ASSESSING PERCEPTIONS ASSOCIATED WITH AGROCHEMICAL USE ON FOOD PRODUCTION AMONG SMALLHOLDER FARMERS IN KIBOGA DISTRICT: A CASE STUDY OF KIBIGA SUB-COUNTY

BY

ANNET TEDDY BIRUNGI

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRO–ECOLOGY OF

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DEDICATION

I dedicate this book to my husband Edward who has been supportive and encouraging.

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I am grateful to my Supervisor, Masereka John Pius whose expertise, generous guidance and support made it possible for me to work on a topic that was of great interest to me. It was a pleasure working with him.

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ABRREVIATIONS AND ACRONYMS

CAN	Calcium Ammonium Nitrate
DDT	Dichlorodiethyltrichloethane
DAP	Diammonium phosphate
FAO	Food and Agriculture Organization
IPM	Integrated Pest Management
KAP	Knowledge, Attitudes and Practices
MAAIF	Ministry of Agriculture, Animal Industry and fisheries
OP	Organophosphate
POPs	Persistent Organic Pollutants
GDP	Gross Domestic Product
PMA	Plan for Modernization of Agriculture
UBOs	Uganda Bureau of Statistics
CVI	Content Validity Index
WHO	World Health Organization

ABSTRACT

The study was conducted to examine the perceptions associated with use of agrochemicals on food production in Kibiga Sub-County. The study was guided by the following objectives: to determine the farmers' knowledge, attitudes and practices associated with usage of agrochemicals; to establish the level of food production in Kibiga Sub-County and to examine the impact of farmers 'knowledge, attitudes and practices associated with agrochemicals on food production in Kibiga Sub-County. A case study research design was used. The study predominantly employed a quantitative approach but also used a qualitative approach. The study population consisted of 663 participants. A sample size of 248 respondents was selected using simple and purposive sampling techniques. It was established that all the respondents that took part in the study were mostly above the age of 30. The majority of respondents were between the ages of 40-49 (36.5%). For gender, the majority of the respondents were females (69.4%) and male (29.6%). These results show that gender representation indicated a bigger variation between the male and female with a difference of almost 50%. Academically, many of the respondents had primary school level of education (61.4%). In addition, it was established that (63%) of the respondents were married, 17.9% were single Quantitative data analysis mainly consisted of descriptive statistics (means and standard deviations) and inferential statistics (Spearman correlation and regression). Content analysis was used to analyze qualitative data. Findings revealed that the perceptions of farmers in Kibiga Sub-county were negatively affecting the usage of agrochemicals. It was found out that the level of food production in Kibiga Sub-county has been going down over years. This is because some households were reported to have hunger, their food taste has been declining and also the market is small. Lastly, it was established that farmers 'knowledge, attitudes and practices associated with agrochemicals had a negative impact on food production Kibiga Sub-County. This was because farmers' knowledge, attitudes and practices were reportedly negative towards agrochemicals use and this in the end affected food production. The recommendations were conducting research in areas such as IPM so as to improve food production, develop proper and effective information dissemination channels to ensure that farmers have adequate sources of technical information available on the safe use of the agrochemicals and Farmers should seek advice from agricultural stakeholders such as area agricultural officers.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This study was conducted as an assessment of perceptions associated with agrochemical use on food production among smallholder farmers in Kiboga District while using a Case Study of Kibiga Sub-County. The chapter presents the background to the study, statement of the problem, research objectives, research questions, conceptual framework, and significance of the study as well as the scope of the study, definition of key terms and justification.

1.1.Background to the study

Agriculture is arguably the most important sector of the Ugandan economy. Uganda has an estimated population of 34.6 million and an estimated population growth of around 3% per year, making it one of the fastest growing populations in the world. Around 80% of the population lives in rural areas, depending mostly on subsistence farming (UBOs census report, 2014). Like other developing countries in the world, Uganda has been experiencing rapid human population growth. This increase in human population goes along with rapid expansion of agricultural sector (Mati, 2005). The rapid expansion of the agricultural sector has resulted in increased demand for agrochemicals (Ariga, J, and Jayne,T, 2009).Ngowi A. V.F, (2003) noted that while industrialized countries have been taking significant steps to reduce agrochemicals, particularly pesticide, the use in developing nations is on the increase.

The emergency of agrochemicals in Uganda eclipsed from the common agricultural practices undertaken by the population which is subsistence farming. This form of farming is dominated by smallholder farmers who cultivate less than 2 hectares per household, report UBOS, 2014. Subsistence farming in the country is characterized by poor production which according to Ngow

et al.(2007) is caused by poor farming practices, poor soil fertility, pests, poor infrastructure and insufficiency of extension officers (Mati,2005).

The benefits of agrochemical usage by the early 2000s started to emerge in subsistence farming in Uganda. This was due to increased crops and animal yields and reduced post-harvest losses (Oerke, et al.1994). The benefits associated with the use of agrochemicals have resulted in an increase in the importation of assorted agrochemicals in the country.

The previous studies indicate that farmers misuse agrochemicals and this ends up affecting their food production. Although the Agricultural Chemicals Control Act (2006) clearly mandates the Agricultural Chemicals Board in the Department of Crop Protection of the MAAIF to regulate importation and use of agrochemicals in Uganda, the current status of agrochemical use in the country not good. Majority of Uganda's farmers are illiterate or semi-illiterate and they are unaware about how and when to use agrochemicals.

Integrated Pest Management (IPM) is an ecological approach to pest management as it discourages the use of pest control methods that have negative effects to the non target organisms. Around three quarters of all food crops globally primarily vitamin rich foods such as fruits and vegetables depend on insect pollinators. The vast majority of these pollinators are insects such as bees, moths, flies wasps and beetles (Klein et al., 2007).Inappropriate use of agrochemicals in farming systems could thus cause harm to non-target organisms including these pollinators.

In Uganda, and most African agricultural systems, IPM is not prioritized, particularly through government policies. Though many solutions to pest problems exist, farmers tend to rely on pesticides as the first choice of pest control measure. Knowledge on IPM and its utilization in Africa is limited probably due to lack of IPM policy in many countries (Loehr, B., Seif. A.A, and Nyambo, B., 1998).

Kibiga Sub-County in Kiboga district main economic activities are agricultural related including mixed farming (crops and livestock keeping). Major cash crops include coffee and cereals production with maize, beans and potatoes grown mainly as food crops. Major livestock cash enterprises include dairy cows, poultry, pigs and bee keeping. Pesticides, fertilizers, animal feeds and veterinary drugs are normally purchased through farm inputs stockists in trading centers. The study thus sought to assess the perceptions of smallholder farmers on agrochemical usage and food production using Kibiga Sub-county, Kiboga district, Uganda.

1.2. Problem Statement

The increasing population pressure and subsequent land fragmentation has led to intensive land use practices by farmers in Kibiga Sub-County. A big number of farmers in Kibiga Sub-County rely on cereal products which are usually prone to greater disease and pest infestations and therefore have resulted in increased application of agrochemicals in an effort to improve food production.

Despite the increased application of chemicals, Uganda's agriculture is continues to be characterized by low yields. Pests, vectors and diseases are noted among the main causes of losses in the agriculture sector. The impact of such losses on food production in the area cannot be under estimated. In fact, food production in Kibiga County was in a continuously reducing trend, UBOS report, 2014. It was observed that food production in the area had gone down about 8%. This was attributed to counterfeiting of agrochemical products which is rampant on the market, MAAIF report, 2010. In addition, absence of systematic organization in extension services and orderliness among farmers in Uganda has left many at cross roads. The successful usage of agrochemicals requires adequate knowledge on how farmers perceive pests, their attitude, beliefs and practices to

crop protection problems (Nordi, S. 2002). "Farmers make decisions on pest control ... on the basis of how they perceive the relevant factors and how they seek to achieve food production" (Mumford, 2011). However, in spite of the rapid increase in the quantity of pesticides consumed in Uganda, little is known about the effect of agrochemical use in terms of knowledge, attitudes and practices on food production. It was not yet established to what extent the observed decline in food production can be directly linked to small holders farmers perceptions associated with usage of agrochemicals. It was against this background that this study was conducted to assess the perceptions associated with use of agrochemicals on food production in Kibiga Sub-County, Kiboga District.

1.3 General objective

The general objective of the study was to examine perceptions of agrochemical use on food production in Kibiga Sub-County, Kiboga District.

1.4. Specific Objectives

i) To determine the farmers' knowledge, attitudes and practices associated with usage of agrochemicals

ii) To establish the level of agrochemicals use on food production in Kibiga Sub-County

iii) To examine the impact of farmers 'knowledge, attitudes and practices associated with agrochemicals on food production in Kibiga Sub-County

1.5. Research questions

i) What are the farmers' knowledge, attitudes and practices associated with usage of agrochemicals?

ii) What is the level of food production in Kibiga Sub-County in relation to agrochemical use?

What is the impact of farmers 'knowledge, attitudes and practices associated with agrochemicals on food production in Kibiga Sub-County?

1.6 Scope of the study

The scope of this study consisted of geographical, content and time scope.

1.6.1 Geographical scope

The study was done in Kibiga Sub County, Kiboga District. The study covered the farmers and agricultural Extension workers in Kibiga Sub County and Kiboga district. Kibiga was chosen because it was one of those central parts of Uganda where the application of agrochemicals has been noticed on food production.

1.6.2 Content scope

The study focused on perception associated with agrochemical use and food production. Perceptions associated with agrochemical use became the independent variable and these influenced by knowledge, attitudes and practices, whilst, food production became the dependent variable and this was measured using farmer's incomes, food access and availability at household level.

1.6.3 Time scope

The study focused on the time framed 2008-2016 because this was the period when food production in Kibiga Sub-county has been reducing, UBOS report, 2014.

1.7Significance of the study

The researcher expects the study outcome to contribute significantly to information and knowledge on food production in Uganda in relation to farmers' use of agrochemicals in their crop farming systems.

The present study will make an important contribution to an improved understanding of the effects of agrochemicals on food productivity in Uganda. Such an understanding is necessary for training on the safe use of agrochemicals.

The study will generate information on the impacts of agrochemicals on food production. Information can be used by other scholars as literature review to form basis for further research.

The research outcome can thus be used by Ministry of Agriculture, agrochemical companies and other stakeholders to raise awareness on usage of agrochemicals on food production in Uganda through training and information dissemination.

This information will be useful to the government and other stakeholders in developing appropriate policies for sustainable agricultural production.

1.8 Justification of the study

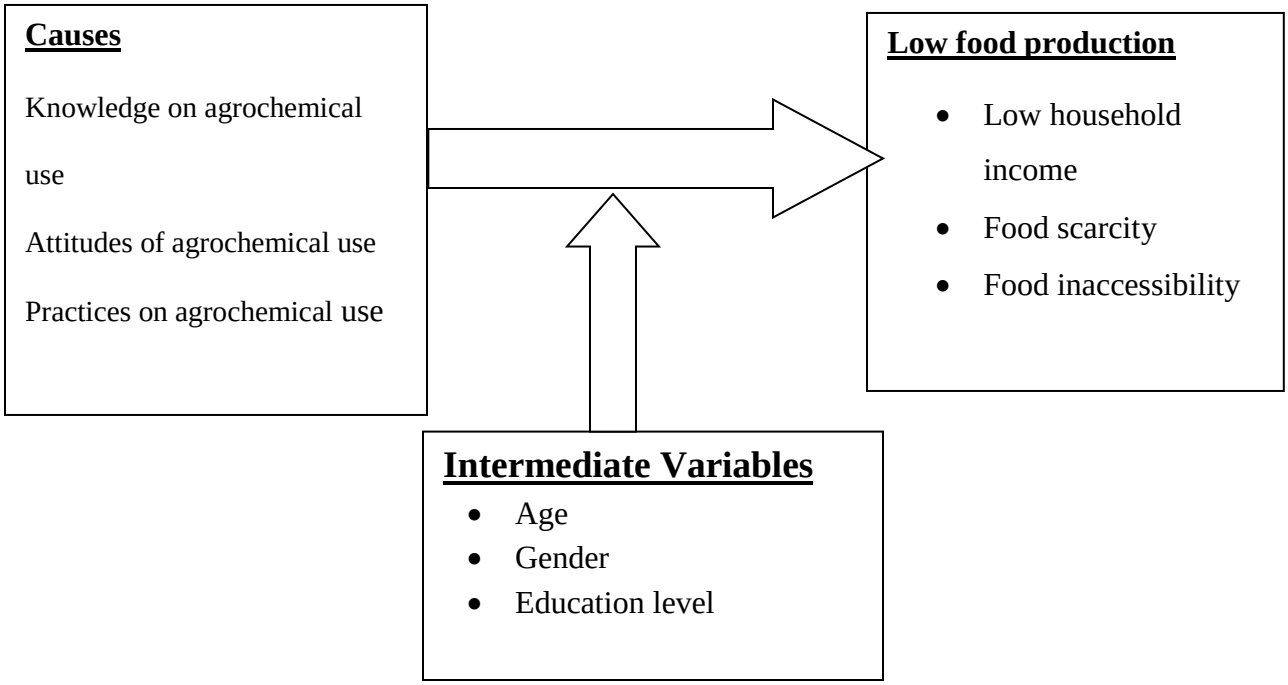
Most farmers in Uganda operate on small holdings and do not benefit economically from these farms due to many obstacles they face especially those related to quality and quantity of agricultural produce. Public concern about agrochemical use is high although varying with factors. Individual differences in knowledge and attitude to pesticide use might be particularly evident in rural areas where farmers and other people live together. Exploring the perception of agrochemical use among rural farmers as a way of improving production will give an insight on how the approach can be used to provide solutions to farmers' problems faced when choosing and using agrochemicals in improving food production.

1.9 Conceptual Framework

The conceptual framework provides a model for linking categories of possible variables or concepts in the study as perceived by the researcher (Odiya, 2009). In the conceptual framework

below, there are essentially three variables that is independent, dependent and intermediate variables. Perception of agrochemical use was conceptualized as the independent variable and food production as the dependent variable.

Independent variables **Dependent variables**



Source: adopted from Ajibade and Shokemi (2003).

In the conceptual framework above, the perceptions associated with agrochemical use in form of knowledge, attitudes and practices have a relationship with food production in the area. It can be realized that the declining food production experienced in form of low household income, food inaccessibility and unavailability is caused by the limited knowledge, negative practices and attitudes that smallholder farmers have on agrochemical use.

Other factors that affect the use of agrochemicals are the age of the farmer, gender and education level of the farmer.

The study therefore aimed at assessing the farmers' knowledge, attitudes and practices in regard to the use of agrochemicals, their effect on food production in terms of food availability, farmer's income and food accessibility.

1.10 Definition of key concepts

Agro-Chemical: This refers to fertilizers, pesticides (fungicides, insecticides and herbicides) used by the farmers in crop production.

Fertilizer: It refers to organic or inorganic chemicals used by the farmers at planting, topdressing or foliar application.

Pest: As used in this study refers organism that is considered to be undesirable or destructive in crop growing namely rodents, diseases, insects and weeds.

Pesticide: As used in this study refers to compounds used by farmers in plant/crops protection from pests and diseases and belongs to broad categories of insecticides, fungicides and herbicides.

Small holder farmers: as used in this study referred to those farmers owning small plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labor.

Attitudes: A tendency to act in a particular way due to both an individual's experience and temperament. Typically, when we refer to a person's attitudes, we are trying to explain his or her behavior. Attitudes are a complex combination of things we tend to call personality, beliefs, values, behaviors, and motivations.

Perception: The process by which organisms interpret and organize sensation to produce a meaningful experience of the world. In other words, a person is confronted with a situation or stimuli. The person interprets the stimuli into something meaningful to him or her based on prior experiences.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, the researcher critically analyzes works of other people related to variables under study. Many important benefits are achieved by the use of agrochemicals in agricultural production and have made important contributions to the successes of the "green revolution (Briggs et al., 1989) and increase in food supply. Use of agrochemicals mainly associated with increased crop yields, animal production and reduced post- harvest losses and makes a significant difference in food production particularly in countries that struggle periodically with famines (Muller, 2000). Below are reviews done as per study objectives;

2.2. Knowledge, attitudes and practices associated with agrochemical usage

Pesticides have become more commonly used since World War II. Pesticides are used to increase food production, improve health (like, reducing pests that could spread disease), decrease agricultural manual labor, and provide a more comfortable environment in which to live with less household "pests." (Ntowi et al, 2006). A number of studies have been conducted on attitudes, practices and knowledge of agrochemical use within farming populations.

Sikhu and Kroschel, 2015 studied pesticide use and knowledge of smallholder potato farmers in Uganda. This study sought to promote proper and safe pesticide-handling practices by providing data needed to guide pesticide regulation policy and training for extension staff and farmers. A household survey was conducted in three major potato-growing agroecological zones of Uganda. 204 potato farmers were interviewed about the type and source of pesticides they use in potato cultivation, the frequency of applications, the use of protective clothing, and cases of pesticide poisoning. The findings were as follows; the types of pesticides used in potato were fungicides

(72%), insecticides (62%), and herbicides (3%). Overall, use of personal protective equipment was low that is, gumboots (73%), gloves (7%), face masks (16%), and long sleeve shirts (42%). Forty-three percent of farmers who applied pesticides reported having experienced skin itching, 25% skin burning sensation, 43% coughing, and 60% a runny nose, 27% teary eyes, and 42% dizziness. The recommendations were an IPM approach involving only moderately to slightly hazardous pesticides when pest and disease incidence has reached economic injury levels and by considering all safety measures during application and storage.

A study by Sa'ed H. Zyoud et al., (2015) on Knowledge and practices of pesticide use among farm workers in the West Bank, Palestine involved381 farm workers. The majority (97.9%) of the participants were male. The mean participant scores for knowledge and safety procedures were 2.8 ± 3.2 out of 8 and 9.8 ± 2.4 out of 15, respectively. There was a significant positive correlation ($r = 0.323$; $P < 0.001$) between the knowledge and safety procedure scores. Unsafe behaviors were identified as the storage of pesticide products at home, the preparation of pesticides in the kitchen, inadequate disposal of empty pesticide containers, eating and drinking during pesticide application, and using inadequate protective clothing. The most frequent self-reported toxicity symptoms associated with pesticide use were skin rash (37.5%), headache (37%), excessive sweating (24.9%), and diarrhea (21.3%). There was a strong significant negative correlation ($r = -0.83$; $P < 0.001$) between self-reported toxicity symptoms and scores for protective measures. The recommendations were the need for more educational programs regarding the safety and use of pesticides and promotion of Legislation on the use of safer pesticides.

Fadlullah Olayiwola Issa, T. K. Atala, J. G. Akpoko and S. A. Sanni.,(2015)conducted a study to assess the level of adoption of recommended agrochemical practices among crop farmers in

Kaduna and Ondo States of Nigeria. It measured the perception of farmers on pesticides and their knowledge on the harmful effects of pesticides. A total of 260 crop farmers who had sustained the use of agrochemicals for at least five years were selected for the study using a multi-stage sampling technique. Data were collected using pretested, structured interview schedule. Descriptive statistics (mean and percentages) were used for data analysis. The results obtained revealed that 33.1% of the farmers considered pesticides as always favorable (harmless) whereas 30% of the respondents perceived pesticides as sometimes unfavorable (harmful). All (100%) the respondents indicated that pesticides cause damage to human health. Furthermore, the level of adoption of recommended agrochemical practices (RAPs) was generally low (weighted mean =1.49) despite high level of awareness (weighted mean =2.24). This study recommend campaigns for attitudinal changes on the use of agrochemical to be mounted by extension agencies in collaboration with relevant stakeholders.

Sahabat (2008) conducted a study on use of pesticides in Malaysia and found out that almost three-quarters of pesticide users had no knowledge of the danger of pesticide use, and that the problem was observed when there were inadequate controls and safety measures regulating their use.

Gupta et al.(2008) studied the Consumers Perception on Pesticide residue and their management in vegetables in city area of Varanasi district. The total of 100 respondents was selected randomly from the three distinct areas. Frequency and percentage were used to analyze the data. The findings revealed that safer measures to be taken for vegetables contaminated to make safer to eat (the proper decontamination of fruits and vegetables prior to their consumption) were not known to respondent.

Obopile, M., Munthali, DC. and Matilo, B. (2008). studied the Vegetable farmers' knowledge of pests, diseases and pest management practices by interviewing 112 growers in Botswana. Most of the farmers grew brassicae crops, Swiss chard and tomato, and considered arthropod pest problems as the major constraint to vegetable production. *Bagradahilaris* Burm, *Plutellaxylostella*L, and *Brevicorynebarassicae*L, were the most serious pests on brassicas, with red spidermites (Tetranychus spp.) being the most serious pests on tomato. About 98%of farmers relied heavily on the use of synthetic pesticides to control these pests and their decision to apply pesticides was mostly on noticing the presence of a pest or disease. An integrated pest management programme is needed to reduce over reliance on pesticides.

Mazlan and Mumford (2005) studied the knowledge and practice of pest management, particularly the use of pesticides against *Plutellaxylostella*. A survey of 99 cabbage farmers was conducted in five different zones in the Cameron Highlands. *P.xylostella* remains the major pest in cabbage and more than 90% of farmers use pesticides for control. There were 11 types of insecticides used to control this pest and each farmer usually used 3–4 types of insecticide to control the pest over a season. Both high and low toxicity pesticides were commonly used. There was a significant difference in pesticide spray frequency during wet and dry seasons, with more frequent sprays during the wet season. The study also revealed that more than 50% of farmers observed 10–14 day pre-harvest intervals, while 4% observed a pre-harvest interval of only 1–4 days. They found out that Wholesale markets still play an important role in marketing of fresh produce despite the increasing role of supermarkets in the food chain. It was also discovered that regulations on pesticide residue monitoring were only applied at the farm gate and any penalties are directed at the growers and the origin of fresh produce could only be traced up to the wholesaler. Therefore,

it is less effective to impose pesticide monitoring at the retailer level, as the origin of the produce could not be traced, nor could feedback to producers be achieved.

Ntowi et al (2006) studied the farmer perceptions and pesticide use practices in vegetable production in Ghana, using a small survey of 137 farmers who applied pesticides. Data from this sample of farmers were used to describe the status of use of pesticides in vegetable. The survey showed that knapsack sprayers were the most widely used type of equipment for spraying pesticides. However, on large-scale vegetable farms of 6-10 acres, motorized sprayers were also used. Various inappropriate practices in the handling and use of pesticides caused possible poisoning symptoms among those farmers who generally did not wear protective clothing. Younger farmers (<45 years of age) were the most vulnerable group, probably because they did more spraying than older farmers (>45 years of age). Farmers did not necessarily associate hazardous pesticides with better pest control. The introduction of well-targeted training programmes for farmers for the safe use of pesticides is advocated.

Kishor (2007) studied the Pesticide use knowledge and practices in Nepal and thus, interviewed a total of 325 males and 109 females during 2005 to assess gender differences on pesticide use knowledge, attitude and practices. More than 50% of females had never been to school and only <8% individuals were found trained in Integrated Pest Management (IPM). Almost all males and females did not smoke, drink and eat during pesticides application and also perceived that pesticides are harmful to livestock and plant diversity.

Ngowi *et al.* (2007) studied smallholder farmers in Northern Tanzania about farmers' practices, perceptions and related cost and health effects on vegetable pest management using pesticides. The types of pesticides used by the farmers in the study areas were insecticides (59%), fungicides

(29%) and herbicides (10%) with the remaining 2% being rodenticides. Pesticides were bought from pesticides shops (60%), general shops (30%) and cooperative shops (10%). The pesticides were supplied in containers ranging from 0.5 to 5 litres or in packets ranging from 0.5 to 25 kilo grams. Vendors often dispensed smaller quantities of pesticides in unlabelled containers. About a third of the farmers applied pesticides in mixtures. Up to 90% of this third had a maximum of 3 pesticides in a mixture. In all cases, there were no specified dosages either from the labels or extension workers regarding these tank mixtures. More than 50% of the respondents applied pesticides up to 5 times or more per cropping season depending on the crop. Insecticides and fungicides were routinely applied by 77% and 7%, respectively. Fifty-three percent of the farmers reported that the trend of pesticide use was increasing, while 33% was constant and 14% was decreasing.

Suleisin and Ismet (2007) conducted study of 61 randomly selected fruit-growers in a specific area of Turkey to reveal their perceptions regarding the harmful effects of pesticides and whether these were reflected in their pesticide practices. The analysis showed that adoption of pesticide practices was influenced more by characteristics such as age, fruit growing experience and education. Thus the harmful effects of the pesticides were not fully reflected in practices.

Gandhi and Patel (1997) on the other hand examined farmers' perception, awareness and behavior on the use of pest control technology in agriculture in relation to food productivity in Andhra Pradesh, Punjab and Gujarat. The study also indicated that farmers' awareness regarding the ill-effects of pesticides on water and air were very limited. Pesticide use levels were determined by extent of irrigation and presence of cotton and wheat in the cropping pattern. The intensity of

pesticide use was higher on small farms compared to large farm. They also found out that Education tends to reduce the pesticide use and younger farmers spend more on pesticides.

Shaikh et al , 2015 conducted a study to determine the farmers' attitude towards using agro-chemicals in rice field in Laxmipur district of Bangladesh. Data were collected from seventy farmers following simple random sampling technique, complied and interpreted as per objectives of the study. About 87% of the farmers had low to medium knowledge on use of agro-chemicals in rice cultivation. About 74% of the farmers had moderately favorable attitude towards using agro-chemicals. Family annual income, extension media contact and knowledge on agro-chemical were the most important factors that affect the attitude of the farmers towards using agro-chemicals in crop production. It was recommended that the arrangement of need based training with more extension contact for the farmers would be helpful to improve the behavior of using agro-chemicals.

Vanitha Prasannath and Kandeeparoopan Prasannath., (2013) conducted a study on Assessment on the Agrochemical Usage of Vegetable Farmers in Kaluthavalai, Batticaloa DistrictThe objectives of the study were (i) to assess the level of farmers' knowledge on pest management practices and extent of awareness on safe use of agrochemicals and (ii) to evaluate the socioeconomic factors which influence the usage of agrochemicals. A pretested questionnaire was employed in order to collect data from randomly selected 50 farmers who cultivate vegetables in more than 0.25 ha at the selected village, Kaluthavalai in Batticaloa district which experiences intensified agrochemical applications. The results revealed that almost all the farmers depended on agrochemicals for the control of pests and diseases. It was found that 64% of the vegetable cultivation farmers had medium level of awareness, while only 10% of the farmers were having

high level of awareness. At present, insecticides were heavily (68%) used among vegetable farmers followed by fungicides (22%) and herbicides usage was very minimal (10%) among the vegetable growers. In the study area, 76% of the respondents were practicing over dosages than the recommended rates. Years of farming experience and socioeconomic factors showed significantly a positive correlation with farmers' awareness on secure pesticide usage. At the same time, the level of education, total income, age of the farmer and family size of the farmer had no relationship with the level of knowledge on pest management. The ground level details which were collected from this study could be used to design suitable community health awareness interventions that would improve farmers' knowledge towards proper use of pesticides in order to secure their health and surroundings

2.3. The level of food production

Suresh Patidar, and Himanshu Patidar, (2015), conducted a study on farmers' perception towards organic farming which is thought of as the best alternative to avoid the ill effects of chemical farming. Organic farming is gaining popularity all over the world, as it can diversify agricultural production systems towards attaining improved productivity, farm income and food, as well as environmental safety. The aim of this study was therefore to evaluate farmers perception of organic farming and issues associated with it. The study was conducted in Madhya Pradesh, India. The state of Madhya Pradesh consists of 39 districts; out of these a convenient and purposive sampling technique was used to select 100 respondents from 50 villages of Khargone district of Nimar region. Study revealed that 67% of respondents have positive perception towards organic farming. Also, 5 out of 9 variables selected, affects respondents perception towards organic farming. There were significant relationships ($p \leq 0.05$) between respondents' age, educational background, farm size, benefits, social aspects and perception of organic farming.

Lami A. Nnamonu., and Abraham E. Ali., (2013) conducted a study on perceptions towards organic farming. The aim of this study was therefore to evaluate farmers and consumer perception of organic farming and issues associated with agrochemical use in Makurdi, Benue State of Nigeria. The study involved 150 respondents (farmers and consumers) consisting of 94 males and 56 females. The study revealed that 56% of respondents had a positive perception towards organic farming while 38% had a negative perception and 6% were undecided. Even though 58.67% agree that fertilizers and pesticides are effective, with 40% disagreeing and 1.33% undecided, 90.66% agreed that these agrochemicals can damage the environment, 7.34% disagreed and 2% were undecided. The study showed that organic farming and organic food are cheaper than conventional (or industrial) where 79.33 and 58.67% agreed, 18.00 and 30.67% disagreed and 2.67 and 10.66% were undecided, respectively. There were significant relationships ($P \leq 0.05$) between respondents' gender, age, educational background, respondent type and perception of organic farming and agrochemical use.

Kitale (1995) indicated that farmers in the North Rift Valley region of Kenya only grew a narrow range of crops, notably maize, beans, wheat, potatoes, and exotic vegetables such as cabbages and kales. The major source of farm income was maize and milk. Since market liberalization, the farmers started facing fluctuating farm incomes from sale of maize and milk. Over- dependence on maize for both food production and income generation made farm households insecure during periods of drought and glut production. Inadequate crop diversification for food and cash make farmer's food and income insecure whenever there are external shocks to their farming system. For instance, during periods of glut production, maize prices drop drastically as supply exceeds demand and crop losses are high because only a few farmers have invested in farm storage (Wasula et al, 2012). The result was low farm income, which translated into subsequent decline in the use

of purchasable inputs such as fertilizers and seed. The narrow range of crops grown also contributed to inadequate food supply in case of poor weather. Using the Farmer Participatory Approach (FPA), agrochemicals were introduced to the farmers (Yao et al, 2011). Over time, the farmers who adopted agrochemicals, crop varieties, their farm incomes and food supply in the region had improved. Stable farm incomes are necessary for farmers to meet their domestic needs such as health and payment of school fees, besides re-investing in the farm.

Fertilizers are used to supplement the essential plant nutrients in the soil. Fertilizers are broadly divided into organic fertilizers (composed of organic plant or animal matter), or inorganic or commercial fertilizers. Plants can only absorb their required nutrients if they are present in easily dissolved chemical compounds. Both organic and inorganic fertilizers provide the same needed chemical compounds. Organic fertilizers provide other macro and micro plant nutrients and are released as the organic matter decays—this may take months or years (Bell et al, 2006). Organic fertilizers nearly always have much lower concentrations of plant nutrients and have the problems of economical collection, treatment and transportation. Synthetic fertilizers are commonly used for growing all crops, with application rates depending on the soil fertility, usually as measured by a soil test and according to the particular crop (Rossberg, *M.*2006).

Major nutrients supplied include Nitrogen, Phosphorus and Potassium by soil application whereas micronutrients such as Zinc, Boron and Manganese are applied mainly through foliar sprays. Phosphatic fertilizers include Diammonium phosphate (DAP), triple superphosphate and Monoammonium phosphate. Nitrogen fertilizers include Calcium Ammonium nitrate (CAN) and Urea while Potassium fertilizers include Potassium chloride and Potassium sulphate (Vitosh, 2005). Major pesticides classes are organochlorines, Organophosphates and carbamates. The

organochlorines have significant toxicity to plants or animals, including humans. Dioxins, produced when organic matter is burned in the presence of chlorine and some insecticides such as DDT are persistent organic pollutants (POPs) which pose dangers when they are released into the environment. For example, DDT, which was widely used to control insects in the mid-20th century, also accumulates in aquatic food chains (Rossberg, M., 2006).

2.4 The impact of Knowledge, attitudes and practices associated with usage of agrochemicals on food production

A study by Bell E.m., Sandler.D.P and Alavanja M.C., (2006)on high pesticide exposure events among farmers and spouses enrolled in the Agricultural Health during 5 years since enrollment. Cases and controls were identified from the 16,415 private pesticide applicators and 14,045 spouses with completed five-year follow-up interviews as of October 2000. Among the applicators, 306 cases with at least one HPEE in the five years since enrollment and 612 controls, randomly selected from those without a reported HPEE, were identified for analysis. Among the spouses, 63 cases were identified and 126 controls were selected. Risk for a new HPEE was increased among applicators reporting at enrollment ever having an HPEE with an odds ratio (OR) of 3.8 (95% CI: 2.7, 5.3). Compared to applicators who applied pesticides fewer than 5 days per year, the ORs ranged from 1.4 (95% CI: 0.9, 2.2) for 6 to 10 days per year to 2.2 (95% CI: 1.4, 3.6) for more than 20 application days per year. The incidence of HPEE among Iowa applicators was much greater (8.8/1000 applicators) than among North Carolina applicators (2.0/1000). Spouses reported fewer HPEEs compared to applicators (2/1000 spouses). Overall, the observed risk factors for new HPEEs among applicators are similar to risk factors observed in previous cross-sectional analyses of HPEE history. Further, only 13% of applicators and 22% of spouses

with symptoms resulting from HPEE sought medical care, suggesting that pesticide poisoning surveillance data may seriously underreported the frequency of such events.

The increase of food production per capita could be obtained by a number of ways or a combination of ways such as increasing the area of agricultural land, enhancing the yield of crops through the use of agrochemicals, organic fertilizers, biological controls, and improved soil and water management (Clarke, E. E., Levy, A. S. and Calvert, I. A. (2010). According to Camargo and Alonso (2006), in the present time, probably the immediate response to the need for increasing production of food is a more intensive use of agrochemicals. Agrochemicals include two large groups of compounds: chemical fertilizers and pesticides. The use of chemical fertilizers tremendously increased worldwide since the 1960s and largely was responsible for the ‘‘green revolution’’, for example, the massive increase in production obtained from the same surface of land with the help of mineral fertilizers (nitrogen, phosphorus, potassium) and intensive irrigation. This has been the success story of rice, corn and wheat productions that increased worldwide. This revolution was assisted also with the introduction of more productive varieties of rice and wheat (dwarf wheat).

The use of pesticides, including insecticides, fungicides, herbicides, rodenticides, etc., to protect crops from pests, allowed to significantly reduce the losses and to improve the yield of crops such as corn, maize, vegetables, potatoes, cotton, as well as to protect cattle from diseases and ticks and to protect humans from malaria vectors. The world has known a continuous growth of pesticide usage, both in number of chemicals and quantities, sprayed over the fields. Pesticides are poisons intentionally dispersed in the environment to control pests, but they also act upon other species causing serious side effects on non-target species. Residues of pesticides contaminate soils and

water, remain in the crops, enter the food chain, and finally are ingested by humans with foodstuffs and water (Barcelo and Hennion, 2007; Taylor et al., 2003).

Assessing past experience of increasing the production of food through using higher amounts of agrochemicals, suggests that this procedure is likely to degrade food and water quality further. This does not automatically imply that agrochemicals are useless or totally harmful, but current problems call upon much better control of their registration and use (Harris, 2002). This control may require the ban of persistent chemicals, education of farmers and rural workers, and close monitoring of residues in the environment and in foodstuffs with yields ranging from 1–3t/ha to 5t/ha.

Damalas et al (2012) ascertain that to make agriculture more productive and profitable in the face of rising costs and rising standards of human and environmental health, the best combination of available technologies has to be used. Much of the increases in yield per unit of area can be attributed to more efficient control of (biotic) stress rather than an increase in yield potential. The reduction of current yield losses caused by pests, pathogens and weeds are major challenges to agricultural production (Damalas et al, 2012). The intensity of crop protection has increased considerably as exemplified by a 15–20-fold increase in the amount of pesticides used worldwide (Oerke, 2005). Estimates of actual losses in crop production worldwide were updated nearly 30 years later for the period 1988–90 on a regional basis for 17 regions by Ibitayo (2006). Increased agricultural pesticide use nearly doubled food crop harvests from 42 % of the theoretical worldwide yield in 1965 to 70 % of the theoretical yield by 1990. Unfortunately, 30 % of the theoretical yield was still being lost because the use of effective pest-management methods was

not applied uniformly around the world and it still is not. Without pesticides, 70 % of crop yields could have been lost to pests (Dasgupta and Meisner, 2012).

The increased threat of higher crop losses to pests has to be counteracted by improved crop protection whatever method it will be (biological, mechanical, chemical, IPM and training of farmers (McDougall, 2010). The use of pesticides has increased dramatically since the early 1960s; in the same period also, the yield average of wheat, rice and maize, the major sources for human nutrition, has more than doubled. Without pesticides, food production would drop and food prices would soar. With lower production and higher prices, farmers would be less competitive in global markets for major commodities. Where overall crop productivity is low, crop protection is largely limited to some weed control, and actual losses to pests may account for more than 50 % of the attainable production (Kishi, 2010). In large parts of Asia and Latin America, great advances have been made in the education of farmers, whereas the situation is still poor in Sub-Saharan Africa and has worsened in the countries of the former Soviet Union because of the lack of resources (McDougall,2010).

The literature reviewed clearly indicates that there are a number of studies in place that have viably established that perceptions associated with agrochemical usage have relationship with food production, however, key gaps were identified that called for conducting of this study. Most of the gaps were in form of historical, methodological, conceptual, theoretical and contextual.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter comprises of the research design, area of study, study population, sampling procedures, sample size, data collection methods and instruments, quality control methods, data management and processing, data analysis, ethical considerations and limitations to the study.

3.1 Research Design

This study used a case study research design. A case study research design was used since the Kibiga Sub-county was chosen to represent the whole Kiboga District in this study. The study used mostly quantitative approaches during sampling, data collection, quality control and analysis. At data collection stage, quantitative design involved administering closed ended questionnaire to respondents. Quantitative approach was used because it is important in creating correlations and regressions between research variables. In addition, this study used a quantitative approach because the study called for using statistics to generalize findings. The study also used qualitative approaches to collect and analyze data.

3.2 Research Study Area

The study was conducted in Kibiga Sub-County in Kiboga District located in the Central Region of Uganda. The town of Kiboga is the site of the district headquarters. Kiboga District is bordered by Nakaseke District to the northeast and east, Mityana District to the south, Mubende District to the southeast, and Kyankwanzi District to the northwest. The district headquarters are approximately 120 kilometres (75 miles), by road, northwest of Kampala, Uganda's capital and the largest city. The coordinates of the district are: 01 00N, 31 46E (Latitude: 1.0000; Longitude: 31.7667). In 1991, the national population census estimated the district population at 98,200. The

2002 national census estimated the population at 108,900, with an estimated annual population growth rate of 4.3 percent. In 2012, the population of was estimated at 165,100 (UBOS, 2014).

3.3 Study Population

The study population consisted of 663 respondents who are the small holder farmers in the study area according to 2014 population census in Uganda. 647 were smallholder farmers in Kibiga Sub-County (UBOS, 2014) and 16 were agricultural and extension officials in the area. These were selected since they possessed the knowledge, attitudes and practices associated with agrochemical use in the area.

3.4 Sampling procedures

The sampling procedures put into context, the sample size and the sampling techniques as demonstrated below.

3.4.1 Sample Size

The sample size was determined using the table in Appendix III from a study by Morgan and Krejcie (1970, as cited in Amin, 2005). The model uses a table which has two columns {population column (N) and Sample column (S)}. In this model, the population study related with the corresponding sample to the nearest estimate.

The study population consisted of 647 smallholders farmers which is the estimated number of small holder farmers in Kibiga sub-county and 16 agriculture extension worker making a total of 663 (six hundred and sixty three). The smallholder farmers were randomly selected while the agriculture extension workers were purposively selected. The sample size for the smallholder farmers was 234 (two hundred and thirty four) as determined from a study by Morgan and Krejcie,

1970 while the sample size for the agriculture extension workers was 14. The total sample size for the study was 248 (two hundred and forty eight).

3.4.2 Sampling Techniques

The study used simple random sampling technique to select farmers. This technique was chosen because the category of these farmers are scattered and had a large population size and as such necessitated the use of simple random sampling to minimize sampling bias (Mugenda, O.M., and Mugenda, A. G., 2003). Purposive sampling was chosen because it allowed the selection of people who had experience in agrochemical use and food production to participate in the study and this was used on extension workers in Kiboga district.

3.5 Data Collection Methods and instruments

This section expounds on the data types and the data collection instruments used in the study.

3.5.1 Data types

The main type of data in this study was primary data. Primary data was responses from the respondents. The advantage of primary data is its originality. Primary data was collected using questionnaire and interview guide.

3.5.2 Data collection instruments

The researcher adopted both quantitative and qualitative instruments to collect data as provided below.

3.5.2.1 Questionnaire

This was used to collect primary data from smallholder farmers in Kibiga Sub-County, and, it involved using a questionnaire depicted in Appendix I. The questionnaire (Appendix I) was used in this case because it had proved to be a valuable method of collecting a wide range of information from a large number of individuals especially when it comes to people like farmers (Sekaran,

2003). The questionnaires are popular because the respondents fill them in at their own convenience and are appropriate for large samples. The questionnaire was designed with both open and closed ended questions (Amin, 2005).

3.5.2.2 Interview Guide

The researcher prepared and used a semi-structured interview guide (Appendix II) to conduct interviews with agricultural extension workers in Kiboga district. Interviews were chosen because they are thought to provide in-depth information about a particular research issue or question. Still, interviews were chosen because they made it is easy to fully understand someone's impressions or experiences, or learn more about their answers as compared to questionnaires. According to Mugenda, O, M and Mugenda, A.G (2003), interviews are advantageous in that they provide in-depth data which is not possible to get using questionnaires.

3.6 Data Collection Procedures

The researcher obtained a letter from Faculty of Agriculture; Uganda Martyrs University (Appendix V) introducing her to Kiboga district and specifying that the data to be collected was solely for study purposes. Upon obtaining the requisite permission, the researcher proceeded with data collection using questionnaires, to selected smallholder farmers. After that, interviews were conducted with agricultural extension workers in Kiboga district.

3.6 Quality control methods

Controlling quality is about ensuring acceptable levels of reliability and validity of the study through proper control of intermediate variables. An intermediate variable is any other independent variable which can also affect the dependent variable, (Oso and Onen, 2008).

3.6.1 Validity

Validity refers to the ability of instrument to collect justifiable and truthful data. In other words, it is the ability of the instruments to measure what it is developed to measure. The concept is concerned with the soundness of instruments since it considers what the instrument measures and how well it measures it. A validity test was carried out prior to the administration of the questionnaires. Three experts were used. This was done in order to find out whether the questions are capable of capturing the intended responses. Content Validity Index (CVI) was calculated in order to establish the validity of the questionnaire.

The validity index for the independent variables that is farmers' knowledge and practices and a 5 point anchor were 0.888 and 0.776 respectively while that for the dependent variable was 0.845'

As recommended by Amin (2005), for the instrument to be valid, the C.V.I should be at least 0.7. Therefore, since all the items were above 0.7, it was valid for conducting the study.

3.6.2 Reliability

Gay (1996) defined reliability as the degree of consistency that the instrument demonstrates. After pilot testing in the field, reliability of the instrument, on multi-item variables (i.e. Farmers' perceptions and food production was tested using the Cronbach Alpha Method provided by Statistical Package for the Social Scientists.The researcher used this method because it was expected that some items or questions would have several possible answers. The researcher established reliability of the questionnaires by computing the Cronbach alpha coefficient of the items (questions) that constituted the dependent variable and that of the items that constituted the independent variable. The Cronbach alpha coefficient for the independent variables that is farmers' knowledge and practices at a 5 point anchor were 0.831 and 0.786 respectively while that for the dependent variable was 0.786.

According to Cronbach Alpha Coefficient Test (Cronbach, 1971), the questionnaire was considered reliable since all the coefficients in Table 3.3 were above 0.7 which is the least recommended Cronbach Alpha coefficient in survey studies (Amin, 2004; Gay, 1996).After the approval of the proposal, the researcher designed the questionnaire, validated it then tested its reliability using the Cronbach Alpha method. After modifying the instrument, the researcher secured a letter of introduction to assist the researcher proceed with the study. Two research assistants were selected to help in data collection from respondents.

3.7 Measurement of Variables

Mugenda., O.M. and Mugenda, A.G.(2003) supports the use of nominal, ordinal, and Likert type rating scales during questionnaire design and measurement of variables. The nominal scale was used to measure such variables as age. The ordinal scale was employed to measure such variables as level of education and marital status. The five point Likert type scale (1- strongly disagree, 2-disagree, 3-not sure, 4- agree and 5-Strongly agree) was used to measure two independent variable (knowledge and practices) and the dependent variable (food production). The choice of this scale of measurement was that each point on the scale carries a numerical score which is used to measure the respondent's attitude and it is the most frequently used scale in the study of social attitude.

3.8 Data management and processing

The data was organized and summarized in one data collection site. The researcher then checked for completeness and accuracy. The raw data was then captured in Excel (spread sheet) before it is entered into SPSS Version 20 for quantitative analysis and interpretation. Cleaning and editing was done before and after entering data into the computer software to examine outliers and inconsistencies of responses.

3.9 Data Analysis

SPSS Version 20 was used in detailed analysis of data. Analysis was done at Univariate, Bivariate and multivariate levels.

3.9.1 Univariate analysis

Here the researcher looked at how many subjects fell into given categories and they were given simpler unit of analysis. Data collected was systematically organized to facilitate analysis. The unit of analysis was the individuals who responded to the survey. The raw data was edited to ensure completeness. Thereafter, it was coded using statistical figures to enable quantitative analysis in SPSS Version 20. Appendix IV illustrates the coding sheet that was used.

3.9.2 Bivariate analysis

Responses were grouped into repeated subjects. The repeated subjects were presented in the results based on the study objectives. Here a spearman correlation coefficient was used to determine the relationship between the two variables. The spearman coefficient was 0.05 level of significance.

3.9.3 Multivariate analysis

The statistical package was used to analyze quantitative data that goes beyond two variables in this study using SPSS Version 20. Here, multiple regressions were used to determine the degree of relationships between more than two variables. Correlation coefficient was computed to establish the degree of the relationships between the independent variables and the dependent variables and to determine the strength and direction of their relationship.

3.10 Ethical Consideration

Informed consent was sought from the respondent before any interview. The data was collected by use of reliable and valid tools, coded and data collection tools which were used to avoid any form of information misuse. The researcher ensured that all citations and references of different authors are acknowledged. The researcher maintained confidentiality of the respondents and

protected their privacy at all times. Lastly, the researcher tried to be considerate during the interactions with respondents.

3.11 Limitations of the study

The following were the limitations encountered by the researcher during the study.

Time consuming activity; some respondents felt that exercise was time consuming. The researcher however made an effort to not consume too much of the respondents' time and also tried to capture their interest.

Expectation of handouts; some respondents expected to receive a token of appreciation after the interview in form of money, a bar of soap or sugar. The researcher however made an effort to explain to the respondents what the purpose of the study was and how the study will benefit the respondent in the long run.

Interpretation of the questions; this affected the meaning as some respondents had difficulty in interpreting the questions correctly. Efforts were made to explain and interpret for them every time an opportunity occurred.

In this chapter the procedures that were followed in conducting the study have been unveiled. It has been established that a case study research design was employed in the study. The population of the study was basically smallholder farmers and extension officials in Kiboga district. The 248 respondents were both purposively and randomly selected. Data was analyzed qualitatively and quantitatively. Qualitatively, data was coded and put in thematic contextual analysis. Quantitatively, data was entered in SPSS. Variables were measured in the Likert scale format (strongly disagree 1, disagree 2, undecided 3, agree 4 and strongly agree 5).

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents results of the study based on the formulated objectives and research questions as presented in chapter one. The chapter analyzes the variables involved in the study and estimates the conceptual model described in chapter one. In the first two sections data description and analysis is presented. The analysis of the results is then discussed. Data collected was quantitatively and qualitatively analyzed. Quantitative data was presented in tables. Research questions are also answered by establishing extents to which independent variables are related to dependent variables.

4.2 Response Rate

The table below shows the expected number of interviews and Questionnaires distributed and the number of actual interviews conducted and questionnaires returned.

Table 4.1: Showing Response Rate

Instruments	**Frequency**	**Percent**
Questionnaires		
Number of questionnaires distributed	234	100
Number of questionnaires returned	189	80.8
Interview		
Number of interviews schedules planned	14	100
Number of interviews done	10	71.4
Total of planned interviews and questionnaires	248	100
Total interviews conducted and questionnaires returned	199	80.3
Non-response rate	49	19.7

Source: Primary data (2016)

Out of the 234 questionnaires that were distributed, 189 were returned making 80.8% return rate. On the side of interviews conducted, out of the 14 respondents set to be interviewed; 10 were reached making 71.4% return rate. The overall total is 199 respondents for both interviews and questionnaires which is 80.3 %.

However, according to Amin (2005), 70% of the respondents are enough to represent the sample size set for the study. This means that 80.8% and 71.4% for questionnaires and interviews respectively is sufficient for this study.

4.3 Demographic Information of respondents

The demographic information shows the characteristics of the elements in the sample size. The general information of the respondents, which formed the basis under which the interpretations were made, was established.

4.3.1 Gender of Respondents

This information was necessary to enable the researcher to obtain information on whether the respondents were either male or female. Below is the gender of respondents in table 4.2

Table 4.2: Gender of Respondents

Gender	**Frequency**	**Percentage**
Male	56	29.6
Female	133	70.4
Total	**189**	**100.0**

Source: primary data (2016)

The majority of the respondents were female (70.4%) and male were (29.6%). These results show that gender representation indicated a big variation between the male and female with a difference of 77. On the side of the interviews conducted, most of them were male and these constituted

80%. The remaining percentages of 20% were female. This therefore tells us that very few men are involved in agriculture in Kibiga Sub-county. This type of work is dominated by women. This is consistent with what Bell, Sandler & Alavanja, (2006) indicated that most of the farmers in rural areas are mostly women and these are mostly looking for subsistence produce that is why they tend to have negative perceptions on agrochemical usage.

4.3.2 Age of Respondents

This information was necessary to enable the researcher to obtain information on the age of the respondents. Below is the age of respondents in table 4.3.

Table 4.3: Age of Respondents

	Frequency	Percent
18- 20	7	3.7
20-29	24	12.7
30-39	41	21.7
40-49	69	36.5
50 and above	48	25.4
Total	**189**	**100.0**

Source: primary data (2016)

It was established that most the respondents that took part in the study were above the age of 30. 36.5% were between ages of 40-49 years; 25.4% were above 50years, 30-39 years had 21.7% representation, 20-29years were represented by 12.7% and those 18-20years had 3.7% representation as this age group is usually still of school going age and the few involved in agriculture rarely use agrochemicals.On the side of the interviews conducted, most of them were aged years between 40-49years and these took 50%, those 50years and above had a representation of 30% and the remaining percentage 20% were 30-39years. The size of ages is synonymous with what Clarke, E. E., Levy, A. S. and Calvert, I. A. (2010) had earlier indicated that most of the

smallholder farmers are aged above 35years and these ages tend to rely very much on traditional knowledge rather than using agrochemicals. This implies that the respondents were mature enough to analyze issues relating to agrochemical usage. The respondents adequately responded to the questions put forward and by virtue of their experience, their responses were sound enough such that the researcher was able to generate adequate data from them for the study. The majority of respondents were between the ages of 40-49 (36.5%) because most of the farmers are mostly mature people and many youths are rarely in agriculture.

4.3.3 Level of education of Respondents

The information is necessary to enable the researcher to know whether the respondents are educated or illiterate. Below is the level of education of respondents in table 4.4

Table 4.4: Level of education of Respondents

Education level	Frequency	Percent
No education	41	21.7
Primary	116	61.4
Secondary	20	10.6
Certificate	12	6.3
Total	**189**	**100.0**

Source: primary data (2016)

Many of the respondents had studied up to primary level (61.4%) compared to 21.7% who had no formal education, 10.6% had studied up to secondary level and those who had certificate of higher education were only 6.3%.The results from the study findings are synonymous with what Clarke *et al.* (2006) had already established that most of the smallholder farmers in villages are not very much educated and this directly affects their usage of agrochemicals and their level of food production. On the side of the interviews conducted, most of the interviewees had studied up to degree level and these were 50%. Those who had a diploma were 40% and those who a certificate

in agriculture was 10%. This therefore means that the study was informed by people who had a good understanding of the agriculture situation. This helped the researcher to explore the local perceptions of farmers towards using agrochemicals and its effect on food production.

4.3.4 Marital status of respondents

The information was necessary to enable the researcher to know the marital status of respondents in Kibiga Sub-county since it had been found that women dominate the agricultural sector in the area. Below is the marital status of respondents in table 4.5.

Table 4.5: Marital status of respondents

	Frequency	Percent
Married	119	63.0
Single	24	12.7
Widowed	20	10.9
Cohabiting	8	4.2
Divorced	18	9.5
Total	**189**	**100.0**

Source: primary data (2016)

Table 4.5 above shows that majority of the respondents (63%) were married while 12.7% were single. The least number of respondents were cohabiting constituting 4.2% of the total number of respondents and those who were widowed constituted 10.9% of the total number of respondents and 9.5% of the respondents were divorced. On the side of the interviews conducted, most of them were also married and these constituted 80%. Only 20% were single. The implication was that since the largest portion of the respondents were married, it gave a good starting point to assume that they had enough labor that would bar them from using agrochemicals. The findings seemed synonymous with earlier scholars like Azeem, M., et al who had indicated that marital status of

smallholders is more often married and this provides them with enough labor to use in their garden without resorting to usage of agrochemicals.

4.4 Univariate analysis

Univariate analysis presents findings presented on observations of the perceptions associated with agrochemical usage in terms of knowledge, attitudes and practices and food production in Kibiga Sub-county. While presenting the findings on the observation of knowledge and practices associated with usage of agrochemicals in Kibiga Sub-county and food production, means and standard deviations were used to present this information. Data on attitudes was qualitatively analyzed and presented.

4.4.1 Farmers' knowledge associated with usage of agrochemicals

In an effort to find out farmers' knowledge associated with usage of agrochemicals, respondents were asked to react on different preconceived statements as shown in table 4.6 below.

Table 4.6: Descriptive Statistics on Farmers' knowledge associated with use of agrochemicals

Items	SD	D	N	A	SA	Mean	Std. Deviation
I can differentiate between licensed and non-licensed agrochemicals	61.8%	31.5%	3.9%	1.5%	1.3%	1.03	1.944
I am aware that potentially beneficial organisms in the farm can be harmed through use of agrochemicals	3.9%	2.6%	5.4%	53.9%	34.2%	4.11	.926
Foods produced using agrochemicals have a normal appearance	5.2%	5.2%	7.92%	42%	35.5%	4.18	.907
Agrochemicals destroy the soils	2.6%	3.9%	6.99%	58%	25.3%	3.21	.907
The importance of agrochemicals has been recommended by extension workers in the area	0%	0%	1.6%	46.3%	49%	3.10	.882
Foods produced using agrochemicals can be marketed	9%	6%	10.5%	43%	27.5%	4.00	.843
Agrochemicals increase yields in the garden	0%	10.5%	25.5%	34%	26%	4.00	.841
Agrochemicals control pests and diseases	3%	3%	21.5%	38.5%	30%	4.00	.837

Source: primary data (2016): *SA- strongly disagree, D-disagree, N-not sure, A- agree and SA-Strongly agree*

The results in table 4.6 above revealed that the means for most of items were above 3.5 and standard deviation less than one. Based on the scale of 1-strongly disagree to 5-strongly agree, any data mean of above 3.5 and standard deviations below one indicates existence of the variables understudy. This thus, statistically means that farmers have the required knowledge to use agrochemicals in their gardens in Kibiga Sub-county. The items that confirmed the above statistical claim included;

Agrochemicals increase yields in the garden (M=4.29) and (SD=.841). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This thus means that farmers in Kibiga Sub-county are aware that agrochemicals can improve their yield which is very important for its adoption.

Agrochemicals control pests and diseases (4.30) and (SD=.837). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This thus means that farmers in Kibiga Sub-county are aware that agrochemicals can control pests and diseases which can be a determinant factor for its adoption.

Foods produced using agrochemicals can be marketed (M=4:27) and (SD=.843). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This thus means that farmers know that agrochemicals have no negative effect on the market of food produced through application of agro-chemicals.

The importance of agrochemicals has been recommended by extension workers in the area (M=4.25) and (SD=.882). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This therefore implies that the importance of agrochemicals has been recommended by extension workers in the area which partly play a significant role in its adoption and usage by local farmers.

Agrochemicals destroy the soils (M=4.21) and (SD=.907). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This implied that farmers are aware that consistent application of agrochemicals in the soil affects the soils. This may be among the factors leading to less adoption or usage of agrochemicals in Kibiga Sub-county. The study findings is in agreement with Morris-Cotterill (2002) who had earlier established that the largest barrier to usage of agrochemicals in developing countries lies in the perception that agrochemicals destroy the soil and the environment.

Foods produced using agrochemicals have a normal appearance (M=4.18) and (SD=.907). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This was also agreed on by most of the respondents and it meant that farmers are aware that there is no bad appearance on the crops because of using agrochemicals. This is a very high determinant to usage of agrochemicals in the area.

I am aware that potentially beneficial organisms in the farm can be harmed through use of agrochemicals (M=4.11) and (SD=.926). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from

different respondents. This thus implied that farmers in the area were aware that potentially beneficial organisms in the farm can be harmed through use of agrochemicals and this partly plays a significant role in usage of agrochemicals.

I can differentiate between licensed and non-licensed agrochemicals (M=1.03) and (SD=1.944). Since the mean is below 3.5 and the standard deviation is above 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This tells us that the biggest number of farmers cannot differentiate between licensed and non-licensed agrochemicals. This may be part of the reasons as to why few farmers end up using agrochemicals in Kibiga Sub-county. This study finding is in agreement with Roger (2001) who had indicated that non-licensed agrochemicals affect food productivity and at the end scare away farmers from using all types of agrochemicals thinking all of them are counterfeit.

The position of the farmers above seemed contrary to what the key informants or interviewees indicated in interviews. For instance, the largest number of key informants disagreed with the fact that the farmers have enough knowledge on agrochemical usage. For instance, one of the extension workers in Kibiga Sub-county was quoted saying:

> "*We as extension workers are not well facilitated to help our farmers understand the usage of different agrochemicals on market…this has been the very reason why many of them have remained with the mentality that agrochemicals have to distort the soils or have side effects….such knowledge has kept many of our farmers away from using agrochemicals….*" *(Anonymous).*

The above quotation implies that there are a number of farmers in Kibiga Sub-county who still lack the required knowledge on usage of agro-chemicals. This becomes a center stage to determine their perceptions towards the usage of agrochemicals. This is in line with Morris-Cotterill (2002) and Rogers (2001) who had earlier established that the largest barrier to usage of agrochemicals in

developing countries lies in the perception that agrochemicals destroy the soil and the environment.

4.4.2 Farmers' practices associated with usage of agrochemicals

In an effort to find out farmers' practices associated with usage of agrochemicals in Kibiga Sub-county, respondents were asked to react on different pre-conceived statements and table 4.7 below has more details.

Table 4.7: Descriptive Statistics on farmers' practices associated with use of agrochemicals

Items	SD	D	N	A	SA	Mean	Std. Deviation
I prefer using agrochemicals than traditional fertilizers	17.3 %	8.9%	39.4%	15.7%	19.7%	3.28	1.136
In our area if you do not add agrochemicals to the soil, you cannot get enough yields	9.2%	10.5%	43.5%	25%	11.8%	3.33	1.078
I only use licensed and approved agro-chemicals	7%	21%	38%	21%	13%	3.42	1.069
While using agrochemicals, I observe very well the safety measures	6.5%	6.8%	50%	28.9%	7.8%	3.44	1.022
I read carefully the precautions to ensure the organisms are not harmed when applying Agrochemicals or pesticides	3.9%	3.9%	7.8%	52.6%	31.8%	3.57	.658

Source: primary data, 2016

The results in table 4.8 above reveal that the means for most of the items were below 3.5 and had standard deviations above 1. It was found out that out of the 5-items that were introduced to respondents, 4-items were scored with a data mean below 3.5 and standard deviations above 1 and 1-item had data means above 3.5 and standard deviations below 1. Based on the scale of 1-strongly disagree to 5-strongly agree, any data mean of below 3.5 and a high standard deviation indicates

non-existence of the variables under study. This thus, statistically means that farmers' practices associated with usage of agrochemicals in Kibiga Sub-county are not favorable.

I read carefully the precaution to ensure the organisms are not harmed when applying Agrochemicals/pesticides (M=3.57) and (SD=.658). Since the mean is above 3.5 and the standard deviation is below 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This response was agreed on by most of the respondents. This implies that farmers take precautions to ensure the organisms are not harmed when applying Agrochemicals/pesticides which is favorable to food production. This is in line with what Smith et al (1999) had earlier asserted that the biggest mistake done by farmers is not to read carefully the precautions appended on the agrochemicals. They indicated that this harms the soil and crop growth.

While using agrochemicals, I observe very well the safety measures (M=3.44) and (SD=1.022). Since the mean is below 3.5 and the standard deviation is above1, this therefore meant there is no much variation in the mean score obtained from different respondents. This thus tells us that the biggest number of farmers do not take time to observe very well the safety measures attached on the bottles or sacks of agrochemicals and this in the end affects their food production or lead to future soil exhaustion or leads to side effects on the physical bodies of farmers. Such practices may be the sole reason why the big number of farmers does not adopt usage of agrochemicals.

I only use licensed and approved agro-chemicals (M=3.42) and (SD=1.069). Basing on the fact that the mean is below 3.5 and the standard deviation is above 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This tells us that the biggest number of farmers cannot differentiate between licensed and non-licensed agrochemicals. This

may be part of the reasons as to why few farmers end up using agrochemicals in Kibiga Sub-county. This study finding is in agreement with Roger (2001) who had indicated that non-licensed agrochemicals affect food productivity and at the end scare away farmers from using all types of agrochemicals thinking all of them are counterfeits.

In our area if you do not add agrochemicals to the soil, you cannot get enough yields (M=3.33) and (SD=1.078). Basing on the fact that the mean is below 3.5 and the standard deviation is above 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This tells us that the underlying reason for less adoption of agrochemicals in Kibiga Sub County lies in the fact that many farmers believe that they can have enough yields even if they do not apply agrochemicals.

I prefer using agrochemicals than traditional fertilizers (M=3.28) and (SD=1.136). Basing on the fact that the mean is below 3.5 and the standard deviation is above 1, this therefore meant there is no much variation in the mean score obtained from different respondents. This tells us that the underlying reason for less adoption of agrochemicals in Kibiga Sub County lies in the fact that many farmers believe that traditional fertilizers work more effectively than agro-chemicals.

The above findings were in line with the opinions of the biggest number of key informants. For instance, many of the key informants indicated that most of the farmers strongly believe in their traditional supplements more than the agrochemicals. This is because that is what they have known and their perceptions are centering on that. For instance, one of the Extension Workers was quoted in an interview saying:

> "*Our farmers still practice traditional mechanism of supplementing their soils and these farmers fully believe that agrochemicals cannot work more than their*

decomposed inputs…add on the fact that many of them still have fears of unlicensed or counterfeit agrochemicals that they think can affect their health and soils…." (Anonymous)

Basing on the above findings, it is quite clear that a good number of farmers find it hard to use agrochemicals because they prefer their traditional agricultural practices especially when it comes to inputs and supplements.

In summary, it is clear that the perceptions of farmers associated with usage of agrochemicals in Kibiga Sub-county are still negative since they prefer their traditional methods of food production. This is because it has been indicated that farmer's practices associated with usage of agrochemicals in Kibiga Sub-county are still negative.

4.4.3 Farmers' attitudes associated with usage of agrochemicals

In an effort to find out farmers' attitudes associated with usage of agrochemicals in Kibiga Sub-county, respondents were asked a number of open ended questions.

Qualitative analysis revealed that farmers' attitudes associated with usage of agrochemicals in Kibiga Sub-county were not relatively positive. The respondents generally had a negative attitude towards agrochemical use.

When asked about their knowledge on agrochemical use, Most of the respondents said their knowledge was insufficient. This implied that farmers have no enough knowledge on usage of agro-chemicals which makes it a factor as to why they may not be using them which at the end may affect their food production. This is particularly in line with what Amos (2007) said that few farmers have the required knowledge to use agro-chemicals and this forms their attitudes to think that they have side effects or negative effects on their food production.

When asked about the effect of agrochemicals on their soils most of the respondents said that agrochemicals are destructive. One of the respondents was quoted saying:

"Our soils have become old and depleted. The more chemicals we add, the more the yields gradually go down… We just don't know what to do….. Our fore fathers never had chemicals but produced enough food….The harvest from our gardens are decreasing as the years go by…."(Anonymous).

This thus implied that in Kibiga Sub-county, the biggest portion of farmers still hold an attitude that agrochemical degrades soils. This can partly explains why they do not usually use agrochemicals in their farmlands. This is in line with what Shenider, F, Pathak, R.S. and S.M. Othieno., (2009). argued that most of the rural farmers shy away from using agro-chemicals because they find most of them dangerous to their soils and living organisms.

When asked about the benefits that they derive from the use of agrochemicals, the major issues that came were control of pests and diseases and convenience in weeding because agrochemical application is cheaper than hiring labour. This was also reflected with strong agreement from most of the respondents. It implied a positive attitude that might have rendered some of the farmers in Kibiga Sub-county to adopt agrochemicals because they reduce on the amount of work and labor required in farmland. This is in agreement with what Amedu (2005) found out that most of the farmers use agrichemicals because they perceive them to reduce on the amount of work to be done in the garden compared to traditional mechanism like putting fertilizers which is very labor intensive.

When asked about the effect of agrochemicals on the human body most respondent said they think the effect is negative. One of the respondents said:

"Chemicals could the cause of many diseases that are common amongst the young population that were not there in olden days… Where do they come from,… if not from muzungu medicines? We need to go back to our traditional ways of farming….."(Anonymous).

This implied that many people leave usage of agrochemicals because they perceive them to have negative effects on their body in the long run. This kind of attitude may be the very reason why farmers in Kibiga Sub-county do not use agrichemicals.

When asked about their opinion on whether foods produced using agrochemicals have side effects many respondents were not sure. This implied that the attitudes of farmers towards the side effects of foods produced for customer using agrochemicals was doubted. This means that to meet market demands, many farmers are likely not to use agrochemicals.

When asked about their opinion on the effect of agro chemicals on the environment, the majority of the respondents said that the effect was negative. This implied that farmers are aware that consistent application of agrochemicals in the soil affects the environment. This may be among the factors leading to less adoption or usage of agrichemicals in Kibiga Sub-county. The study finding is in agreement with Morris-Cotterill (2002) who had earlier established that the largest barrier to usage of agrochemicals in developing countries lies in the perception that agrochemicals destroy the soil and the environment.

On the side of the interviews conducted, their responses seem in support of the above claims put forward by the farmers in Kibiga Sub-county. This is because the biggest portion of interviewees

indicated that most of the famers in the area still have poor attitudes towards usage of agrochemicals. One of the extension workers in Kibiga Sub-county was quoted saying:

> *"We still have a big challenge of attitude change because most of the farmers find it hard to change to agrochemicals…yes, some of agrochemicals are expensive for our farmers but most of them are just rigid while thinking that all agro-chemicals have health effects and destroy their soils…other still have thoughts that agrochemicals is modernity that will come to pass when it has left their soils exhausted." (Anonymous)*

Another key informant added,

> *"I have met a number of farmers who still think that agrochemicals are not to be used because they were not used by their ancestors and that is why they managed to keep their soils like that" (Anonymous).*

The above responses thus mean there are still negative attitudes that form perceptions among farmers in Kibiga sub-county that have rendered them not to use agrochemicals. These findings are particularly in line with what Amos (2007) said that few farmers have the required knowledge to use agro-chemicals and this forms their attitudes to think that they have side effects or negative effects on their food production. Shenider, F, Pathak, R.S. and S.M. Othieno., (2009)further argued that most of the rural farmers shy away from using agro-chemicals because they find most of them dangerous to their soils and living organisms.

4.4.4 Level of food production in Kibiga Sub-county

To establish the level of food production in Kibiga Sub-county respondents were asked to react on different preconceived statements and table 4.8 has more details.

Table 4.8: Descriptive Statistics on the Level of food production in Kibiga Sub-county

Items	SD	D	N	A	SA	Mean	Std. Deviation
Our crops are no longer attacked by pests and diseases	26.3%	18.4%	30.2%	10.5%	14.6%	2.28	1.974
I get enough produces from my farm	27.6%	18.4%	28.9%	7.8%	17.3%	2.43	1.884
The taste of our foods has remained good in our household	22.3%	22.7%	31.5%	10.5%	13%	2.99	1.790
The market for our products has been expanding	3.9%	19.7%	39.4%	13%	15.7%	3.04	1.787
The issue of hunger has not been heard in my household	11.8%	25%	43.4%	9.2%	10.5%	3.17	1.632
Foods produced in my household is of good quality	6.5%	6.5%	7.8%	50%	28.9%	3.78	.976
We can ably survive on food produced in my farm	3.9%	3.9%	7.8%	52.6%	31.5%	4.12	.845

Source: primary data, 2016

The results in table 4.9 reveal that the means for most of the items were below 3.5. It was found out that out of the 7-items that were introduced to respondents, 5-items were indicated with a data mean below 3.5 and 2-items had data above 3.5. Based on the scale of 1-strongly disagree to 5-strongly agree, any data mean below 3.5 indicates non-existence of the variables understudy. This thus, statistically means that the level of food production in Kibiga Sub-county has been going down over years. Among the items that had means below 3.5 included; The issue of hunger has not been heard in my household (3.17); The market for our products has been expanding (3.04); The taste of our foods has remained good in our household (2.99); I get enough produces from my farm (2.43); Our crops are no longer attacked by pests and diseases (2.28). These perhaps indicated

that food production in Kibiga sub-county is going down since some households were reported to have hunger, their food taste has been declining and the produce market is also very small.

On the other hand, some of the items were indicated with means above 3.5 and with low standard deviations which to a small extent indicated that food production was convincingly enough and these include, the item "we can ably survive on food produced in my farm"(4.12); and "Foods produced in my household is of good quality" (3.78). These means that despite the fact that there is low food production, the quality of food produced is still good and some households can ably survive on the food they produced on their farmlands.

4.5 Bivariate Analysis

Correlation statistics were used in bivariate analyses. Correlation statistics is a method of assessing the relationship between variables or factors. To be precise, it measures the extent of association between the ordering of two random variables although; a significant correlation does not necessarily indicate causality but rather a common linkage in a sequence of events. Thus, the study analyzed the relationships that exist among the independent and dependent variables as well as among the independent variables/ factors.

4.5.1The impact of farmers 'knowledge associated with agrochemicals on food production in Kibiga Sub-County

To test the impact of farmers 'knowledge associated with agrochemicals on food production in Kibiga Sub-County, a spearman rho correlation coefficient was done by the study and the results are shown in Table 4.9.

Table 4.9: Correlation results between farmers' knowledge associated with agrochemicals and food production

(Correlation)	(Variables)	(Correlation and significant level)	Farmers' knowledge	Food production
Spearman's rho	Farmers' knowledge	Correlation Coefficient	1.000	-.269
		Sig. (2-tailed)	.	.452
		N	189	189
	Food production	Correlation Coefficient	-.269	1.000
		Sig. (2-tailed)	.452	.
		N	189	189

Correlation is significant at the 0.05 level (2-tailed).

Source: primary data, 2016

Findings show that there was a negative correlation (*rho* = -.269) between farmers 'knowledge associated with agrochemicals and food production. These findings were subjected to a test of significance (p) and it is shown that the significance of the correlation (p = .452) is greater than the recommended critical significance at 0.05. Thus, the impact was insignificant. Therefore, this implied that farmers 'knowledge associated with agrochemicals had affected food production in Kibiga Sub-county.

4.5.2The impact of farmers' attitudes associated with agrochemicals on food production in Kibiga Sub-County

To assess the impact of farmers' attitudes associated with agrochemicals on food production in Kibiga Sub-County, the data was qualitatively analyzed. Since the majority of respondent had a

negative attitude towards agrochemical use, this implied that the impact on food production was also negative.

4.5.3. The impact of farmer's practices associated with agrochemicals on food production in Kibiga Sub-County

To test the impact of farmers' practices associated with agrochemicals on food production in Kibiga Sub-County, a spearman rho correlation coefficient was done by the study and the results are shown in Table 4.11 below. Table 4.11: Correlation results between farmers' practices associated with agrochemicals and food production

(Correlation	(Variables)	(Correlation and significant level)	Farmers' practices	Food production
Spearman's rho	Farmers' practices	Correlation Coefficient	1.000	-.303
		Sig. (2-tailed)	.	.229
		N	189	189
	Food production	Correlation Coefficient	-.303	1.000
		Sig. (2-tailed)	.229	.
		N	189	189

Correlation is significant at the 0.05 level (2tailed).

Source: primary data, 2016

Findings show that there was a negative correlation (*rho* = -.303) between farmers practices associated with agrochemicals and food production. These findings were subjected to a test of significance (p) and it is shown that the significance of the correlation (p = .229) is greater than the recommended critical significance at 0.05. Thus, the impact was insignificant. Therefore, this implied that farmers practices associated with agrochemicals negatively impact on food production

in Kibiga Sub-county. Therefore, basing on the above finding, it is important that farmers practices associated with agrochemicals be improved if food production in the area is to improve.

4.6 Multivariate analysis

Regression was used to establish the multivariate results of the study. Table 4.12 below has more details.

Table 4.10 showing multivariate analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F Statistic	Sig.
1	-.950[a]	-.802	-.703	.47158	14.277	.000

a. Predictors: (Constant), knowledge, attitudes, practices

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.939	.341		5.681	.000
	Knowledge	-.159	.089	.567	4.996	.078
	Practices	-.327	.105	.391	3.125	.003

a. Dependent Variable: food production

Source: primary data, 2016

Findings in table 4.12 show a negative and linear relationship (Multiple R = -.950) between farmer's perception associated with usage of agrochemicals and food production. Going by the adjusted R Square, it is shown that farmer's perception associated with usage of agrochemicals accounts for 70.3% change in food production. Essentially, this means that farmer's perceptions

associated with usage of agrochemicals impact negatively food production in Kibiga sub-county by 70.3%.

4.7 Discussion of the findings

The discussion of the findings has been done according to study objectives as shown below.

4.71 Farmers' knowledge, attitudes and practices associated with usage of agrochemicals

It has been established in the study that the perceptions of farmers associated with usage of agrochemicals in Kibiga Sub-county are still negative and likely to have a significant effect on food production in the area.

On farmer's knowledge associated with usage of agrochemicals, all items introduced to respondents had a positive connotation which meant that farmers were aware about the usage of agrochemicals. However, this was contrary to what interviewees indicated that most of the farmers lacked the required knowledge associated with usage of agrochemicals. This implied that the knowledge of farmers in the area was being doubted towards the usage of agrochemicals. This study finding was in agreement with Morris-Cotterill (2002) who had earlier established that the largest barrier to usage of agrochemicals in developing countries lies in the perception that agrochemicals destroy the soil and the environment. This study findings were also in agreement with Roger (2001) who had indicated that non-licensed agrochemicals affect food productivity and at the end scare away farmers from using all types of agrochemicals thinking all of them are fake.

On, farmer's attitudes associated with usage of agrochemicals, qualitative results revealed the attitudes of respondents to agrochemical use were negative. This position was also further supported by the key informants in an interview. This implied that farmers in the area had negative attitudes towards the usage of agrochemicals. This was in agreement with what Amedu (2005)

found out that most of the farmers use agrochemicals because they perceive them to reduce on the amount of work to be done in the garden compared to traditional mechanism like putting fertilizers which is very labor intensive. Furthermore, the study findings were in with what Shenider, F. Pathak, R.S. and S.M. Othieno (2009). had earlier argued that most of the rural farmers shy away from using agro-chemicals because they find most of them dangerous to their soils and living organisms. This is particularly also in line with what Amos (2007) said that few farmers have the required knowledge to use agro-chemicals and this forms their attitudes to think that they have side effects or negative effects on their food production.

On, farmer's practices associated with usage of agrochemicals, most of the items introduced to respondents turned out to be negative. This position was also further supported by the key informants in an interview. This implied that farmers in the area had negative practices. This is in line with what Smith, K. R., Corvalan, C.F. and Kiellstrom, T. (1999). had earlier asserted that the biggest mistake done by farmers is not to read carefully the precautions appended on the agrochemicals. They indicated that this harms the soil and crop growth.

4.7.2 The level of food production in Kibiga Sub-County

The results from the study indicated that the level of food production in Kibiga Sub-county has been going down over years. This is because some households were reported to have hunger, their food taste has been declining and the market is also very small.

4.7.3 The impact of farmers 'knowledge, attitudes and practices associated with agrochemicals on food production in Kibiga Sub-County

The study findings indicated that farmers 'knowledge, attitudes and practices associated with agrochemicals had a negative impact on food production in Kibiga Sub-County. Findings showed that there was a negative correlation (*rho* = -.269) between farmers 'knowledge associated with agrochemicals and food production; further, it was shown that farmers attitudes associated with agrochemicals were negative and, also findings showed that there was a negative correlation (*rho* = -.303) between farmers practices associated with agrochemicals and food production.

Depending on the adjusted R Square, it is clear that farmer's perception associated with usage of agrochemicals negatively impact 70.3% change in food production in Kibiga sub-county. This study finding is in agreement with Cesna *et al.,* (2005) who had earlier indicated that when a pesticide is released into the environment many things happen to it. Sometimes, the leaching of some herbicides into the root zone can result in better weed control and at times releasing pesticides into the environment can be harmful, as not the entire applied chemical reaches the target site. Arias-Estevez *et al*., (2008) further assures that the behavior of soils which have been applied to pesticides for example is governed by a variety of complex dynamic physical, chemical and biological processes, including sorption–desorption, volatilization, chemical and biological degradation, uptake by plants, run-off, and leaching.

In congruent with study findings, Pimentel and Greiner (1996) further point out that a higher proportion of pesticide poisonings and deaths occur in developing countries where there are inadequate occupational safety standards, protective clothing, and washing facilities; insufficient enforcement; poor labeling of pesticides; illiteracy; and insufficient knowledge of pesticide hazards. Throughout the world, the highest levels of pesticide exposure are found in farm workers,

pesticide applicators, and people who live adjacent to heavily treated agricultural land. Because farmers and farm workers directly handle 70-80% of the pesticides they use, they are at the greatest risk of exposure (McDuffie, 1994).

In conclusion therefore, it is imperative to understand that the study findings indicated that the perceptions of farmers associated with usage of agrochemicals in Kibiga Sub-county were negatively affecting the usage of agrochemicals. It was further established that farmer's practices and attitudes mostly affect the usage. On the second objective, it was found out that the level of food production in Kibiga Sub-county has been going down over years. This is because some households were reported to have hunger, their food taste has been declining and the market is also very small. On the third objective, it was established that farmers 'knowledge, attitudes and practices associated with agrochemicals had a negative impact on food production in Kibiga Sub-County.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMENDATIONS

5.1 Introduction

The general objective of this study was to examine the perceptions associated with use of agrochemicals on food production in Kibiga Sub-County. The study made inference on the study objectives which included; determining the farmers' knowledge, attitudes and practices associated with usage of agrochemicals; establishing the level of food production in Kibiga Sub-County and examining the impact of farmers 'knowledge, attitudes and practices associated with agrochemicals on food production in Kibiga Sub-County.

5.2 Summary of findings

5.2.1 Demographic factors

It was established that all the respondents that took part in the study were mostly above the age of 30. The majority of respondents were between the ages of 40-49 (36.5%). For gender, the majority of the respondents were females (69.4%) and male (29.6%). These results show that gender representation indicated a bigger variation between the male and female with a difference of almost 50%. Academically, many of the respondents had primary school level of education (61.4%). In addition, it was established that (63%) of the respondents were married, 17.9% were single. These respondent's bio data thus implied that most of the respondents had the required ages, with gender variations and academic qualifications to respond to the study.

5.2.2 Farmers' knowledge, attitudes and practices associated with usage of agrochemicals

It has been established in the study that the perceptions of farmers associated with usage of agrochemicals in Kibiga Sub-county were negatively affecting the usage of agrochemicals. On farmer's knowledge associated with usage of agrochemicals, all items introduced to respondents had a positive response which meant that farmers were aware about the usage of agrochemicals.

However, this was contrary to what interviewees indicated that most of the farmers lacked the required knowledge associated with usage of agrochemicals. This implied that the knowledge of farmers in the area was being doubted towards the usage of agrochemicals. This study finding was in agreement with Morris-Cotterill (2002) who had earlier established that the largest barrier to usage of agrochemicals in developing countries lies in the perception that agrochemicals destroy the soil and the environment.

On, farmer's attitudes associated with usage of agrochemicals, most of the questions asked to respondents turned out to be negative towards agrochemical use. This position was also further supported by the key informants in an interview. This implied that farmers in the area had negative attitudes towards the usage of agrochemicals. This was in agreement with what Amedu (2005) found out that most of the farmers use agrochemicals because they perceive them to reduce on the amount of work to be done in the garden compared to traditional mechanism like putting fertilizers which is very labor intensive.

On, farmer's practices associated with usage of agrochemicals, most of the items introduced to respondents turned out to be negative. This position was also further supported by the key informants in an interview. This implied that farmers in the area had negative practices that lead to less usage of agrochemicals.

5.2.3 The level of food production in Kibiga Sub-County

The results from the study indicated that the level of food production in Kibiga Sub-county has been going down over years. This is because some households were reported to have hunger.

5.3.4 The impact of farmers 'knowledge, attitudes and practices associated with agrochemicals on food production in Kibiga Sub-County

The study findings indicated that farmers 'knowledge, attitudes and practices associated with agrochemicals had a negative impact on food production in Kibiga Sub-County. Findings showed that there was a negative correlation (*rho* = -.269) between farmers 'knowledge associated with agrochemicals and food production; it was revealed qualitatively that there was a negative attitude towards the use of agrochemicals to increase food production and, also findings showed that there was a negative correlation (*rho* = -.303) between farmers practices associated with agrochemicals and food production.

Depending on the adjusted R Square, it clear that farmer's perception associated with usage of agrochemicals negatively impact 70.3% change in food production in Kibiga sub-county.

5.3 Conclusion

Below are the conclusions made on each and every study objective;-

On the first objective, it was established that that the perceptions of farmers associated with usage of agrochemicals in Kibiga Sub-county were negatively affecting the usage of agrochemicals. It was further established that farmer's practices and attitudes mostly affect the usage.

On the second objective, it was found out that the level of food production in Kibiga Sub-county has been going down over years. This is because some households were reported to have hunger, their food taste has been declining and the market is also very small.

On the third objective, it was established that farmers 'knowledge, attitudes and practices associated with agrochemicals had a negative impact on food production in Kibiga Sub-County. This was because farmer's knowledge, attitudes and practices were reportedly negative and

insignificant towards usage of agrochemicals and this in the end affected food production. These study findings therefore, provided a direct evidence that farmer's perceptions associated with usage of agrochemical affects food production in Kibiga Sub-county, Kiboga District and Uganda are negative.

5.4. Recommendations

In light of the above conclusions, below are the suggested recommendations;

- **i)** The results of the study indicate that farmers prefer using their traditional methods of improving productivity, I recommend conducting of research in areas such as Integrated Pest Management (IPM) so as to improve food production.
- **ii)** There should be developed proper and effective information dissemination channels to ensure that farmers have adequate sources of technical information available on the safe use of the agrochemicals
- **iii)** Farmers who wish to increase yield, to control pest and disease and improve marketability of their outputs should seek advice from agricultural stakeholders such as area agricultural officers so as to have adequate understanding of pest ecology, economic injury level, types of pesticides to control specific insect pests, use pesticides as recommended in quantities and methods of application, time lapse between last picking and spraying, and take precautionary measures.

Areas for further research

A research should be carried out to provide alternative pest management methods to increase food production and reduce use of pesticides since farmers prefer their traditional methods. Integrated pest management is one area that could be researched on.

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APPENDICES

APPENDIX I:

SELF ADMINISTERED QUESTIONNAIRE FOR SMALLHOLDER FARMERS INKIBIGA SUB-COUNTY

INTRODUCTION

Dear Respondent,

I am a student from Uganda Martyrs University, Nkozi. I am undertaking a research to generate data and information on "*Assessing the Perceptions Associated with Agrochemical Use on Food Production among Smallholder Farmers in Kiboga District: Case Study".* You have been selected to participate in this study because of the contribution you make in the agricultural sector in the area is central to the kind of information required. The information you provide is solely for academic purposes and will be treated with utmost confidentiality. Kindly spare some of your valuable time to answer these questions by giving your views where necessary or ticking one of the alternatives given. Indeed your name may not be required. Thank you for your time and cooperation.

SECTION A: BACKGROUND DATA

Please circle the numbers representing the most appropriate responses for you in respect of the following items:

1. Your gender a) Male b) Female

2. What is your age group?

a) Below 20 b) 20-29, c) 30-39, d) 40-49, e) 50 and above

3. What is your highest level of education?

a) Primary, b) Secondary, c) No education d) Certificate e) Others (specify)

4. What is your marital status?

a) Single b) Married c) divorced d) Separated e) Widowed

SECTION B: PERCEPTIONS ASSOCIATED WITH AGROCHEMICAL USAGE

i) Knowledge

In this section please tick in the box that corresponds to your opinion/view according to a scale of 1 = Strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, 5 = Strongly Agree

No	Statement	1	2	3	4	5
1	Agrochemicals increase yields in the garden					
2	Agrochemicals control pests and diseases					
3	Foods produced using agrochemicals have a normal appearance					
4	Foods produced using agrochemicals can be marketed					
5	The importance of agrochemicals has been recommended by extension workers in the area					
6	I am aware that potentially beneficial organisms in the farm can be harmed through use of agrochemicals					
7	I can differentiate between licensed and non-licensed agrochemicals					
8	Agrochemicals destroy the soils					

ii) Practices

In this section please tick in the box that corresponds to your opinion/view according to a scale of 1 = strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, 5 = strongly Agree

No.	Statement	1	2	3	4	5
1	I prefer using agrochemicals than traditional fertilizers					
2	In our area if you do not add agrochemicals to the soil, you cannot get enough yields					

No.	Statement	1	2	3	4	5
3	I only use licensed and approved agro-chemicals					
4	While using agrochemicals, I observe very well the safety measures					
5	I read carefully the precaution to ensure the organisms are not harmed when applying Agrochemicals/pesticides					

iii)

iii) Attitudes

1. Do you have sufficient knowledge on use of agrochemicals?
2. What opinion do you have on foods produced using agrochemicals?
3. What is the effect of agrochemicals on the environment?
4. What effect do agrochemicals have on your soils?
5. What benefit do you obtain from using agrochemicals?
6. What can be done about agrochemicals use in your area?

SECTION C: FOOD PRODUCTION

In this section please tick in the box that corresponds to your opinion/view according to a scale of 1 = Strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, 5 = Strongly Agree

No.	Statement	1	2	3	4	5
1	I get enough produces from my farm					
2	The taste of our foods has improved in our household					
3	Foods produced in my household is of good quality					
4	The issue of hunger has not been heard in my household					
5	We can ably survive on food produced in my farm					
6	The market for our products has been expanding					
7	Our crops are no longer attacked by pests and diseases					

THANK YOU FOR YOUR PARTICIPATION!

APPENDIX II:

INTERVIEW GUIDE FOR EXTENSION WORKERS

i) Do you think smallholder farmers do have the required knowledge to use agrochemicals in the area?

ii) If yes, explain while mentioning the most used agrochemicals in the area

iii) Do you think smallholder farmers do have the right attitude towards agrochemicals usage in the area?

iv) Do you think the practices in the area allow the usage of agrochemicals?

v) To what extent has farmers 'knowledge, attitudes and practices associated with agrochemicals improved on food production in Kibiga Sub-County

THANK YOU

APPENDIX III:

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Source: Krejcie& Morgan (1970, as cited by Amin, 2005)

Note.—*N* is population size.

S is sample size.

APPENDIX IV: CODING SHEET

Respondent	Gender	Age	Education	Marital Status	Knowledge	Practices	Food production
1	1	5	1	2	2	1	1
2	1	4	1	1	2	1	2
3	2	4	1	2	1	1	2
4	1	4	2	1	2	1	2
5	1	3	1	1	1	2	1
7	1	4	1	2	1	1	1
8	2	2	3	2	2	1	1
9	1	3	1	3	3	1	1
10	2	4	2	3	1	2	1
11	1	5	1	1	1	3	1
12	1	3	1	4	1	1	1
13	2	2	1	4	4	1	1
14	1	1	4	2	1	1	2
15	1	2	1	5	1	1	2
16	1	5	2	1	4	2	2
17	2	5	3	1	2	1	1
18	1	4	1	2	3	1	1
19	2	4	4	1	2	1	1
20	1	4	4	2	2	2	1
21	1	4	4	1	1	3	1
22	2	4	1	1	2	1	1
23	1	2	2	2	1	1	1
24	1	3	3	2	1	1	1
25	1	4	1	3	2	1	2
26	2	5	1	3	3	2	2
27	1	4	1	1	1	1	2
28	2	4	2	4	1	1	1
29	1	1	1	4	1	1	1
30	1	2	1	2	4	2	1
31	2	5	3	2	1	3	1
32	1	5	1	1	1	1	1
33	1	4	2	1	4	1	1
34	1	4	1	2	2	1	1
35	2	4	1	1	3	1	1
36	1	4	1	2	2	2	2
37	2	4	4	1	2	1	2
38	1	2	1	1	1	1	2
39	1	3	2	2	2	1	1
40	2	4	3	2	1	2	1
41	1	5	1	5	1	3	1

APPENDIX V: DATA COLLECTION CONSENT LETTER

Uganda Martyrs University

making a difference

Faculty of Agriculture

24. 06. 2016

TO WHOM IT MAY CONCERN

This is to introduce the bearer BIRUNGI Annet a Second year student of Master of Science Agro-ecology, Registration Number 2011-M152-20004 in the Faculty of Agriculture of Uganda Martyrs University.

She is conducting a Research Project to enable her prepare a Dissertation as a partial requirement for the award of her degree.

I should be very grateful if you would accord the student all the necessary assistance and cooperation.

Yours Sincerely,

Assoc. Prof. Julius Mwine

Dean Faculty of Agriculture

Uganda Martyrs University P. O. Box 5498 - Kampala - Uganda
Tel: (+256)038-410611 Fax: (+256)038-410100 E-mail: umu@umu.ac.ug