

EFFECT OF USING AGRO-CHEMICALS IN BANANA CULTIVATION

BY

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A thesis

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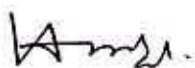
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CERTIFICATE

This is to certify that the thesis entitled “**Effect of Using Agro-chemicals in Banana Cultivation**” submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in Agricultural Extension and Information System**, embodies the result of a piece of bona fide research work carried out by **Atish Chakma**, Registration No. 27621/00839 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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**DEDICATED
TO
MY BELOVED PARENTS**



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LIST OF ABBREVIATIONS

AEO- Agriculture Extension Officers

ASSP- Agricultural Support Services Project

BRAC-*Bangladesh Rural Advancement Committee*

BDO- Block Development Officers

BBS-*Bangladesh Statistical Bureau*

CARE-*Co-operative for American Relief Everywhere*

DNIDA-*Danish International Development Agency*

DAE- *Department of Agricultural Extension*

FAO- Food and Agriculture Organization

FFS- Farmer Field School

EC- European Commission

NPFCSP- National Food Policy Capacity Strengthening Programme

VWL- *Village Level Workers*

VEOs- Village Extension Officers

USAID- United States Agency for International Development

df- degree of freedom

et al- and other

EFFECT OF USING AGRO-CHEMICALS IN BANANA CULTIVATION

ABSTRACT

The main purpose of the study was to determine the extent of effect of using agro-chemical in banana cultivation as perceived by the banana growers. The study was conducted in Monohordi upazilla of Narsingdi, Kapasia upazilla of Gazipur and Madhupur upazilla of Tangail districts. Five villages were purposively selected from each of the selected upazillas. Banana growers of these selected villages constituted the population of the study. A total of 150 banana growers constituted the sample for the study by taking 10 from each village and 50 from each upazilla. The study was a part of a research project entitled "Effect of using agro-chemicals and hormones for cultivation and marketing of vegetables and banana" which was carried out with the support of the National Food Policy Capacity Strengthening Programme, People's Republic of Bangladesh, USAID, European Commission and FAO. The data were collected from the sample respondents through personal contact with the help of a pretested interview schedule during the period from January to June, 2008. The independent variables were: age, level of education, family size, farm size, commercialization of banana, annual family income, marketing opportunity, training exposure, benefits derived from agro-chemicals, problems faced in using agrochemicals and use of agro-chemicals. Data collected from the respondents were compiled, coded, tabulated and analyzed in accordance with the objectives of the study. An overwhelming majority (87.3 percent) of the respondents perceived low to medium effect of using agro-chemicals in banana cultivation towards food adulteration compared to 0.7 percent high effect and 12.0 percent no effect. Level of education and problems faced in using agrochemicals of the respondents had significant positive relationship with the effect of using agro-chemicals in banana cultivation but farm size had significant negative relationship with the effect of using agro-chemicals in banana cultivation as perceived by the respondents.



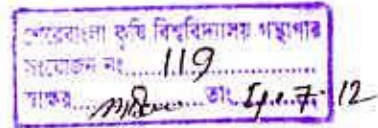
Chapter 1

Introduction



Chapter I

INTRODUCTION



1.1 General Background

Farmers of Bangladesh produce many crops for human consumption as well as industrial use. These crops have natural enemies like insects and diseases. Large quantities of crops are damaged by these insects and pests every year. Due to continuous crop cultivation without following cropping rotation the soil loses its fertility. To save the crop from their enemies and to maintain the soil fertility, scientists have discovered and applied chemical control measures of insects and diseases like chemical pesticides, chemical fertilizers, hormones, etc.

Modernizing banana cultivation led use to modern technologies such as high yielding varieties, planting system, irrigation, fertilizers, pesticides etc. Due to introduction of these technologies in banana farming several adverse impacts have appeared to the environment.

Sattar (1994) reported many problems about adverse effect or hazardous action of chemicals in soils, crops human health, air, water and other environments and some of the major problems like (i) decrease the organic matter and iodine content in soils, soil hardening, increased acidity or alkalinity (ii) cause disease to certain fish species (iii) decreased population of soil organisms including earth worms and reduce soil fertility (iv) change the taste and quality of some fruits, vegetables (v) pollute the surface as well as ground water etc. Fertility status of the land has decreased by extensive use of chemical fertilizers. Soil organic matter status reduced to 0.5 percent and acidity of the land has also increased in some parts of the country (Anonymous, 1994). Toxicity of ammonium chloride decreases the pH value of water until a concentration of free CO₂ is reached which is itself toxic to fish (Albaster and Herbert, 1954). Pesticide pollution and fertilizer wastes also caused microbial degradation in soil (Garg *et al.*, 1994). Excessive use of chemical fertilizers also reduces water conservation capacity of soil (Khaleque, 1993 and Reazuddin, 1994).

Chemicals and hormones are also being used in harvested crops at the time of marketing. Most of these chemicals are harmful to human body. By using excess chemical fertilizers, the chemical composition of harvested crops may change. For marketing banana the farmers and wholesalers often use various types of chemicals unconsciously. They do not know the proper doses of these chemicals. The products grown with chemical fertilizers and chemical pesticides are understood to lower the quality of the products and create health hazards. The farmers who use these chemicals are affected first, and those who eat the poisoned products are affected consequently. Environmentalists and nutritionists warn that if the farmers and wholesalers increase the use of chemicals and hormones in farming, harvesting, storing, transporting and marketing injudiciously food adulteration might also be increased tremendously. In this regard, Murakami (1991) established a vicious cycle of chemical agriculture and showed that the ultimate result of using chemical inputs in agricultural crops is food quality degradation (Figure 1.1).

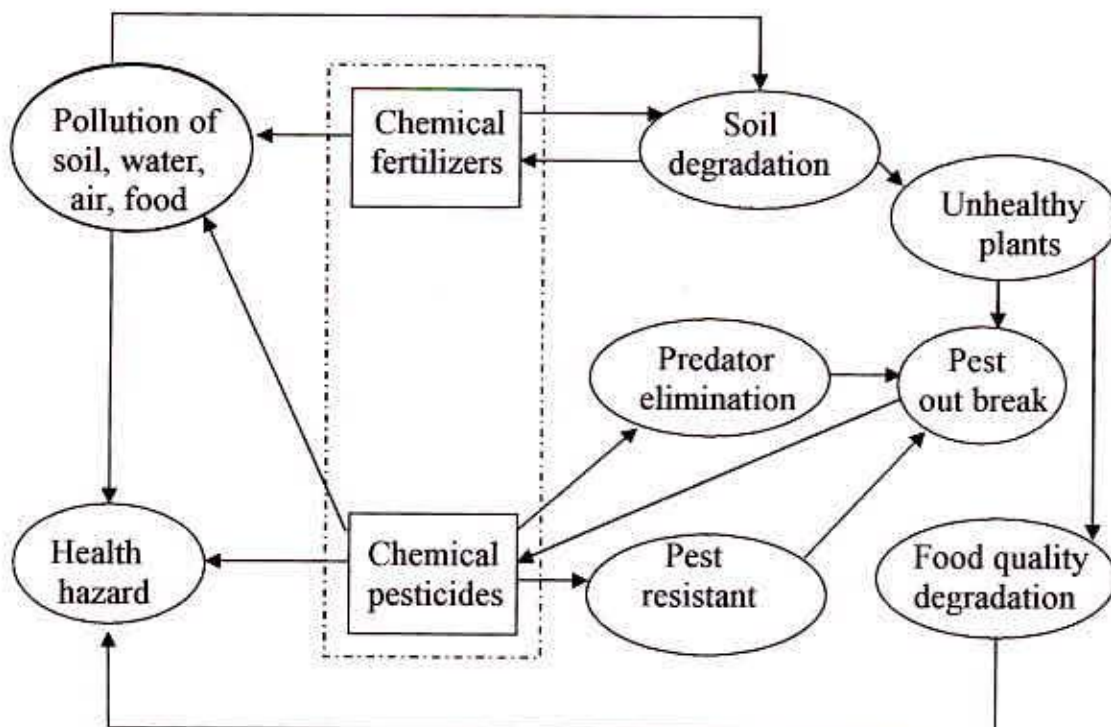


Figure 1.1 Vicious cycle of chemical agriculture

Agro-chemicals are excessively used for vegetable cultivation and banana production and marketing. But very little or limited research work has so far been done to

determine the effects of using agrochemicals. Therefore the researchers felt it was necessary to conduct the research entitled “Effects of using agro-chemicals in Banana cultivation”.

1.2 Statement of Problem

The rapid increase in the use of pesticides in agriculture in recent years has led to concern about its environmental effects. Two dangers are of particular importance in this context. Firstly, pesticides use can have adverse health effect for the farm workers and others exposed to pesticides. Secondly, it might contaminate the ground and surface water, harming downstream users of that water and damaging inland fisheries (Pagiola, 1995). The use of chemical fertilizers for production creates a strong nutritional imbalance in soils by increasing the reserve of particular nutrients or decreasing the initial status through enhanced uptake by crops. Chemical fertilizers also affect the physical, chemical and biological properties of soil. These adverse soil properties ultimately create a strong imbalance in soil ecology and affect the crop yields. The organic fertilizers, on the other hand, tend to maintain good soil fertility without significant yield decline.

From different viewpoints, it is clear that agro-chemicals have serious affect on ecosystem. Non-judicious use of it 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 fibre while maintaining or increasing soil productivity, farm productivity, and environmental quality. Goals in achieving success in sustainable agriculture will not be possible if the millions of banana growers do not perceive the consequences of the use of agro-chemicals in proper perspective and behave accordingly.

In view of the above consideration, the present study would attempt to fin out the answers to the following research question:

1. What were the characteristics of the banana growers involved in their perception on the effect of using agro-chemicals in banana cultivation?
2. What were the perceptions of the banana growers on the effect of using agro-chemicals in banana cultivation?
3. What were the relationships of the selected characteristics of the banana growers with their perception on the effect of using agro-chemicals in banana cultivation?

1.3 Specific Objectives

The following specific objectives were selected in order to give proper direction of the study.

1. To determine and describe some selected characteristics of Banana growers and the selected characteristics were:
 - a) Age
 - b) Level of education
 - c) Family size
 - d) Farm size
 - e) Commercialization of Banana
 - f) Annual family income
 - g) Marketing opportunity
 - h) Training exposure
 - i) Benefits derived from agro-chemicals
 - j) Problem faced in using agro-chemicals
 - k) Use of agro-chemicals
2. To determine the extent of effect of using agro-chemical in Banana cultivation as perceived by the banana growers.
3. To explore the relationship between the selected characteristics of the banana growers and the effect of using agro-chemicals in Banana cultivation as perceived by them.

1.4 Justification of the Study

Bangladesh is an agro-based country and most of the people in the country live in villages and they are directly or indirectly involved in agriculture. They are closely related with modern agricultural technologies. In one side, agro-chemicals increase yield and production but in another side it affects the whole environment. Banana is important fruit crop in Bangladesh. Commercial banana growers are using Agro-chemicals in non-judicious way. As a result, many adverse effects might be occur.

In Bangladesh many government and non-government organizations (like CARE, DANIDA, Intercooperation, Oxfam, BARC, PROSHIKA) are working in the fields of agriculture and rural development. Sustainable agricultural growth and protection of environment are the issues of high priority today. The present research work tried to find out the effect of using agro-chemical in Banana cultivation as perceived by the banana growers. The findings of this research might be useful to those who are concerned with planning, budgeting, implementation, monitoring and evaluation of agricultural program, rural development activities, environmental protection programs and market development program. The knowledge and skills gained by the researcher in conducting this research might help him to conduct similar other studies in the similar field and different crops in future.

Various agro-chemical companies and farms could also make use of the findings of this research in determining policies and practices for introducing and the marketing of their products.

1.5 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 Banana growers with the effect of using agro-chemicals in Banana cultivation. The related characteristics are age, level of education, family size, farm size, commercialization of banana,

annual family income, marketing opportunity, training exposure, benefits derived from agro-chemicals, problems faced in using agrochemicals, Use of agro-chemicals.

1.6 Assumptions of the Study

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

- i) The respondents, included in the sample were capable of furnishing proper responses to the questions included in the interview schedule.
- ii) Views and opinions furnished by the respondents were the representative views and opinions of the whole population of the study.
- iii) The responses furnished by the respondents were reliable. The researcher was well adjusted to the social environment of the study area. So the respondents gave their opinions without any hesitation.
- iv) All the data concerning the independent and dependent variables were normally and independently distributed with their respective means and standard deviation.
- v) The findings of the study might have general applications to other parts of the country with similar personal, socio-economic and cultural conditions.

1.7 Limitation 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:

- i) The study was confined to Monohordi upazilla of Narsingdi, Kapasia upazilla of Gazipur and Madhupur upazilla of Tangail districts.
- ii) Population for the present study was kept confined within the heads of farm families in the study area.
- iii) There were many characteristics of the banana growers in the study area but only eleven of them were selected for investigation.

- iv) The researcher was depended on the data furnished by the selected respondents during their interview with him.
- v) Facts and figures collected by the researcher applied to the situation prevailing during the year 2008.

1.8 Definition of Terms

Certain terms have been used in this research report which are defined and interpreted as follows for clarity of understanding.

Effect

It has been referred to the result of any kind of activity that is expected or unexpected by one and does or does not positively contribute to crop production, economic, environment and socio-cultural aspect.

Agro-chemicals

It refers to the chemical, fertilizers and pesticides which are frequently used for banana cultivation by the banana growers.

Chemical fertilizers

Chemical fertilizers may be defined as the materials of synthetic origin which are added to soil to provide one or more plant nutrients. For example, urea, TSP, potash, etc. is the main chemical fertilizers which are frequently used in agriculture specially in banana cultivation.

Pesticides

Pesticides refer to those chemical products which are used to save the banana plants form the damage of pests and diseases.

Banana growers

The term 'banana growers' refers to an individual who is engaged in banana cultivation directly or indirectly on lands owned by himself or received from others (by Share cropping, lease, etc.) or partly owned and partly received from others.

Age

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

Level of education

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

Family size

Family size refers to the number of member including the respondent himself/herself, his/her wife/husband children and other permanent dependents, who live and eat together in a family unit.

Farm size

Farm is the total land area devoted to the maintenance of farming enterprise by banana growers. It included the homestead, own land under own cultivation, land taken from or given to others on share cropping, land taken from others on lease.

Commercialization of Banana

Commercialization of Banana of an individual referred to the ration of value of banana sold and total value of banana raised. It was expressed in percentage.

Annual family income

Annual family income of a banana growers is referred to the total earning by him and other members of his family from agricultural (field crop, fish, livestock, poultry, fruits and vegetables and timbers, etc.) and other sources (service, business, etc.) during a year. Annual family income of the respondent also included the cost of maintaining his family. It was expressed in Taka.

Marketing opportunity

Marketing opportunity is the smooth process of handover goods or products from growers to consumers through direct or via some channels.

Training exposure

It refers to the total number of days that a respondent received training in his entire life from different organizations under different training program.

Benefits

Benefits means any types of positive gain of the banana growers that was obtained from specific interventions.

Problem faced

Problem means any difficult situation which requires some actions to minimize the gap between “what ought to be” and “what is” The term problem faced refers to different problems faced by the banana growers in using agro-chemicals.

Use of agro-chemicals

In this study, use of agro-chemical is the status of application of chemical fertilizers, pesticide and hormone for the production of banana.





Chapter 2

Review of literature



Chapter II

REVIEW OF LITERATURE

To carry out the research program review of literature gives the clear and concise direction of the researcher. In this Chapter, review of literatures relevant to the objectives of this study is presented. This was mainly concerned with farmers' perception the effect of using agro-chemicals in Banana cultivation. There was serious dearth of literature with respect to research studies on this aspect. So the directly related literatures were not readily available for this study. Some researchers addressed various aspects of farmers' role, their opinion on extension program and its effect on client group and suggesting strategies for their emancipation from socio-economic deprivations. A few of these studies relevant to this research are briefly discussed in this chapter under three sections. The first section is concerned with concept of effectiveness of using agrochemicals in crop production or related aspects. The second section contains the review on the past studies in concerning the relationships between dependent and independent variables. Conceptual framework of the study is cited in the third section.

2.1 Concept of effectiveness of using agrochemicals in crop production or related aspects

Effectiveness refers to the degree of results of any kind of activity that is expected or unexpected by one and does or does not positively contribute to crop production, economic, environment and socio-cultural aspect.

Hovland and Wesis (1951) observed that the effectiveness of source in communicating developmental information to the rural people depends on the people's perception on the credibility of these sources.

Bettinghous (1973) observed similar finding that if an individual was rated by the receivers as highly credible, the supposition would be that such an individual would have, because of his characteristics, great persuasive abilities.

Vroom (1964) concluded that effectiveness fully depends on function of ability and motivation. However, abilities and motivations of individuals are largely determined by his characteristics (Anwar, 1994). Vinake (1962) has shown that a number of characteristics of an individual affect the quality and quantity.

Sinha and Prasad (1966) reported that village level workers (VWL) were working very effectively while the role of Agriculture Extension Officers (AEO) and Block Development Officers (BDO) as source of information was almost negligible.

Tripathy and Pandey (1967) reported that indirect methods were most effective followed by personal contact, demonstration, group discussion and literature. Radio, film show and meeting were moderately effective. Tours, exhibits and fairs were less effective. They also reported that effectiveness of extension teaching methods differed in the following contexts. Effectiveness of methods for all improved practices differ significantly as a whole; they differ significantly from each other for the same practice, rate of adoption is positively related to effectiveness of methods; and number of methods employed has positive correlation to the rate of adoption.

Rajaguru and Satapathy (1971) observed that field agent was most effective followed in descending order by neighbour and friend, literature, VLW, radio, AEO, and film show. The most interesting finding is that BDO was not contacted at all by farmers at any of the five stages.

Deep (1978) stated that ineffective groups are those that cannot work together as a team toward the same objective. Cameron (1980) argued that organization can be effective when a group reaches its goal (according to goal model). Organization can be effective when internal processes are operating well (according to internal process model). It may be stated that there is a great significant positive relationship between group effectiveness and its member's performance. This is because when individual performance is upto mark, the group becomes effective. The goal achievement is significant factor of effectiveness and group process is also an important factor which helps the group to be effective.

In “before-after” design, Canada (1983) tested the effectiveness of four posters in opinion change among 200 student of Western Leyte. Pre-exposure data on opinion showed a significant difference in the four campaign areas-nutrition, family planning, reforestation, and environmental conservation. But post-exposure data did not. Also a significant change in opinion took place in each of the campaign area.

Huque (1985) ascertained the effectiveness of the “Primer” in two co-published editions with the Filipino change agents. Using a validated criterion-referenced test, he found a significant difference in the performance scores of the subjects’ one group being treated with English edition and the other with Cebuano edition. The posttest scores in both the group were significantly higher at 0.01 level of probability compared to their pretest scores.

Paul (1989) observed that as regards effectiveness of result demonstration 74 percent farmers opined it as high in comparison to 21 percent medium and only 5 percent low. In other words, 95 percent of the farmers considered result demonstration either as medium or high in respect of their effectiveness.

Suyanarayana *et al.* (1990) revealed that 65 percent of the contact farmers were effective in influencing other fellow farmers, 23 percent of the contact farmers were more effective, and 12 percent were less effective. It was particularly observed that the contact farmers who effectively used extension teaching methods were significantly successful in extension knowledge on improved technology to other farmers in the area of their operation.

Mohanan (1992) stated that in Gambhira collective farming co-operative group member’s effectiveness has no significant relationship with their age, family size, working members in his family, education level, average value assets, farm size, value of house and cattleshed, value of livestock, value of consumer durables, total incomes, per capita income and farm employment.

Majydan (1996) determined the effectiveness of 11 communication media by farmers’ perception on four message characteristics adequateness, understandability, and

applicability and persuasiveness. Based on the comprehensive perception indices, farm magazine, newspaper and extension publication (leaflet, booklet, etc.) obtained ranks of 8th, 9th and 11th, respectively. The perception means of the interpersonal and mass media were 847 and 580, respectively. He concluded that interpersonal media dominate over the mass media in their relative effectiveness.

Walker (1996) in his article reported that the aim of Agricultural Support Services Project (ASSP), which began in 1992, was to improve the operational and organizational efficiency and effectiveness of the Bangladesh Department of Agricultural Extension. A mid-term review was conducted of the ASSP in 1994 and is reviewed in Agricultural Research and Extension Network paper No. 59c and No. 61 (ODI 1996). This briefing note updates events in Bangladesh since the 1994 review. Mention is made of the Jessore Pilot Program which is based on local needs assessment and local planning and extension approaches, including need assessment, bottom up extension planning and targeting.

2.2 Review of Past Studies Concerning the Relationship between Dependent and Independent Variables

Ten characteristics of the Banana growers were selected as independent variables of the study. The researcher made utmost effort to search out studies dealing the relationships of the selected characteristics of the farmers with the effect of using agro-chemicals in Banana cultivation and found that only a few such relevant works were done in home and abroad. As a result, there is a serious dearth of research works. So, directly no study concerning effect of using agro-chemicals in Banana cultivation was available. However, some studies showing relationships between selected characteristics of the Banana growers and effectiveness of different aspects are cited here. Generally effectiveness and perception helps to increase level of effectiveness, awareness, knowledge and attitude towards adverse effect of using agro-chemicals. So, the cited review studies, though not directly concerned, are supposed to indicate some dimensions of effectiveness.

2.2.1 Age and effect of using agro-chemicals

Hamid (1997) made a survey to determine the awareness of farmers on environment. He found that age of the farmers had negative relationship with the awareness on environmental pollution.

Islam *et al.* (1998) conducted a survey to determine the awareness to farmers on environmental and obtained a negative correlation with the awareness on environmental pollution.

Hanif (2000) found in his study that there was a positive significant relationship between age of the respondents and their awareness on environmental pollution in case of farmer field school (FFS) farmers. He also found that there was a negative insignificant relationship between age of farmers and their awareness on environmental pollution.

Sutradhar (2002) found in his study that there was positive insignificant relationship between age of the respondents and their awareness on the environmental degradation caused by the use of modern agricultural technologies.

2.2.2 Education and effect of using agro-chemicals

Sutradhar (2002) found that in his study there was positive significant relationship between age of the respondents and their awareness on the environmental degradation caused by the use of modern agricultural technologies.

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

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

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

Islam *et al.* (1998) observed that education of the farmers had significant positive relationship with the awareness on environmental pollution.

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

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

Whhab (1975) in his study on attitude of farmers towards use of fertilizers observed that there was positive relationship between education and attitude towards the use of phosphorus and potash fertilizers while the relationship was not significant in case of use of phosphorus and potash fertilizers.

Sharma and Sharma (1970) studied farmers awareness of important contagious bovine diseases. He found that there was a significant positive relationship between literacy of the farmers and their awareness of bovine diseases.

2.2.3 Family size and effect of using ago-chemicals

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

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

Sutardhar (2002) found in his study that there was positive significant relationship between Family size of the respondents and their awareness on the environmental degradation caused by the use of modern agricultural technologies.

2.2.4 Farm size and effect of using ago-chemicals

Wahhab (1975) studied on the attitude of farmers towards the use of fertilizers and found that farm size had a negative but not statistically significant relationship with

the attitude towards the use of urea but had positive significant relationship towards the use of phosphorus and potash fertilizers.

Karim *et al.* (1987) carried out the study on attitudes of farmers towards use of urea in jute cultivation and found that farm size of the farmers had significant and positive relationship with their attitude towards the use of urea.

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

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

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

Sutardhar (2002) found in his study that there was positive significant relationship between farm size of the respondents and their awareness on the environmental degradation caused by the use of modern agricultural technologies.

2.2.5 Commercialization and effect of using agro-chemicals

Karim *et al.* (1987) revealed that commercialization of farmers had positive significant relationship with their attitude towards the use of urea.

2.2.6 Annual family income and effect of using agro-chemicals

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

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

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

Sutardhar (2002) found in his study that there was positive significant relationship between annual income of the respondents and their awareness on the environmental degradation caused by the use of modern agricultural technologies.

2.2.7 Market opportunity and effect of using agro-chemicals

There were no available literature related to the relationship between market opportunity of using agro-chemicals and its effects.

2.2.8 Training exposure and effect of using agro-chemicals

Rayapareddy and Jayarmiah (1989) working on village extension officers (VEOs) knowledge of rice production technology with application of chemicals and found that training had significant positive relationship with the knowledge level of VEOs.

Karim and Hossain (1995) observed that the farmers differed significantly in their knowledge in Banana cultivation based on their exposure to training. Hossain (2001) found that the length of the respondents had positive relationship with their knowledge of crop cultivation.

2.2.9 Benefit and effect of using agro-chemicals

There were no available literature related to the relationship between benefits of using agro-chemicals and its effects.

2.2.10 Problem faced and effect of using agro-chemicals

Rashid and Mahbob (1987) revealed that the highest proportion (46 percent) of the farmers had high problem conformation. While about one-third (31 percent) had medium problem faced and less than one-fourth (23 percent) had low problem faced. It generally observed that the greater the problem faced by an individual in any work, the less is the progress in that work. It is, therefore, likely that the problem faced of

the farmers will have adverse effective on their progress in farming which leads to change attitude.

Akanda *et al.* (1997) revealed that majority of the farmers (80.95) percent) had high problem confrontation compared to 16.19 percent having medium and 2.69 percent having low problem conformation.

Karim *et al.* (1997) found that the majority (64 percent) of the growers had high problem confrontation, while 32 percent had very high and only 4 percent had medium problem conformation.

2.2.11 Use and effect of using ago-chemicals

There were no available literature related to the relationship between use and effect of using agro-chemicals and its effects.

2.3 Conceptual framework of the study

The scientific research, selection and measurement of variables constitute an important task. The hypothesis of a research while constructed properly consists 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 researcher introduces, removes or varies the independent variables (Townsend, 1953). An independent variable is that factor which is manipulated by the researcher in her attempt to ascertain its relationship to an observed phenomenon. Variables together are the causes and the phenomenon is effect and thus, there is cause effect relationship everywhere in the universe.

The conceptual framework of Rosenberg and Hovland (1960) was kept in mind while making structural arrangements for the variables. This study is concerned with the effect of using agro-chemicals in banana cultivation. Thus, the effect of using agro-chemicals in banana cultivation was the dependent variable and 11 selected characteristics of the Banana growers were considered as the independent variables. Problems of an individual may be affected through interacting forces of many independent variables. It was not possible to deal with all independent variables in a

single study. It was therefore the independent variables were age, level of education, family size, farm size, commercialization of banana, annual family income, marketing opportunity, training exposure, benefits derived from agro-chemicals, problems faced in using agrochemicals, Use of agro-chemicals. In the light of the foregoing discussion, a conceptual framework has been developed for this study, which is diagrammatically presented in the Figure 2.2

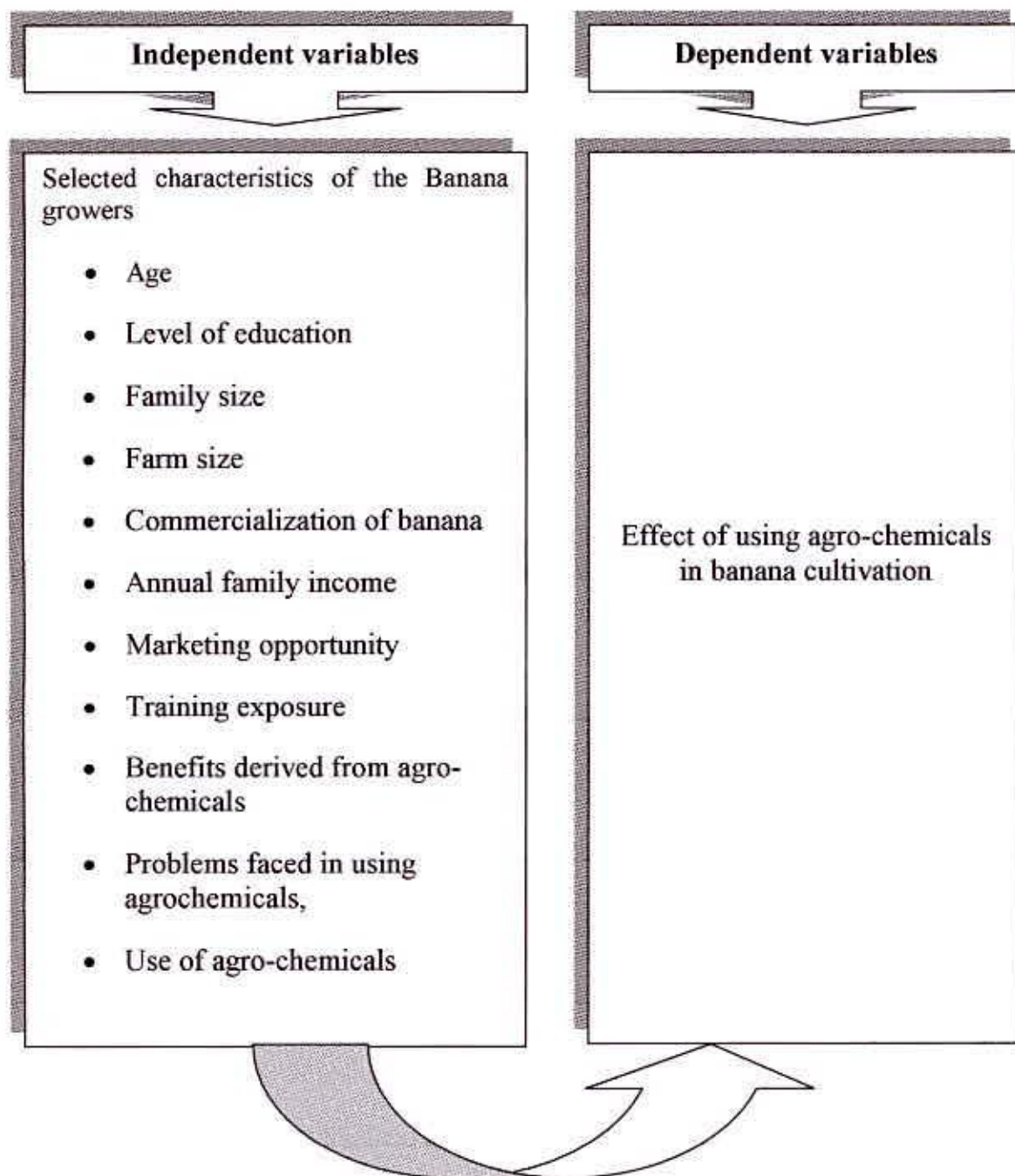



Figure 2.2 The conceptual framework of the study



Chapter 3

Methodology

Chapter III

METHODOLOGY



Methodology plays an important role in a scientific research. A researcher should be very careful in formulating methods and procedures in conducting research. Methodology should be such that would enable the researcher to collect valid and reliable information and to analyze that information to arrive at correct conclusions. The methods and procedures followed in this study have been described in this chapter.

3.1 Locale of the study

The study was conducted in Monohordi upazilla of Narsingdi, Kapasia upazilla of Gazipur and Madhupur upazilla of Tangail districts. For clarity of understanding a map is presented in Figures 3.1 showing the study area.

3.2 Population and Sampling

Five villages were purposively selected from each of the selected upazillas. Banana cultivators of these selected villages constituted the population of the study. Ten banana cultivators were purposively selected from each selected village. Thus, a total of 150 banana growers constituted the sample banana growers for the study (Table 3.1).

Table 3.1 Study area and sample banana growers

District	Upazilla	No. of Villages	No. of sample banana growers
Narsingdi	Monohordi	5	50
Gazipur	Kapasia	5	50
Tangail	Maodhupur	5	50
Total		15	150

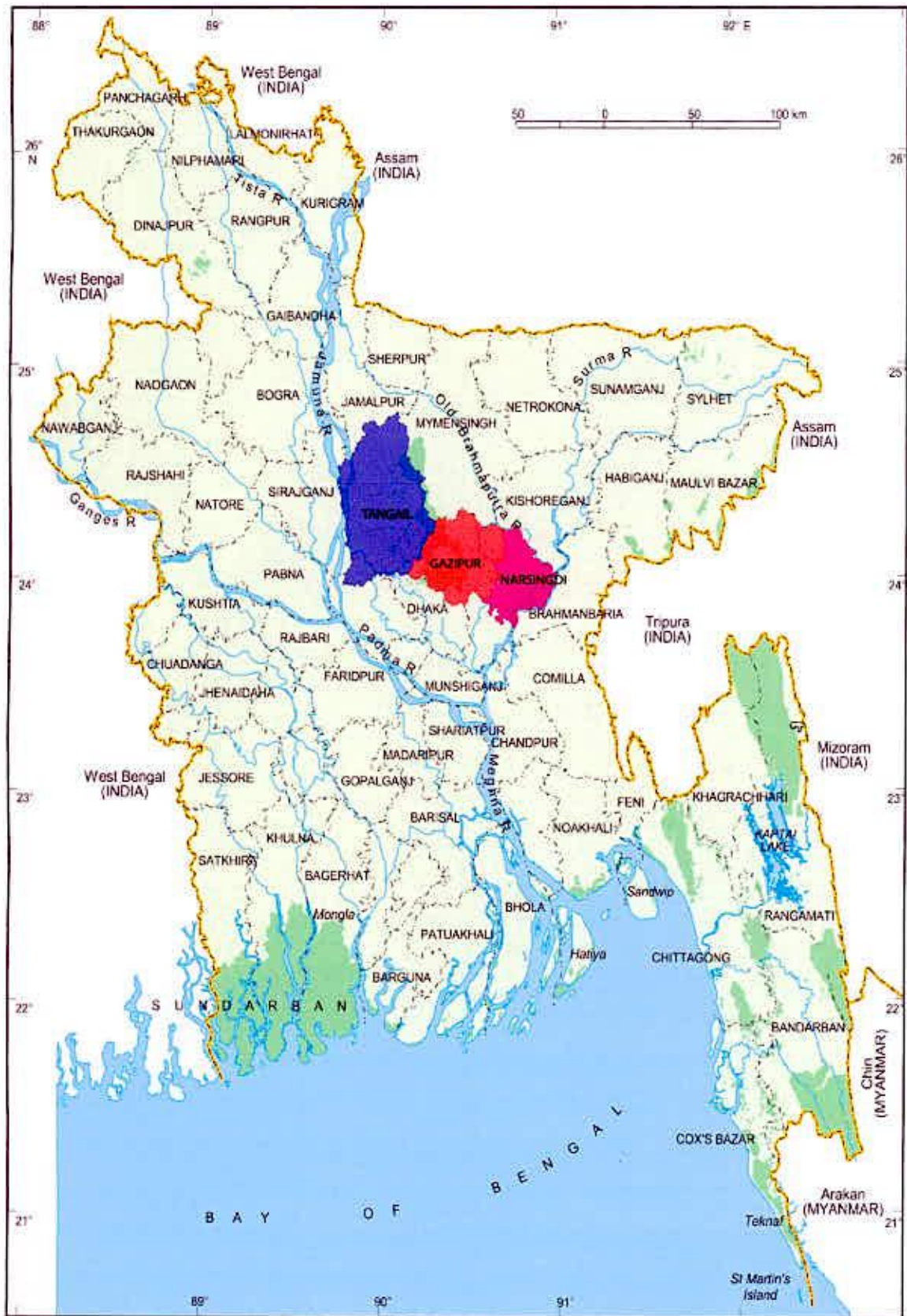


Figure 3.1 Maps of Bangladesh Showing Narsingdi, Gazipur and Tangail Districts

3.3 Variables of the Study

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

The selection of independent of variables required a very careful deliberation and comprehensive search. Taking into account the relevant available literature, discussion with teachers, experts and research fellows in the relevant field and considering the time and resources available to the researcher were the primary basis for selecting the variables. The researcher selected eleven characteristics of the Banana growers as the independent variables. The selected characteristics of Banana growers included age, level of education, family size, farm size, commercialization of Banana, annual family income, marketing opportunity, training exposure, benefits derived from agro-chemicals, problems faced in using agrochemicals and use of agro-chemicals.

The effect of using agro-chemicals in banana cultivation was the dependent variable of this study. A variety of factors might influence the effect of using agro-chemicals in Banana cultivation and it is very difficult to deal with all the related factors in a single study.

3.3.1 Measurement of Independent Variables

The eleven selected characteristics of the Banana growers were selected as independent variables of this study. Procedures followed in measuring these characteristics have been described below:

3.3.1.1 Age

Age of a Banana grower referred to the period of time from his/her birth to the time of the interview. The age of Banana growers was measured in terms of years which were obtained from him during interview.

3.3.1.2 Level of education

Educational qualification was measured in terms of grades (class) passed by a respondent. If a person received education outside the school, his education was assessed in terms of educational standard of the school. One (1) score was assigned for one year of successful schooling. For example, if a respondent passed the final examination of class V, his education score was taken as 5, if a respondent had education outside school and the level of education was equivalent to that of class V of the school, then his education score was taken as 5. Each illiterate person who can not read or write was given a score of 0 (zero). A person not knowing reading or writing but able to sign only was given a score of 0.5.

3.3.1.3 Family Size

Family size was measured by the total number of family members of the respondent including himself/herself, his wife/husband, children and other dependent fully or partially on respondent's income. The total number of family members was considered as the family size score of a respondent. For example, if a respondent has 7 members in his family his family size score was taken as 7.

3.3.1.4 Farm size

Farm size was measured in terms of actual operating land a respondent had in his authority. It included homestead, cultivated land owned by a banana growers, land taken from others on lease area and land taken from or given to others on half-share basis. The farm size of the respondents was computed in terms of hectares by using the following formula:

$$FS = A + B + C + \frac{1}{2} (D + E)$$

Where,

FS = Farm size

A = Homestead area

B = Own land under own cultivation

C = Land taken from others on lease

D = Land taken from others as half-share basis

E = Land given to others as half-share basis

The total area of land thus obtained was considered as the farm size score of the respondent.

3.3.1.5 Commercialization of banana

Commercialization of banana of a respondent was measured by using the following formula developed by Karim and Mahboob (1974) and used by Ali (2008):

$$\text{Commercialization of banana} = \frac{\text{Value of sold banana (Tk.)}}{\text{Value of total yield of banana (Tk.)}} \times 100$$

Relevant market price was used in determining the commercialization score of an individual. Commercialization of banana score of the respondents could range from 0 to 100, while 0 indicating no commercialization and 100 indicating very high commercialization of banana.

3.3.1.6 Annual family income

The annual family income refers to the total earnings of the respondent and the members of his family both from agricultural and non-agricultural sources during a year. It was expressed in taka. In measuring this variable, the total earning in taka of an individual respondent was converted into score. A score of one was given for every one thousand taka.

3.3.1.7 Marketing opportunity

Marketing opportunity was measured with help of the scale developed by Ali (2008). Marketing opportunity of a farmer was considered to be very suitable when the four indicators such as transport facilities, buying price of agricultural inputs, selling price of agricultural produces and storage facilities were very good, very low, very high and very good, respectively and vice-versa. In this connection, scoring system was used as follows-

Items	Scores				
	Very good (4)	Good (3)	Fair (2)	Bad (1)	Very bad (0)
Transport facilities	Very good (4)	Good (3)	Fair (2)	Bad (1)	Very bad (0)
Buying price of agricultural inputs	Very low (4)	Low (3)	Fair (2)	High (1)	Very high(0)
Selling price of agricultural produces	Very high (4)	High (3)	Fair (2)	Low (1)	Very low (0)
Storage facilities	Very good (4)	Good (3)	Fair (2)	Bad (1)	Very bad (0)

119 Respondents were asked on the above items and they gave responses as perceived by them. Finally marketing opportunity was determined by summing up all the scores of all the responses of a respondent. Thus, marketing opportunity score of a respondent could range from 0-16, where '0' indicated very low marketing opportunity and '16' indicated very high marketing opportunity.

3.3.1.8 Training exposure

7/0/14 Training exposure was operationalized by the total number of days a respondent attended in various training courses during his life.

3.3.1.9 Benefits derived from agro-chemicals

Benefits derived from agro-chemicals was computed for each respondent to determine his degree of benefit obtained on the basis of nine different items of benefit. The scale used for computing the benefits derived from agro-chemicals scores was large, moderate, little and no benefit and represent for 3, 2, 1 and 0, respectively.

Scores obtained for benefits to each of the above nine benefits item were added together to get the benefits derived from agro-chemicals score of a respondent. Benefits derived from agro-chemicals score of an individual could range from 0 to 27, where 0 indicated no benefits and 27 indicated very high benefit.

3.3.1.10 Problem faced in using agro-chemicals

Problem faced by the banana growers were measured by twenty problem items. The extent of problem was classified into high, medium, little and not at all for each problem item. The weights assigned against the classes were 3, 2, 1 and 0, respectively. Finally the score of problem faced by an individual in using agro-chemicals was determined by adding the scores obtained by him/her against all the twenty problems items. Thus, problem faced by the banana growers using agro-chemicals score could range from 0 to 60, where 0 indicated no problem and 60 indicating very high problem faced in using agro-chemicals.

3.3.1.11 Use of agro-chemicals

Three types of agro-chemicals namely chemical fertilizers, chemical pesticides and hormones were considered for banana cultivation. Farmers were asked to indicate their extent of use of these three types of agro-chemicals with four alternative responses as 'no use', 'low use', 'medium use' and 'high use. Weights were assigned for these alternative responses as 0, 1, 2 and 3, respectively for each of three types of agro-chemicals. Score of use of agro-chemicals of a respondent was determined by adding his/her scores of these three types of agro-chemicals. Thus, the score of use of agro-chemicals of the respondents could range from 0-9, where '0' indicated no use and '9' indicated very high use of agro-chemicals.

3.3.2 Measurement of Dependent Variable

Effect of using agro-chemicals in banana cultivation was the dependent variable of this study. It was measured on the basis of the perception of the banana growers on the effect of using agro-chemicals in banana cultivation. In measuring effect of using

agro-chemicals in banana cultivation, a 4-point rating scale was used. The scale contained five statements on the effect of using agro-chemicals in banana cultivation. On the basis of the perception of the banana growers with each of the statements a 4-point scale as 'large effect', 'moderate effect', 'little effect' and 'not at all effect' of using agro-chemicals was used and weights were assigned to these alternative responses as 3, 2, 1 and 0, respectively. The effect of using agro-chemicals in banana cultivation score of a respondent was determined by adding up the weights for responses obtained by him/her against all the five statements. Therefore, score of effect of using agro-chemicals of a respondent could range from 0 to 15, where '0' indicated no effect and '15' indicated very high effect of using agro-chemicals in banana cultivation.

3.4 Data Gathering Instrument

A carefully designed interview schedule was used in collecting data. The draft interview schedule was prepared in Bengali in accordance with the objectives of the study. The interview schedule was pre-tested with 20 banana growers of the study area. Necessary corrections, alteration, addition and modifications were made in the interview schedule based on pre-test results. The modified and corrected interview schedule was then printed in Bengali for its final form. The English version of the interview schedule may be seen in Appendix I.

3.5 Collection of Data

Data were collected personally by the researcher himself from the sample through a door to door visit to all the selected banana growers. Appointments with the interviewees were made in advance with the help of local leaders. This helped the researcher to have a friendly orientation to the banana growers. To obtain valid and pertinent information, the researcher made all possible efforts to explain the purpose of the study to the respondents. Rapport was established with the banana growers prior to interview and the objectives were clearly explained by using local language to possible extent. Moreover, as an extra care, the researcher managed a rural youth of

the respective areas to assist him in establishing rapport with the respondents. Whenever, any respondent faced difficulty in understanding a question care was taken to explain the same adequately. At the time of data collection, the researcher was also aware about side talking and tried to avoid that problem tactfully. Data were collected by the investigators during the period of January to June 2008 by face to face interviews with banana growers.

3.6 Data Processing

Qualitative data were converted into quantitative data by means of suitable scoring wherever necessary. Data obtained from the respondents were first transferred to a master sheet, then compiled, tabulated and analyzed in accordance with the objectives of the study.

3.7 Categorization of Respondents

For describing the independent and dependent variables, the respondents were classified into appropriate categories. In developing categories, the investigator was guided by the nature of data and general considerations prevailing in the social system. The procedures for categorization have been discussed while describing the variables in Chapter IV.

3.8 Statistical Treatment

Data collected for the study were compiled, coded, tabulated and analyzed in accordance with the objectives of the study. The used statistical measurement in describing the selected dependent and independent variables were frequency and percent distribution, range, mean and standard deviation. For clarity of understanding, tables were used for presentation (in chapter IV). To find out the relationships between independent and dependent variables Pearson's Product Moment Co-efficient of correlation 'r' was computed. Five percent (0.05) level of probability was used as the basis for rejecting any null hypothesis. If the computed 'r' value was equal or large than the table value at 0.05 level of probability with (n-2) degree of freedom, the null

hypothesis was rejected and it was concluded that there was a significant relationship between the variables concerned. If the computed 'r' values were found to be smaller than the table value at 0.05 level of probability, the concerned null hypothesis could not be rejected and led to the conclusion that there was no significant relationship between the concerned variables.



Chapter 4

Results and Discussion

Chapter IV

RESULTS AND DISCUSSION

This chapter deals with the findings that were recorded in accordance with the objective of the study. It contains findings and possible interpretation of the recorded information. The chapter has three (3) sections. The first section deals with the characteristics of the respondent banana growers. The second section deals with the effect of using agro-chemicals in banana cultivation as perceived by the banana growers. The third section deals with the relationship between individual characteristics of the respondents with the effect of using agro-chemicals in banana cultivation as perceived by them.

4.1 Characteristics of the Banana growers

Banana growers possess various interrelated characteristics that influence their perception on the effect of using agro-chemicals in banana cultivation. It was therefore, hypothesized that the characteristics of the respondents would have an effect on the perception of the effect of using agro-chemicals in banana cultivation. However, the salient features of eleven selected characteristics of the respondents such as age, level of education, family size, farm size, commercialization of banana, annual family income, marketing opportunity, training exposure, benefits derived from agro-chemicals, problems faced in using agrochemicals and use of agro-chemicals are presented below:

4.1.1 Age

The age of the banana growers ranged from 14 to 86 years. The mean and standard deviation were 41.38 and 11.48 respectively. Considering the observed age the respondents were classified into three categories namely 'young', 'middle' and 'old'. The distribution of the banana growers on the basis of their age is presented in Table 4.1.

Table 4.1 Distribution of the Banana growers according to their age

Categories (Years)	Banana growers		Mean	Standard deviation
	Number	Percent		
Young aged (upto 35)	60	40	41.38	11.48
Middle aged (36-50)	63	42		
Old aged (above 50)	27	18		
Total	150	100		

Table 4.1 indicates that the middle aged banana growers constitute the highest proportion (42 percent) followed by young aged (40 percent) and the lowest (18 percent) proportion was made by the old aged category. Data also indicate that the young and middle aged banana growers constitute an overwhelming majority (82 percent) of the banana growers. The young and middle aged banana growers generally tend to be involved with banana cultivation than the oldest. In fact, banana growers who carry ability to take risk and think about the improved or modern agriculture they usually involved in banana cultivation. In this study, it was observed that young and middle aged people prefer to involve with banana cultivation.

4.1.2 Level of Education

The education of the banana growers ranged from 0 to 15 with the mean and standard deviation of 4.67 and 4.08, respectively. Based on their education, the banana growers were classified into five categories on 'illiterate' (0), 'can sign name only' (0.5), 'primary education' (1 to 5), 'secondary education' (6 to 10), and above secondary (above 10). The distribution of the banana growers according to their education is presented in Table 4.2.

Table 4.2 Distribution of the Banana growers according to their level of education

Categories (Schooling years)	Banana growers		Mean	Standard deviation
	Number	Percent		
Illiterate (0)	21	14	4.67	4.08
Can sign only (0.05)	36	24		
Primary education (1-5)	35	23.3		
Secondary education (6-10)	52	34.7		
Above secondary (above 10)	6	4		
Total	150	100		

Table 4.2 shows that (34.7 percent) of the banana growers had secondary level of education followed by 24 percent and 23.3 percent can sign only and primary level of education, respectively. Only 14 percent of the banana growers were illiterate and only 4 percent had above secondary level education. Education broadens the horizon of outlook of banana growers and expands their capability to analyze any situation related to needs. About 62 percent of the banana growers had primary to above secondary level educated. So, it is expected that literate and educated persons would have good outlook toward banana cultivation.

4.1.3 Family Size

Family size of the banana growers ranged from 1 to 18 with the mean and standard deviation of 5.99 and 2.30, respectively. According to family size, the banana growers were classified into three categories viz. 'small family', 'medium family' and 'large family'. The distribution of the banana growers according to family size is presented in Table 4.3.



Table 4.3 Distribution of the Banana growers according to their family size

Categories (No. of members)	Banana growers		Mean	Standard deviation
	Number	Percent		
Small family (upto 4)	39	26	5.99	2.30
Medium family (5-7)	85	56.7		
Large family (above 7)	26	17.3		
Total	150	100		

Data in Table 4.3 indicate that the medium family constitute the highest proportion (56.7 percent) followed by small family (26 percent). Only 17.3 percent banana growers had large family size. Such finding is quite normal as per the situation of Bangladesh. Table 4.3 also showed that average family size of the banana growers was higher than that of national average of 5.4 (BBS, 2005)

4.1.4 Farm size

The farm size of the banana growers ranged from 0.09 hectare to 12.15 hectare with a mean and standard deviation of 1.13 and 1.55, respectively. Based on their farm size, the banana growers were classified into four categories by following the categorization made by DAE (1999). These categories were marginal farm holder (upto 0.2 ha), small farm holder (0.201 to 1.0 ha) and medium farm holder (1.01 to 3.0 ha) and large farm holder (above 3.0 ha). The distribution of the banana growers according to farm size categories is presented in Table 4.4.

Table 4.4 Distribution of the Banana growers according to their farm size

Categories (ha)	Banana growers		Mean	Standard deviation
	Number	Percent		
Marginal (upto 0.2 ha)	4	2.7	1.13	1.55
Small (0.201-1.0 ha)	106	70.7		
Medium (1.01 to 3.0 ha)	32	21.3		
Large (above 3.01 ha)	8	5.3		
Total	150	100.0		

Table 4.4 indicates that small farm size holders constituted the large proportion (70.7 percent) of the banana growers. Only 21.3 percent of the banana growers respondents had medium farm size and 5.3 percent had large farm size and 2.7 percent had marginal farm size. From the findings it is observed that 92 percent of the banana growers were under the group of small and marginal farm size holder banana growers.

4.1.5 Commercialization of banana

Commercialization of banana score of the banana growers ranged from 72% to 99% with a mean and standard deviation of 93.0 and 4.57, respectively. According to the observed score of commercialization of banana the banana growers were classified into three categories viz. 'Low commercialization, 'medium commercialization and 'high commercialization'. The distribution of the banana growers according to commercialization of banana is presented in Table 4.5.

Table 4.5 Distribution of the Banana growers according to commercialization of banana

Categories (percentage)	Banana growers		Mean	Standard deviation
	Number	Percent		
Low commercialization (72% to 81%)	12	8	93.0	4.57
Medium commercialization (82%- 90%)	84	56		
High commercialization (> 91 to 99%)	54	36		
Total	150	100		

Data in Table 4.5 indicates that the medium levels commercialization of banana constitutes the highest proportion (56 percent) of the banana growers followed by high commercialization of banana (36 percent) and low commercialization of banana (8 percent). Table 4.5 again showed that an overwhelming majority (92%) of banana growers belonged to the medium to high commercialization of banana. More commercialization of banana could create opportunity for increasing production area and use of agro-chemicals for maximum yield and benefit of banana.

4.1.6 Annual family income

Annual family income of the banana growers ranged from 12 to 860 thousand taka with the mean and standard deviation of 131.64 and 43.80 respectively. On the basis of their annual family income, the banana growers were classified into three categories as low, medium and high annual family income. The distribution of the banana growers according to their annual family income is presented in Table 4.6.

Table 4.6 Distribution of the Banana growers according to their annual family income

Categories ('000 Taka)	Banana growers		Mean	Standard deviation
	Number	Percent		
Low income (upto 100)	60	40	131.64	43.80
Medium income (101-300)	75	50		
High income (above 300)	15	10		
Total	150	100.0		

Data in Table 4.6 revealed that the banana growers having medium annual family income constitute half (50 percent) of the banana growers followed having medium annual income (40 percent) and low annual income constitute the lowest proportion (10 percent). Finding again revealed that 60% of the banana growers had medium to high annual income. It means that bananas are commercially grown by the medium and high income category farmers.

4.1.7 Marketing opportunity

Marketing opportunity scores of the banana growers ranged from 4 to 14 with the mean and standard deviation of 11.23 and 1.00, respectively. According to marketing opportunity, the banana growers were classified into three categories viz. 'low', 'medium' and 'high opportunity' on the basis of their observed scores and the distribution unity is presented in Table 4.7.

Data in Table 4.7 indicate that the medium opportunity constitutes the overwhelming majority (88 percent) of the banana growers. Only 10% and 2 percent had high and low marketing opportunity, respectively. More marketing opportunity could influence

for increasing yield and benefits of the banana growers. The findings also indicate that there were homogenous opportunity of marketing for the banana growers and it was moderate in nature.

Table 4.7 Distribution of the Banana growers according to marketing opportunity

Categories (opportunity)	Banana growers		Mean	Standard deviation
	Number	Percent		
Low (upto 9)	3	2	11.23	1.00
Medium (10-12)	132	88		
High (above 12)	15	10		
Total	150	100		

4.1.8 Training exposure

The scores of training exposure of the banana growers ranged from 0 to 7, with an average of 0.008 and standard deviation of 0.75. Based on their training exposure, the banana growers were classified into the two categories i.e., no training and low training exposure. The distribution is shown in the Table 4.8

Table 4.8 Distribution of the Banana growers according to their training exposure

Categories (Score)	Banana growers		Mean	Standard deviation
	Number	Percent		
No training (0)	144	96	0.008	0.75
Low training (1)	6	4		
Total	150	100		

Overwhelming majority (96 percent) of the banana growers had no training and only 4 percent had low level training of 1 to 7 days. Nobody had high training on banana cultivation. The banana growers training exposure indicate that the banana growers of the study area did not get sufficient information about modern agricultural technology.

The study areas were the major banana cultivating area of Bangladesh and the growers were cultivating banana inheritably.

4.1.9 Benefits derived from agrochemicals

Benefits derived from agro-chemicals scores of the banana growers ranged from 6 to 27 against the possible range from 0-27. The mean and standard deviation of benefits derived from agro-chemicals score was 16.11 and 4.05 respectively. On the basis of benefits derived from agro-chemicals scores, the banana growers were classified into three categories namely, 'low benefit', 'moderate benefit' and 'sound benefit. The distribution of the respondents according to their benefits derived from agro-chemicals given in Table 4.9.

Table 4.9 Distribution of the Banana growers according to benefit derived from agro-chemicals

Categories (score)	Banana growers		Mean	Standard deviation
	Number	Percent		
Low benefit (upto 10)	14	9.3	16.11	4.05
Medium benefit (11-20)	102	68		
High benefit (Above 20)	34	22.7		
Total	150	100		

Data of Table 4.9 reveals that two-third (68 percent) of the banana growers derived medium benefit followed by 22.7 percent high benefit category and 9.3% low benefit by using agro-chemicals in banana cultivation. More benefit is to be considered as vision of an explanation in any aspect of the situation to take risk and use of concerned technology. It was assumed that for getting higher yield overwhelming majority (90.7%) of the banana growers derived medium to high benefits by using agro-chemicals in banana cultivation.

4.1.10 Problem faced in using agro-chemicals

Problem faced in using agro-chemicals score of the banana growers s ranged from 5 to 48 against the possible range from 0-60 with a mean and standard deviation of 27.99

and 8.31 respectively. Based on their problem faced in using agro-chemicals, the respondents were classified into three categories. These categories were 'low, medium and high problem faced'. The distribution of the banana growers is presented in Table 4.10.

Table 4.10 Distribution of the Banana growers according to their problem faced in using agro-chemicals

Categories (score)	Banana growers		Mean	Standard deviation
	Number	Percent		
Low problem (upto 20)	28	18.7	27.99	8.31
Medium problem (21-40)	114	76		
High problem (above 40)	8	5.3		
Total	150	100.0		

Findings from the Table 4.10 revealed that more than three-fourths of the banana growers faced medium problem in using agro-chemicals compared to 18.7% and 5.3% low and high problems, respectively.

4.1.11 Use of agro-chemicals

Use of agro-chemicals score of the banana growers ranged from 2 to 9 with a mean and standard deviation of 6.3 and 0.99 respectively against the possible range of 0-9. According to use of agro-chemicals the banana growers were classified into three categories viz. 'Low user, medium user and 'high user'. The distribution of the banana growers according to use of agro-chemicals is presented in Table 4.11.

Table 4.11 Distribution of the Banana growers according to use of agro chemicals

Categories	Banana growers		Mean	Standard deviation
	Number	Percent		
Low use (1to 3)	2	1.3	6.3	0.99
Medium use (4 to 6)	55	36.7		
High use (7 to 9)	93	62		
Total	150	100		

Data in Table 4.11 indicates that majority (62 percent) of the banana growers were the high user of agro-chemicals compared to 36.7 percent medium user and 1.3 percent low user. It means that all the farmers were the user of agro-chemicals ranging from low to high level for getting higher yield.

4.2 Effect of using agro-chemicals

The observed scores of the perception of the banana growers on the effect of using agro-chemicals in banana cultivation ranged from 0 to 12 against the possible range from 0 to 15 with the average of 4.23 and standard deviation 2.29. The Banana growers were classified into four categories on the basis of their perception on the effect of using agro-chemical in banana cultivation 'no effect, low effect, medium effect and high effect. Distribution of the banana growers based on their perception on the effect of using agro-chemicals in banana cultivation is shown in Table 4.12.

Table 4.12 Distribution of the Banana growers according to the effect of using agro-chemicals

Categories (Score)	Banana growers		Mean	Standard deviation
	Number	Percent		
No effect (0)	18	12	4.23	2.29
Low effect (1 to 5)	99	66		
Medium effect (6 to 10)	32	21.3		
High effect (11 to 15)	1	0.7		
Total	150	100		

About two thirds (66 percent) of the banana growers perceived low effect compared to 21.3 percent receiving medium effect and 0.7 percent high effect of using agro-chemicals in banana cultivation towards food adulteration. It means that an overwhelming majority (88 percent) of the banana growers perceived low to high effect of using agro-chemicals in banana cultivation towards food adulteration.

4.3 Relationship of the selected characteristics of banana growers with the effect of using agro-chemicals in banana cultivation as perceived by them

Pearson Product Moment Correlation co-efficient was computed in order to find out the extent of relationship between the dependent variable and independent variables (Table 4.13). To reject a null hypothesis 0.05 level of significance was used.

Table 4.13. Results of Pearson's product moment correlation showing the relationship between the selected characteristics of the banana growers and effects of using agro-chemicals in banana cultivation as perceived by them

Dependent variable	Independent variable	Value of co-efficient of correlation	Tabulated value of "r" (N=150 with N-2 d f)	
			0.05	0.01
Effect of using agro-chemicals in banana cultivation as perceived by the banana growers	Age	-0.094 ^{NS}	0.160	0.210
	Level of education	0.167*		
	Family size	0.020 ^{NS}		
	Farm size	-0.192*		
	Commercialization of banana	-0.059 ^{NS}		
	Annual family income	-0.150 ^{NS}		
	Market opportunity	-0.017 ^{NS}		
	Training exposure	0.098 ^{NS}		
	Benefits derived from agro-chemicals	0.076 ^{NS}		
	Problems faced in using agro-chemicals	0.264**		
	Use of agro-chemicals	-0.033		

NS: Not significant

*: Correlation is significant at the 0.05 level

** : Correlation is significant at the 0.01 level;



4.3.1 Relationship between age and effect of using agro-chemicals

The coefficient of correlation between age of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be -0.094. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a negative trend between the concerned variables.*
- *The calculated value between the concerned variables 'r' (-0.094) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*

Based on the above findings it was concluded that age of the banana growers had non significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that age of the banana growers was not an important factor regarding effect of using agro-chemicals in banana cultivation.

4.3.2 Relationship between level of education and effect of using agro-chemicals

The coefficient of correlation between level of education of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.167. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a positive trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (0.167) was found to be greater than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis was rejected.*

- *The relationship between the concerned variables was statistically significant at 0.05 level of probability.*

Based on the above findings it was concluded that level of education of the banana growers had significant positive relationships with the effect of using agro-chemicals as perceived by them. This represent that level of education of the banana growers was an important factor regarding effect of using agro-chemicals in banana cultivation as perceived by them and with the increases of level of education the perception of the respondents increased that the use of agro-chemicals had positive effect on food adulteration. It is quite logical that educated persons had the ability to understand the negative effect of using agro-chemicals towards food quality.

4.3.3 Relationship between family size and effect of using agro-chemicals

The coefficient of correlation between family size of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.020. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a positive trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (0.020) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*

Based on the above findings it was concluded that family size of the banana growers had non significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that family size of the respondents was not an important factor regarding effect of using agro-chemicals in banana cultivation and with the increases of family size effect of using agro-chemicals

also increases. Family size of does not influence effect of using agro-chemicals in banana cultivation.

4.3.4 Relationship between farm size and effect of using agro-chemicals

The coefficient of correlation between farm size of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be -0.192. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a negative trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (-0.192) was found to be greater than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis was rejected.*
- *The relationship between the concerned variables was statistically significant at 0.05 level of probability.*

Based on the above findings it was concluded that farm size of the banana growers had significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that farm size of the banana growers was an important factor regarding effect of using agro-chemicals in banana cultivation. Farmers having large farm size were bound to use chemical input in their large banana garden. It was very difficult to use organic farming in large farm. For this reason, the large farmers perceived lower negative effect of using agro-chemicals in banana cultivation.

4.3.5 Relationship between commercialization of banana and effect of using agro-chemicals

The coefficient of correlation between commercialization of banana of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned

variables was found to be -0.059. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a negative trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (-0.059) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*

Based on the above findings it was concluded that commercialization of banana of the banana growers had non significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that commercialization of banana of the banana growers was not an important factor regarding effect of using agro-chemicals in banana cultivation and with the increases of commercialization of banana effect of using agro-chemicals also decreases.

4.3.6 Relationship between annual family income and effect of using agro-chemicals

The coefficient of correlation between annual family income of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be -0.150. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a negative trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (-0.150) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*

Based on the above findings it was concluded that annual family income of the banana growers had non significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that annual family income of the respondents was not an important factor regarding effect of using agro-chemicals in banana cultivation and with the increases of annual family income effect of using agro-chemicals also decreases.

4.3.7 Relationship between marketing opportunity and effect of using agro-chemicals

The coefficient of correlation between marketing opportunity of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be -0.017. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a negative trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (-0.017) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*

Based on the above findings it was concluded that marketing opportunity of the banana growers had non significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that marketing opportunity of the banana growers was not an important factor regarding effect of using agro-chemicals in banana cultivation. Marketing opportunity of the banana growers does not influence effect of using agro-chemicals in banana cultivation.

4.3.8 Relationship between training exposure and effect of using agro-chemicals

The coefficient of correlation between training exposure of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.098. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a positive trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (0.098) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non-significant at 0.05 level of probability.*

Based on the above findings it was concluded that training exposure of the banana growers had non-significant positive relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that training exposure was an important factor regarding effect of using agro-chemicals in banana cultivation. Training exposure of the banana growers influences effect of using agro-chemicals in banana cultivation.

4.3.9 Relationship between benefits derived from agro-chemicals and effect of using agro-chemicals

The coefficient of correlation between benefits derived from agro-chemicals of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.076. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a positive trend between the concerned variables.*

- *The calculated value between the concerned variables “r” (0.076) was found to be smaller than the tabulated value of ‘r’ (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non-significant at 0.05 level of probability.*

Based on the above findings it was concluded that benefits of the respondents derived from agro-chemicals had non-significant positive relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that benefits derived from agro-chemicals was an important factor regarding effect of using agro-chemicals in banana cultivation. Benefits derived from agro-chemicals influences effect of using agro-chemicals in banana cultivation.

4.3.10 Relationship between problems faced in using agro-chemicals and effect of using agro-chemicals

The coefficient of correlation between problem faced in using agro-chemicals of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be 0.264. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a positive trend between the concerned variables.*
- *The calculated value between the concerned variables “r” (0.264) was found to be greater than the tabulated value of ‘r’ (0.210) with 148 degrees of freedom at 0.01 level of probability.*
- *The null hypothesis was rejected.*
- *The relationship between the concerned variables was statistically significant at 0.01 level of probability.*

Based on the above findings it was concluded that problem faced in using agro-chemicals of the banana growers had significant positive relationships with the effect

of using agro-chemicals in banana cultivation as perceived by them. This represents that with the increases of problem faced in using agro-chemicals the perception on the effect of using agro-chemicals in banana cultivation towards food adulteration was increases. It is logical that persons facing larger problem were the less user of agro-chemicals and they perceived more negative effect of using agro-chemicals in banana cultivation towards food quality.

4.3.11 Relationship between use of agro-chemicals and effect of using agro-chemicals

The coefficient of correlation between use of agro-chemicals of the banana growers and the effect of using agro-chemicals in banana cultivation as perceived by them is presented in Table 4.13. The coefficient of correlation between the concerned variables was found to be -0.033. The following observations were made on the basis of the value of correlation coefficient between the two concerned variables:

- *The relationship showed a negative trend between the concerned variables.*
- *The calculated value between the concerned variables "r" (-0.033) was found to be smaller than the tabulated value of 'r' (0.160) with 148 degrees of freedom at 0.05 level of probability.*
- *The null hypothesis could not be rejected.*
- *The relationship between the concerned variables was statistically non significant at 0.05 level of probability.*

Based on the above findings it was concluded that use of agro-chemicals of the banana growers had non significant negative relationships with the effect of using agro-chemicals in banana cultivation as perceived by them. This represent that use of agro-chemicals of the banana growers was not an important factor regarding effect of using agro-chemicals in banana cultivation and with the increases of use of agro-chemicals effect of using agro-chemicals also decreases.



Chapter 5

Summary, Conclusions and Recommendations



Chapter V

SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Major Findings

The study was conducted in Monohordi upazilla of Narsingdi, Kapasia upazilla of Gazipur and Madhupur upazilla of Tangail districts. Five villages were purposively selected from each of the selected upazillas. Banana growers of these selected villages constituted the population of the study. Ten cultivators were randomly selected from each selected village. Thus a total of 150 banana growers constituted the sample of the study. The researcher himself collected data from the respondents through personal contact. The independent variables were: age, level of education, family size, farm size, commercialization of Banana, annual family income, marketing opportunity, training exposure, benefits derived from agro-chemicals, problems faced in using agrochemicals and use of agro-chemicals. Data collected from the respondents were compiled, coded, tabulated and analyzed in accordance with the objectives of the study. Various statistical measures such as frequency and percentage distribution, mean and standard deviation were used in describing data. Co-efficient of correlation test was used to explore the relationship between the concerned variables. The major findings of the study are summarized below:

5.1.1 Selected characteristics of the respondents

Age: Among the respondents the middle aged respondents constitute the highest proportion (42 percent) followed by young aged (40 percent) and the rest 18% were old.

Level of Education: Sixty two percent of the respondents had primary to above secondary level of education and rest 38% could sign their name sign only or were illiterate.

Family Size: Highest proportion (56.7 percent) of the respondents had medium family size compared to 26% and 17.3% had small and large family size.

Farm size: Overwhelming majority (92%) of the respondents had small to medium farm size.

Commercialization of banana: Overwhelming majority (92%) of the respondents had medium to high commercialization of banana.

Annual family income: Among the respondents 60% had medium to high annual family income and rest 40% had low annual family income.

Marketing opportunity: Overwhelming majority (88 percent) of the respondents had medium marketing opportunity.

Training exposure: Overwhelming (96%) of the respondents had no training exposure and 4 percent had low training exposure of 1 to 7 days training.

Benefits derived from agro-chemicals: Overwhelming majority (90.7 percent) of the respondents derived medium to high benefit by using agro-chemicals.

Problem faced in using agro-chemicals: More than three fourth (76%) of the respondents faced medium problem in using agro-chemicals.

Use of agro-chemicals

The high levels use of agro-chemicals constitutes the highest proportion (62 percent) followed by medium level use of agro-chemicals (36.7 percent) and low level use (1.3 percent).

5.1.2 Effect of using agro-chemicals

About two third (66 percent) of the respondents perceived low effect compared to 21.3 percent medium effect and 0.7 percent high effect of using agro-chemicals in banana cultivation. It means that an overwhelming majority (88 percent) of the respondents perceived low to high effect of using agro-chemicals in banana cultivation.

5.1.3 Relationship between the dependent and independent variables

Level of education and problems faced in using agrochemicals had significant positive relationship with effect of using agro-chemicals in banana cultivation but farm size had significant negative relationship. Family size, training exposure and benefit derived from agro-chemicals had non-significant positive relationship with effect of using agro-chemicals in banana cultivation but age, commercialization of banana, annual family income, marketing opportunity and use of agro-chemicals had non-significant negative relationships.

5.2 Conclusions

On the basis of findings of the study, the following conclusions are made:

1. An overwhelming majority (88 percent) of the farmers perceived low to high effect of using agro-chemicals in banana cultivation.

Therefore, it may be concluded that use of agro-chemicals in banana cultivation should be reduced gradually.

2. Level of education of the respondents had significant positive relationships with their perception on the effect of using agro-chemicals in banana cultivation. Therefore it may be concluded that educated persons had the real perception about the use of agro-chemicals in banana cultivation.
3. Farm size of the farmers had negative significant relationship with their perception on the effect of using agro-chemicals in banana cultivation. It was quite logical that farmers having large farm size were bound to use more agro-chemicals in their large farm.
4. Problems faced by the farmers in using agro-chemical had positive significant relationship with their perception on the effect of using agro-chemicals in banana cultivation. It was therefore concluded that farmers facing more problem in using agro-chemicals in banana cultivation had perceived higher negative effect of using agro-chemicals in banana cultivation.

5.3 Recommendations

5.3.1 Recommendations for policy implications

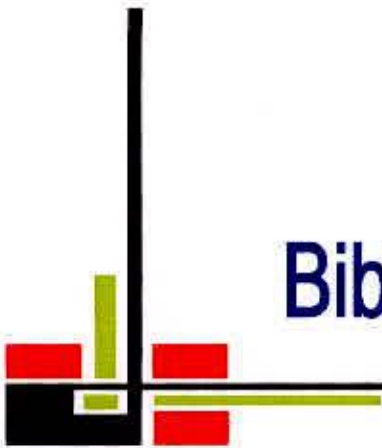
On the basis of the findings of the study and conclusion the following recommendations are made:

1. The concerned authorities like Department of Agricultural Extension (DAE) and other related organizations should take motivational campaign so that the farmers could reduce the use of agro-chemicals in banana cultivation gradually in a logical way.
2. As higher level of education could optimize the use of agro-chemicals in banana cultivation, it may be recommended that non-formal educational programs should be organized by the concerned authorities for the farmers to increase their level of education.
3. Farm size of the farmers had negative significant relationship with the effect of using agro-chemicals in banana cultivation. Therefore, it may be recommended that it is necessary to introduce cooperative cultivation system in banana cultivation with motivational campaign to reduce agro-chemicals specially for the large farmers.
4. Problems faced by the farmers in using agro-chemical had positive significant relationship with their perception on the effect of using agro-chemicals in banana cultivation. Therefore, it may be recommended that publicity, posters, and training may be arranged to create the scope to minimize the problem by reducing the use of agro-chemicals in banana cultivation.

5.3.2 Recommendations for further study

On the basis of the scope and limitations of the study and observations made by the researchers, the following areas were identified for further research:

1. This study was conducted in selected upazillas of three districts of Bangladesh, namely, Narsingdi, Gazipur and Tangail. It is recommended that such studies should also be conducted in other areas of Bangladesh.
2. There are many subject-matter areas on the effects of excess use of chemical inputs in banana cultivation. Further research is needed in connection with other aspects related to society and environment.
3. Banana was considered for this study. Further research is needed to determine the effect of excess use of chemical inputs in other fruits and vegetable cultivation.
4. Further research should be conducted to determine the effect of using other ripening agents, carbide and formalin for banana cultivation and marketing.



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Appendix

APPENDIX

Appendix I. Interview Schedule

**DEPARTMENT OF AGRICULTURAL EXTENSION AND INFORMATION SYSTEM
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA 1207**

An interview schedule for a research study entitle

“Effect of Using Agro-Chemicals in Banana Cultivation”

Serial No.....

Respondent Name :

Village :

Union :

Upazila :



[Please provide the following information. Your information will be kept confidential and will be used for research purpose only]

1. Age

What is your present age? Years

2. Education

What is the level of your education?

- a) Illiterate b. Can sign only c. Have passed class.....
- d. Did not read in School/Madrasha but can read and write and level of education is equivalent to class.....

3. Please mention the number of your family member

State the number of your family members.....

4. Farm size: Please mention your farm size

Sl. No.	Types of land	Land area	
		Local Unit	Hectares
A	Homestead area		
B	Own land under own cultivation		
C	Land taken from others on lease		
D	Land taken from others as half-share basis		
E	Land given to others as half-share basis		
Total: A+B+C+1/2(D+E)			

5. Commercialization of Banana

Please mention the following information

Banana cultivation area	Total yield	Unit price (Tk.)	Value of total yield	Amount of sold Banana	Value of sold Banana
Total					

Commercialization of Banana:.....%

6. Annual income

Please state the income of your family during last year

	Sl. No.	Source of income	Total income (taka)
i. Agricultural income	1.	Banana	
	2.	Other fruits	
	3.	Vegetables	
	4.	Field crops	
		a) Rice	
		b) Jute	
		c) Wheat	
		d) Pulse	
		e) Others	
	5.	Livestock	
	6.	Fisheries	
ii. Non-agricultural source	1.	Service	
	2.	Business	
	3.	Others	
Total (i + ii)			

7. Marketing opportunity

Please inform about your input purchase, product sale, storage and transportation facilities

Marketing facilities	Degree of facilities				
Transportation facilities	Very good	Good	Medium	Bad	Very bad
Buying price of inputs	Very low	Low	Medium	High	Very high
Sale price of products	Very high	high	Medium	low	Very low
Storage facilities of products	Very good	Good	Medium	Bad	Very bad

8. Training exposure: Did you receive any kind of agricultural training in the last five years?

Yes...../ No..... (If yes, please furnish the following information)

SL.	Title of training course	Duration	Training offering organization
1			
2			
3			
4			
Total			

9. Benefit derived from using agro-chemicals in Banana cultivation

Please state how much benefit you obtained from the following items

SL.	Items of benefit	Nature of benefit obtained			
		Large benefit	Moderate benefit	Little benefit	No benefit
1.	Plant nutrients can be supplied easily in banana fields by using chemical fertilizers				
2.	Insects can be controlled easily by using chemical insecticides in banana fields				
3.	Plant diseases can be controlled easily by using chemical pesticides in banana fields				
4.	Weeds can be controlled easily by using chemical herbicides in banana fields				
5.	Increased yield by using chemical fertilizers in banana fields				
6.	Increased yield by using chemical insecticides in banana fields				
7.	Increased yield by using chemical pesticides in banana fields for disease control				
8.	Increased yield by using chemical herbicides in banana fields for weed control				
9.	Increased yield by using hormones in banana fields				

10. Problem faced in using chemical inputs in banana cultivation

Please indicate the nature of problems faced by you in using chemical inputs in banana cultivation

SL.	Items of problem	Nature of problem faced			
		High problem	Medium problem	Little problem	Not at all problem
1.	High cost of chemical fertilizers				
2.	High cost of chemical insecticides				
3.	High cost of chemical pesticides for plant disease control				
4.	High cost of chemical herbicides for weed control				
5.	High cost of hormones that is used in banana cultivation				
6.	Impurity of chemical fertilizers				
7.	Impurity of chemical insecticides				
8.	Impurity of chemical pesticides that is used for banana diseases control				
9.	Impurity of chemical herbicides that is used for weed control in banana fields				
10.	Impurity of hormones that is used in banana cultivation				
11.	Chemical fertilizer create environmental hazards				
12.	Chemical insecticides create environmental hazards				
13.	Chemical pesticides for banana diseases				

	control create environmental hazards				
14.	Chemical herbicides create environmental hazards				
15.	Using hormones in banana cultivation create environmental hazards				
16.	Using chemical fertilizers degrade soil fertility				
17.	Chemical insecticides are harmful to beneficial insects like harmful insects				
18.	Using chemical pesticides degrade soil, water and air quality				
19.	Chemical herbicides are harmful to main crop like weed				
20.	Using hormones in banana cultivation create side effects				

11. Use of chemicals in banana cultivation

Please mention your extent of use of agrochemicals

Agro-chemicals	Extent of use			
	No use	Low use	Medium use	High use
Chemical fertilizers				
Chemical pesticides				
Hormone				

12. Effect of using agro-chemicals in banana cultivation

Please indicate your perception on the effect for using agro-chemicals in banana cultivation

SL.	Item of perception	Nature of perception			
		Large effect	Moderate effect	Little effect	Not at all effect
1.	Using chemical fertilizers in banana cultivation create human food adulteration				
2.	Using chemical insecticides in banana cultivation create human food adulteration				
3.	Using chemical pesticides in banana disease control create human food adulteration				
4.	Using chemical herbicides for weed control in banana cultivation create human food adulteration				
5.	Using hormones in banana cultivation create human food adulteration				

Thanks for your co-operation

Signature of the interviewer with Date

Appendix II. Correlation matrix

Variables	A	B	C	D	E	F	G	H	I	J	K	L
A	1.00											
B	-0.140	1.00										
C	0.336**	0.017	1.00									
D	-0.019	0.024	0.227**	1.00								
E	-0.030	-0.096	0.100	0.366**	1.00							
F	-0.042	0.027	0.016	0.428**	0.394**	1.00						
G	-0.108	0.029	-0.072	-0.004	-0.041	0.014	1.00					
H	0.017	0.121	-0.100	-0.007	0.076	0.346**	0.036	1.00				
I	-0.107	-0.028	0.004	0.167*	0.173*	0.242**	-0.145	0.140	1.00			
J	-0.133	0.013	-0.002	-0.094	-0.030	-0.153	-0.132	0.035	0.117	1.00		
K	-0.254**	-0.105	-0.053	0.210**	0.248**	0.278**	-0.010	-0.014	0.439**	0.223**	1.00	
L	-0.094	0.167*	0.020	-0.192*	-0.059	-0.150	-0.017	0.098	0.076	0.264**	-0.033	1.00

** : Significant at 0.01 level of probability;

A: Age

C: Family size

E: Commercialization of banana

G: Marketing opportunity

I: Benefits derived from agro-chemicals

K: Use of agro-chemicals

** : Significant at 0.01 level of probability

B: Level of education

D: Farm size

F: Annual family income

H: Training exposure

J: Problems faced in using agrochemicals

L: Effect of using agro-chemicals



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