on pesticide packages; 78.57 percent could not understand and 66.67 percent did not give attention to the written information on pesticide packages (Table 4.9). Many mango growers were not knowledgeable about the hazardous nature of these chemicals, and most of them could not read or understand the pesticide information because of different language comprehension, and no literacy. It is well known that educational intervention among pesticide handlers can improve the knowledge, attitude and practice (KAP) score for safe pesticide handling (WHO, 1990). It would be useful to implement continuous education and training programs for mango growers on pesticides handling in order to promote awareness and minimize the risk of pesticide exposure (Gaber and Latif, 2012 and Devi, 2009).

4.2 Dependent Variable

4.2.1 Attitude towards pesticide risk reduction

The mango growers attitude towards pesticide risk reduction was quantified by computing their scores. These scores of the growers could range from 0 to 48. Computed scores of the growers ranged from 10 to 40 and the mean value was 25.88 with a standard deviation of 4.24. On the basis of computed scores, the growers who handle pesticides were classified into the following three categories as less, medium and high favorable.

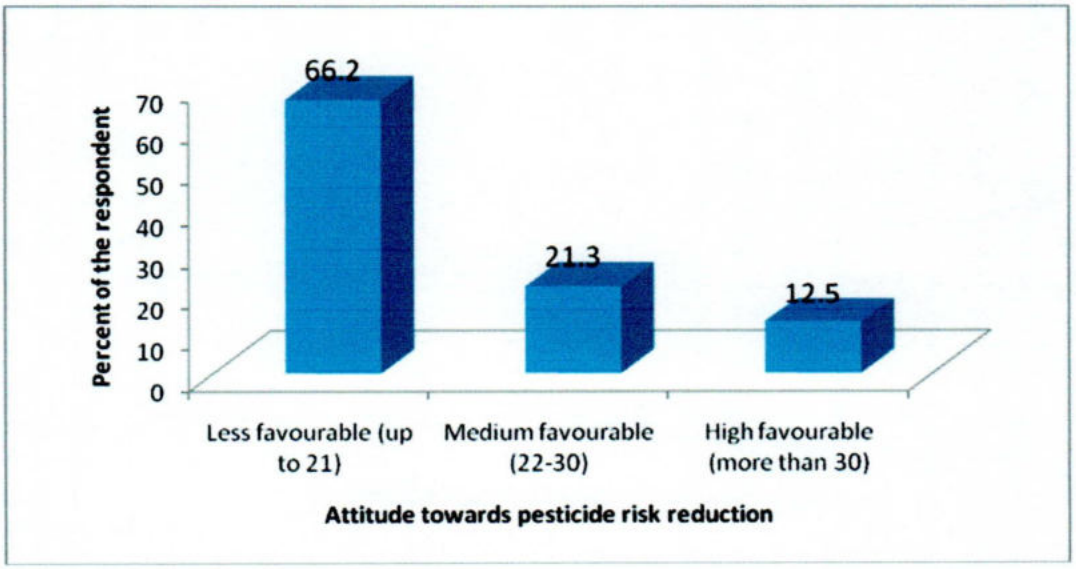


Figure 4.1 Bar graph showing the distribution of the growers based on attitude towards pesticide risk reduction

Figure 4.1 indicated that nearly two-thirds (66.2 percent) of the respondents had less favorable attitude followed by 21.3 percent had medium favorable and only 12.5 percent had high favorable attitude towards pesticide risk reduction.

It is well known that educational intervention among mango growers who handle pesticide can improve the knowledge and attitude score for safe pesticide handling (WHO, 1990). But, from the study it is revealed that majority (55.95 percent) of the mango growers education

status is illiterate to primary (Table 4.2). Due to less educational qualification, awareness to reduce risk regarding safe pesticide use is not created among them. So, mango growers who handle pesticide follow unsafe practices during its exposure due to their unawareness and less knowledge of safe pesticide use. As a result, majority of the respondents had less favorable attitude towards pesticide risk reduction. Control and safety behavior practices reduce exposure to pesticide (Arcury *et al.*, 2002; McCauley *et al.*, 2002 and Vaughan, 1993). But, due to less favorable attitude most of the respondents do not use PPE during pesticide exposure and do not follow personal hygiene and sanitation practices during pesticide exposure.

4.3 Relationship between the Characteristics of the Mango Growers and Their Attitude Towards Pesticide Risk Reduction

The purpose of this section is to explore the relationships between the independent variables and their attitude towards pesticide risk reduction. The relationships were measured by using the Pearson's Product Moment Correlation Co-Efficient (r). The summary of the results of correlation analysis between independent and dependent variables are presented in Table 4.10.

Table 4.10 Co-efficient of correlation showing the relationship between independent and dependent variables

Dependent variable	Independent variables	Correlation of Co-Efficient (r)	Tabulated Value of 'r' with 82 df	
			0.05 level	0.01 level
Attitude towards pesticide risk reduction	Age	-0.015	±0.214	±0.279
	Educational qualification	0.454**		
	Farm size	0.064		
	Annual income	0.191		
	Information transfer	0.243*		
	Knowledge on pesticide use	0.318**		

** Correlation is significant at the 0.01 level;
* Correlation is significant at the 0.05 level.

4.3.1 Age and attitude towards pesticide risk reduction

Relationship between age of the mango growers and their attitude towards pesticide risk reduction was measured by testing the concerned null hypothesis. The co-efficient of correlation between the concerned variables was found -0.015. This led to the following observations regarding the relationship between the two variables under consideration:

Firstly, the relationship showed a negative trend. Secondly, the computed value of 'r' (-0.015) was smaller than the tabulated value (r = 0.214) with 82 degrees of freedom at 0.05 level of probability. Hence, the relationship was statistically not significant.

Based on the above finding, the null hypothesis was accepted and hence, the researcher concluded that age of the respondents had no significant relationship with their attitude

towards pesticide risk reduction. The above facts led to the conclusion that the attitude towards pesticide risk reduction was not related with age of the respondents. Shahin (2012), Meshram *et al.* (2006), Nurjjaman (2000) and Habib (2000) found similar relationships in their respective studies.

4.3.2 Educational qualification and their attitude towards pesticide risk reduction

The co-efficient of correlation between the concerned variables was found 0.454. This led to the following observations regarding the relationship between the two variables under consideration:

Firstly, the relationship showed a positive trend. Secondly, the computed value of 'r' (0.454) was larger than the tabulated value (r = 0.279) with 82 degrees of freedom at 0.01 level of probability. Hence, the relationship was statistically significant at 0.01 level of probability.

Based on the above finding, the null hypothesis was rejected and hence, the researcher concluded that educational qualification of the respondents had significant relationship with their attitude towards pesticide risk reduction. This indicates that the growers with high educational qualification possessed more favorable attitude towards pesticide risk reduction. Singh *et al.* (2014), Sharma *et al.* (2012), Shahin (2012), Meshram *et al.* (2006), Akanda (2001), Nurzaman (2000) and Habib (2000) found similar relationship in their respective studies.

4.3.3 Farm size and their attitude towards pesticide risk reduction

The co-efficient of correlation between the concerned variables was found 0.064. This led to the following observations regarding the relationship between the two variables under consideration:

Firstly, the relationship showed a positive trend. Secondly, the computed value of 'r' (0.064) was much smaller than the tabulated value (r = 0.214) with 82 degrees of freedom at 0.05 level of probability.

Based on the above finding, the null hypothesis was not rejected and hence, the researcher concluded that farm size of the respondents had no significant relationship with their attitude towards pesticide risk reduction. Shahin (2012) and Akanda (2001) found similar relationships in their respective studies.

4.3.4 Annual income and their attitude towards pesticide risk reduction

The co-efficient of correlation between the concerned variables was found 0.191. This led to the following observations regarding the relationship between the two variables under consideration:

Firstly, the relationship showed a positive trend. Secondly, the computed value of 'r' (0.191) was smaller than the tabulated value (r = 0.214) with 82 degrees of freedom at 0.05 level of probability.

Based on the above finding, the null hypothesis could not be rejected and hence, the researcher concluded that annual income of the respondents had no significant relationship with their attitude towards pesticide risk reduction. Nurjjaman (2000) found similar relationships in his respective studies.

4.3.5 Information transfer and attitude towards pesticide risk reduction

The co-efficient of correlation between the concerned variables was found 0.243. This led to the following observations regarding the relationship between the two variables under consideration:

Firstly, the relationship showed a positive trend. Secondly, the computed value of 'r' (0.243) was greater than the tabulated value (r = 0.214) with 82 degrees of freedom at 0.05 level of probability. Hence, the relationship was statistically significant at 0.05 level of probability.

Based on the above finding, the null hypothesis was rejected and hence, the researcher concluded that information transfer of the respondents had significant relationship with their attitude towards pesticide risk reduction. Meshram *et al.* (2006), Akanda (2001), and Nurjjaman (2000) found similar relationships in their respective studies.

4.3.6 Knowledge on pesticide use and attitude towards pesticide risk reduction

The co-efficient of correlation between the concerned variables was found 0.318. This led to the following observations regarding the relationship between the two variables under consideration:

Firstly, the relationship showed a positive trend. Secondly, the computed value of 'r' (0.318) was larger than the tabulated value (r = 0.279) with 82 degrees of freedom at 0.01 level of probability. Hence, the relationship was statistically significant at 0.01 level of probability.

Based on the above finding, the null hypothesis was rejected and hence, the researcher concluded that knowledge of pesticide use of the respondents had significant relationship with their attitude towards pesticide risk reduction. It is likely that if a person has adequate knowledge on pesticide use and if he puts that knowledge into practice and gains success, his attitude towards that subject matter will be positive. Gaber and Latif (2012) and Devi (2009) found similar relationships in their respective studies.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

Agriculture is the prime contributor to Bangladesh economy in respect to the growth and stability. Fruits are known to be the prime source of food for human beings in agriculture. Mango is a high potential and commercial fruit attacked by insect, pests and diseases. That is why mango growers use various types of pesticides. Over use of pesticide causes risks i.e. poisonings and chronic health hazard. They apply pesticides at different methods and use personal protective equipment (PPE). These reduce the acute and chronic health hazards i.e. risksof pesticides to the sprayers.

5.1.1 Characteristics of the mango growers

The major findings of the study were summarized below:

Age: The observed value of age ranged from 22 to 68, the average being 40.20 with a standard deviation of 11.05. Slightly more than half (51.2 percent) of respondents were in the young aged category followed by 34.5 percent middle and 14.3 percent under old categories.

Educational qualification: It ranged from 0 to 12. The mean and standard deviation were 4.77 and 3.90respectively. The highest proportion (41.7percent) of mango growers had secondary education compared to 22.6percent having primary education, 21.4percentrespondents can sign only, 11.9percentilliterate and only 2.40percent had above secondary level of education.

Farm size: Farm size varied from 0.21 to 1.77 hectares. The mean value of farm size was 0.86 hectares with a standard deviation of 0.35. Near about two-thirds (65.5percent) of the respondents had medium sized farms followed by 19.0percent had large sized and 15.5percent had small sized farm respectively.

Annual income: Annual income of the respondents ranged from 35to 90 with the mean of 58.76 and standard deviation 18.71.36.9 percentof the respondents had medium annual income, while 34.5percent had high and 28.6percenthad low annual income.

Information transfer: The information transfer scores of the respondents ranged from 16 to 36 against the possible range of 0 to 48 with a mean and standard deviation of 23.15 and 4.35 respectively. Near about three-fourths (73.8percent) of the respondents had medium, 16.7 percent of the respondents had high and 9.5 percent of the respondents had low information transfer respectively.

Knowledge on pesticide use: More than three-fourths (78.6percent) of the respondents had medium, 14.3 percent of the respondents had high and 7.1 percent of the respondents had low knowledge on pesticide use respectively.

Personal hygiene and sanitation practices: The good proportion of the mango growers(91.66 percent) who handle pesticide reported they did not do training and check-up health before pesticide exposure. However, Most of the mango growers (65.48 percent) handle pesticide ate or drank at workplace. After pesticide use 40.48 percent take shower while 69.05 percent do not change cloths before and after pesticide exposure.

Use of Personal Protective Equipment (PPE): Most of the mango growers i.e. 70.24 percent use safety shoes, 60.71 percent use cap, 23.81 percent use gloves, traditionally 22.62 percent use towel as mask, 11.90 percent use safety glasses and only 4.76 percent use shirt as apron during pesticide application.

Practice of pesticide: Most of the mango growers i.e. 90.48 percent were unaware about pesticide exposure level, 80.95 percent were not instructed or suggested to use safe pesticide handling methods, 72.62 percent do not read the written information on pesticide packages; 78.57 percent could not understand and 66.67 percent did not give attention to the written information on pesticide packages.

5.1.2 Attitude towards pesticide risk reduction

Computed scores of the growers ranged from 10 to 40 with the possible range from 0 to 48 and the mean value was 25.88 with a standard deviation of 4.24. Nearly two-thirds (66.2 percent) of the respondents had less favorable attitude followed by 21.3 percent had medium favorable and only 12.5 percent had high favorable attitude towardspesticide risk reduction.

5.1.3 Relationship between Selected Characteristics of the Mango Growers and their Attitude Towards Pesticide Risk Reduction

Out of six tested null hypotheses, three were rejected. Among these, educational qualification, information transfer and knowledge on pesticide use showed a positive significant relationship with their attitude towards pesticide risk reduction. On the other hand, age, farm size and annual income did not show any significant relationship with the attitude towards pesticide risk reduction. Age also showed a negative trend.

5.2 Conclusions

Based on the findings and their logical interpretations the following conclusions have been drawn:

1. The study findings strongly support the approach of attitude towards pesticide risk reduction which is the major concern for the study area. The mango growers of the study area become aware and conscious about pesticide exposure level and attitude could not be the less favorable attitude converted to highly favorable of the mango growers.

2. (a) Education is generally a contributing factor for gaining knowledge and upgrading the education level of the respondents would contribute to the development of their favorable attitude offering effective education to the respondents may be very useful in forming their favorable attitude towards pesticide risk reduction.

   (b) Though information transfer had significant positive relationship with pesticide risk reduction it may be concluded that the respondents had a great opportunity to connect the information source which could develop favorable attitude towards pesticide risk reduction.

   (c) Knowledge as a component of attitude is very important and has further been proved and confined in this study. Therefore, it may be concluded that if knowledge on pesticide use could be increased, then the attitude towards pesticide risk reduction could also be enhanced.

3. Good proportion of the mango growers reported that they use PPE including safety shoes; cap and gloves etc. However, some complained that they were not aware about PPE. They were also instructed for the use of PPE.

4. As most of the respondents had given negative response against the six questions related to personal hygiene and sanitation. So, it may be concluded that sanitation and personal hygiene facilities may be improved for favorable attitude towards pesticide risk.

5. Change in practice leads to reduce pesticide risk would be implemented continuous education and training programs for mango growers on pesticides handling.

5.3 Recommendations

On the basis of the findings and conclusions of the study, the following recommendations were put forward:

1. It was observed thathighest proportion ofmango growershad less favorable attitude towards pesticide risk reduction due to their unawareness and lack of knowledge. So, The DAE and different pesticide companies like ACI, Syngenta etc. should take necessary actions and set program to train-up the pesticide handlers' for safe pesticide use and its exposure level.

2. For production of agricultural product, to meet the demand of large number of people in the recent world, it becomes a tradition and simple way to use pesticide for protection of the crops from different types of harmful insects and pests. So, farmers can't think production of fruits and agricultural crops without pesticide. Thus, the government and different private agencies should give special emphasis on this issue and take supportive measures so that awareness can be created in user levels for future betterment to environment including human health.

5.3.1 Recommendations for policy implications

1. The personnel of various pesticide companies who are involved in marketing of pesticide including pesticide dealers should have more technical background and skill to effectively train and become aware the respondents about pesticide risks.
2. Program may be set in order to increase the knowledge level of the respondents to pesticide risk. This may be initiated through providing effective training by government and non-government organizations.
3. As the respondents are not adapted to the use of personal protective equipment, so, any initiatives related to this may be started with the younger farmers. DAE and concerned NGOs may take care for it.

5.3.2 Recommendations for further study

A short term and sporadic study being conducted in some specific location cannot provide all information for proper understanding about attitude towards pesticide risk reduction and other related matters. Further studies should be undertaken covering more dimensions of knowledge and attitude towards pesticide risk reduction. The following recommendations are suggested in this connection:

1. The present study was conductedon attitude towards pesticide risk reduction in two selected unions of Sadarupazila under Dinajpur districts of Bangladesh. Findings of this study should be verified by similar research in other working areas.
2. The study was based on attitude towards pesticide risk reduction. Their attitude in other areas needs proper investigation.
3. Relationships of six selected characteristics of the respondents with their attitude towards pesticide risk reduction have been investigated in this study. Further research should be conducted to explore the relationship of other characteristics of pesticide risk reduction with their attitude.
4. Further study should be conducted to explore attitude of extension agents towards pesticide risk reduction.
6. Findings indicated that there was no relationship of age, farm size, and annual income with their attitude towards pesticide risk reduction. Further investigation is necessary to find out such relationship in other part of the country.

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Appendix A

Department of Agricultural Extension

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Attitude Towards Pesticide Risk Reduction of the Mango Growers

Date: Serial no. . . . . .

a) Name of the respondent . . . . . b) Fathers name . . . . . .
c) Village . . . . . d) Union . . . . . .
e) Upazila . . . . . f) District . . . . . .

(Please answer the following questions and put tick(√) whenever necessary)

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

2. **Educational qualification:** Please state of your educational qualification.
   a) Passed class . . . . . .
   b) Do not read and write . . . . . .
   c) Can sign name only . . . . . .

3. **Farm size:** Please indicate the area of land in your possession.

Sl. No.	Type of land use	Land area		Total area (hectare)
		Local unit	Hectare	
1.	Land under own cultivation			
2.	Land taken from others on borga			
3.	Land given to others on borga			
4.	Land taken from others on lease			
5.	Homestead area			
Total farm size=A_1+1/2 (A_2+A_3)+A_4+A_5				

4. **Annual income:** Please indicate the production and income from different sectors in the last year.

Sl. No.	Sources of income	Amount of production	Price per unit (Tk)	Total (tk)
A.	Agricultural crops			
1.	Mango			
2.	Rice			
3.	Jute			
4.	Potato			
5.	Vegetables			
B.	Business/Service			
C.	Others (if any)			

5. **Information transfer:** Please indicate your extent of use of information sources regarding the use of pesticide in mango cultivation.

Sl. No.	Information sources	Extent of information use			
		Regularly	Occasionally	Rarely	Not at all
1.	**Mass media**				
a)	Watching agricultural TV program/ month				
b)	Reading agriculture related newspaper/week				
c)	Reading agriculture related poster/ week				
d)	Reading agriculture related leaflet/ season				
2.	**Group media**				
a)	ICM club meeting/year				
b)	Farmers' training/season				
c)	Farmers field day /year				
3.	**Personal media**				
a)	Sub-Assistant Agriculture Officer/ month				
b)	Pesticide dealer /week				
4.	**personal localite**				
a)	Neighbor/month				
b)	Ideal farmer/week				
c)	Varsity staff/week				

6. **Knowledge on pesticide use:** Please indicate your opinion from the following questions.

Sl. No.	Questions	Total marks	Marks obtained
1.	Name two pests of mango plants.	2	
2.	Name two diseases of mango plants.	2	
3.	Mention two pesticides needed for controlling mango disease.	2	
4.	Mention three names of granular pesticides.	3	
5.	Mention two alternate way of pest control except pesticide.	2	
6.	Name two sprayingequipments commonly used in Bangladesh.	2	
7.	What do you mean by pesticide exposure level?	3	
8.	Mention any two pesticide exposure level used in mango production.	2	
9.	Which brand of pesticide you used in general?	1	
10.	What time is not suitable for spraying?	1	
Total		20	

7. **Personal hygiene and sanitation practices:**Please indicate your answer from the following questions.

Sl. No.	Questions	Farmer's response	
		Yes	No
1.	Do you change clothes before and after pesticide exposure?		
2.	Do you wash your hands after pesticide exposure?		
3.	Do you shower after pesticide exposure?		
4.	Do you eat or drink at the workplace?		
5.	Do you take medical check-up and proper trainingbefore pesticide application?		
6.	Do you avoid any windy and sunny weather beforeusing of pesticides?		

8. **Use of Personal Protective Equipment (PPE):**Please indicate the use of PPE from the following types.

Sl. No.	Name of the PPE	Farmer's response	
		Yes	No
1.	Gloves		
2.	Safety shoes		
3.	Mask		
4.	Aprons		
5.	Safety glasses		
6.	Cap		

9. **Practice of pesticide:** Please indicate your answer from the following questions.

Sl. No.	Questions	Farmer's response	
		Yes	No
1.	Are you aware of pesticide exposure level?		
2.	Did you read information written on pesticide packages?		
3.	Could you understand the information written on pesticide packages?		
4.	Do you give attention to the written information on pesticide packages?		
5.	Have you been instructed or suggested about safe pesticide handling methods?		
6.	Are you aware of pesticide exposure level?		

10. **Attitude towards pesticides:** Please indicate your opinion in respect of the following statements.

Sl. No.	Statements	Extent of opinion				
		SA	A	U	D	SD
1. (+)	We can get high production using pesticides					
2. (-)	I think for reducing pesticide risk farmers should use alternative methods (such as pheromones and microbial pesticides)					
3. (+)	Pesticide helps to reduce the attack of pest					
4. (-)	Pesticide is harmful for skin and eyes					
5. (+)	A careful applicator can minimize dangers associated with pesticides by using precautionary measures					
6. (-)	Most of the health problems are due to the use of pesticides intensively					
7. (+)	Growers applying pesticides need additional training on proper and safely use of pesticides					
8. (-)	Use of pesticide has a long term effect of cancer					
9. (+)	Soil quality increases due to use of pesticide					
10. (-)	Use of chemical pesticides is not sustainable					
11.(+)	Soil micro-organisms are disintegrated due to use of pesticides					
12. (-)	Application of pesticides caused environmental hazards					

SA= Strongly Agree, A= Agree, U= Undecided, D= Disagree, SD= Strongly Disagree

Thanks for your co-operation.

.....

Signature of the interviewer with date

APPENDIX B

Correlation matrix of the dependent and independent variables

	X_1	X_2	X_3	X_4	X_5	X_6	Y
X_1	1						
X_2	-0.368**	1					
X_3	0.153	0.179	1				
X_4	0.171	0.213	0.427**	1			
X_5	-0.111	0.469**	0.017	0.169	1		
X_6	-0.124	0.463**	0.035	0.278*	0.370**	1	
Y	-0.015	0.454**	0.064	0.191	0.243*	0.318**	1

** Correlation is significant at the 0.01 level,

* Correlation is significant at the 0.05 level

Legend,

X_1 = Age

X_2 = Educational qualification

X_3 = Farm size

X_4 = Annual income

X_5 = Information transfer

X_6 = Knowledge on pesticide use

Y = Attitude towards pesticide risk reduction