AN ASSESSMENT OF FACTORS AFFECTING LEVELS OF AWARENESS ON SAFETY AND HEALTH IN USE OF AGRO-CHEMICALS AMONG LARGE SCALE FLOWER FARM WORKERS IN UASIN GISHU COUNTY, KENYA

EUNICE JEROTICH SAINA

A Thesis Submitted to the Graduate School in Partial Fulfillment for the Requirements of the Award of the Degree of Master of Arts in Geography of Egerton University

EGERTON UNIVERSITY

OCTOBER, 2017

DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented for an award of degree in any other university.

Signature…….. **Date**……..

Eunice Jerotich Saina

REG. NO; NM14/3557/13

Recommendation

The thesis has been submitted for examination with our approval as the university supervisors

Signature…….. **Date**……..

Prof. K. N. Ondimu, Ph.D.

Department of Geography

Egerton University

Signature…… **Date**……

Dr. A. Otara, M. Med.

Department of Reproductive Health

Egerton University

COPYRIGHT

DEDICATION

I dedicate this thesis to my dear husband Mark K. Yego and my mother Mary Saina

ACKNOWLEDGEMENT

I would like to express my sincere appreciation to Egerton University and to the Department of Geography for making this study possible, especially guidance given to me by my supervisors; Prof. Kennedy N. Ondimu and Dr. Amos Otara, all of whom gave professional assistance, support and encouragement during the study.

My appreciation is further extended to my colleagues and above all Mrs.Julia Chepkonga and Mr. Frankline Yatich for sharing ideas and support during the entire period of my study and research.

Finally, I express my deepest gratitude to my dear husband Mark Yego and son Finley Kiplagat for constant prayers, patience, support, encouragement and understanding during the time while I was away pursuing my studies.

ABSTRACT

Flower farms play an important role in the horticulture industry which contributes about 10% of agricultural produce in Kenya. They create employment, earn foreign exchange through exports and improve infrastructure in the world. Despite these achievements agro-chemicals used in these farms to increase production pose a great danger to the health of the farm workers and the surrounding environment. The broad objective of this study was to perform an assessment of factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County, Kenya. This study sought: to describe the socio-demographic characteristics of large scale farm workers, assess the knowledge, attitude and practice on safe handling of agro-chemicals among large scale farm workers, determine the prevalence of self-reported health symptoms related to agro-chemicals exposure among large scale farm workers and determine factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County. Data was collected by administering questionnaires and analyzed using SPSS version 20 for descriptive and inferential statistics. The study revealed that some of the agro-chemicals used are acephate, tetradifon, aldicarb and piperophos. Though majority of the respondents have participated in training courses related to the safe handling, age, marital status and level of education had significance in safe handling of agro-chemicals. The results indicate that agro-chemicals can have negative impacts on health, with farm workers that handled agro-chemicals reporting to have had symptoms of the skin, nasal, eye, and chest alongside pregnancy complications. This study recommends that studies be done to assess level of monitoring of safety procedures for farm workers and farms such as wearing protective equipment. It is proposed that further research be conducted to assess social impact of agrochemicals use among adjacent communities, identify their environmental and social impact and to explore the association between agro-chemicals and health outcomes.

TABLE OF CONTENTS

LIST OF TABLES

LIST FIGURES

ACRONYMS AND ABBREVIATIONS

AHS: Agricultural Health Study

ATSDR: Agency for Toxic Substances and Disease Registry

DDT: Dichlorodiphenyltrichloroethane

EDL: Essential Drug List

EMCA: Environmental Management and Coordination Act

EPA: Environmental Protection Agency

EU: European Union

FAO: Food Agricultural Organization

ILO: International Labour Organization

KFC: Kenya Flower Council

MRL: Maximum Residues Levels

NGO: Non -Governmental Organization

OSHA: Occupational Safety and Health Act

PAHO: Pan American Health Organization

PCPB: Pest Control Products Board

PPD: Personal Protective Device

RHS: Royal Health Study

WHO: World Health Organization

UGCIDP: Uasin Gishu County Integrated Development Plan

UGCHSIP: Uasin Gishu County Health strategic and Investment Plan 2013

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Globally, agro-chemicals have been used increasingly since the 1940s. Their use leads to considerable health hazards for people, due to direct contact during application, pesticide drift from fields, or contamination of food or drinking water. The effects of the dispersal and inappropriate handling of agro-chemicals are a significant global health problem. In the European Union alone, more than 200,000 tonnes of agro-chemicals (active ingredients) are used annually (Eurostat Statistical Books, 2007). Africa on the other hand makes up 4% of global pesticide market, a rough estimate of about 75000-100000 tonnes of agro-chemicals (PAN, 2003).

Floriculture development has positive environmental impacts, and not limited to, creation of job opportunities, improved infrastructure, improved worker living standards among others on the other hand negative impacts are illnesses among workers, occupational safety, sexual harassment, surrounding community health, compensation for previous land holders and social change among many people are major challenges (ILO, 2006).

According to estimates of Environmental Protection agency EPA (1992), occupational exposure to agro-chemicals poisons as many as 20,000 farm workers every year and causes farm workers to suffer more chemical-related injuries and illnesses than any other workforce nationwide. Several factors contribute to the underestimation of the problem, including the inability and apprehension of affected workers to get medical care, medical misdiagnosis, lack of training, inappropriate practices and the absence of a coordinated national incident reporting system (Calvert *et al*., 2008).

Agro-chemicals that are classified as being extremely or highly hazardous by FAO and WHO are used in developing countries causing 3.5 to 5 million acute poisonings a year (WHO, 2003). According to WHO, developing countries use about twenty-five percent of the agro-chemicals in the world, and the use is in increasing trend. Some of the agro-chemicals used in flower farms include DDT and chlordane among others. These are essentially dangerous as they are being used without technical and human resources to control it properly.

Farm workers are exposed to agro-chemicals in a variety of ways; First, workers who perform hand labor tasks in treated areas risk exposure from direct spray, aerial drift, or contact with agro-chemical residues on the crop or soil. Second, workers who mix, load, or apply agro-chemicals can be exposed to agro-chemicals due to spills, splashes, and defective, missing or inadequate protective equipment (Lu, Fenske, Simcox and Kalman, 2006).

Exposure to toxic environmental chemicals and related health outcomes are inequitably distributed within and between countries. Globally, the consequences of exposure and harm are disproportionately borne by people with low incomes, discrimination, social factors and economic factors. Documented links between prenatal exposure to environmental chemicals and adverse health outcomes span the life course and include impacts on fertility and pregnancy, neurodevelopment, and cancer. The global health and economic burden related to toxic environmental chemicals is in excess of millions of deaths and billions of dollars every year (Di Renzo *et al*., 2015).

Agriculture work is one of the most common types of employment in the world. Nearly 50 percent of the world labour is employed in agriculture directly and they carry significant risk for development of pesticide risk (Das *et al*., 2001). Agricultural development policies in many developing countries emphasize use of a lot on external inputs as means of increasing food production. This has led to a growth in the use of agro-chemicals and inorganic fertilizer hence a substitution for natural processes and resources. In Kenya, Environment and Management Coordination Act (EMCA***)*** 2016, states that it is the duty of workers to ensure that he or she wears or use any protective equipment or clothing provided by employer or farm and should comply with safety and health procedures requirements given by person having authority over him for his own or any persons safety.

In developing countries, the effects of acute poisoning due to exposure to dangerous levels of agro-chemicals in food are apparently more severe than in industrialized countries. For example, from Africa: in 2008 Nigeria reported that 112 people had been poisoned by pesticide. In some regions, direct contact with agro-chemicals used in agriculture is a widespread problem. Mixing and applying agro-chemicals has resulted in acute poisoning due to uptake via the respiratory organs or through direct contact with the skin or eyes. Agro-chemicals pose a further hazard for the residents of rural areas or surrounding communities for example air pollution, soil pollution when there is soil erosion from the farms and water

contamination especially where water resources are shared with the communities (Organic Consumer Association, 2008).

EMCA(2000) states that no person shall discharge any hazardous substance, chemical, oil or mixture containing oil into any waters or any other segments of the environment contrary to the provisions of the Act. Moreover, health hazards as a result of agro-chemical use are not understood by workers, also the communities living around the farms may be unaware of health hazard; however it is known that extensive use of agro-chemicals has adverse effects on health and surrounding environment and studies show that one in five children die in poorest areas of the world. United Nations, World Bank and World Resource Institute show that pesticide poisoning, malaria and respiratory infections contribute to 11 million childhood deaths every year (WHO (2006).

According to Occupational Safety and Health Act (OSHA, 2007), employees are required to provide information, training and supervision to workers as it is necessary in order to ensure that safety and health at workplace. The act also provide that risk assessment should be carried out in relation to safety and health of persons employed and at same time adopt preventive and protective measures e.g. sending a copy of assessment report to the area occupation, safety and health officer stopping any dangerous operation on activity that exposes persons health risks.

Although there are now some 500 commercial flower growers in Kenya, approximately 75% of Kenya's cut flower exports are grown by about two dozen large and medium scale producers. Such operations range in size from 20 to over 100 hectares, with workforces of between 250 and 6000 (Thoen *et al*., 2000). Large scale farms are found in areas like Rift Valley region like Naivasha, Uasin Gishu and Central region of Kenya for example Kiambu. Much of the remaining flowers production is grown by smallholders in open plots of less than half a hectare.

Some of the major problems encountered by floriculturists include pests, disease and growth control. Agro-chemicals play a big role in increasing crop yields as well as controlling insect vectors that cause diseases like Yellow fever and Malaria. The use of agro-chemicals that have been restricted and banned in industrialized countries are mainly used in many developing countries (Wesseling *et al*.,1997), farm workers engage regularly in spraying agro-chemicals applied in different formulations and stages.

Agro-chemicals have replaced biological, cultural, and mechanical methods for controlling pests, weeds and diseases. On the other hand, in most cases information for the management decisions on agro-inputs comes from input suppliers, researchers, and extension workers rather than from local indigenous sources. It is, therefore, necessary to make better use of indigenous resources in sustainable agricultural production and for health maintenance. Industrialized countries have been taking significant steps to reduce pesticide use, while use in developing countries is on the increase (Wesseling, 2003).

It is clear that there is still a wide overuse of agro-chemicals by farmers applying them as a preventive measure, or without considering recommended doses or synergetic effect, (Barrow l995; Pretty 1995). To achieve the preferred effect and to avoid risks, the pesticide industry and scientists recommend that the most appropriate pesticide should be applied in accurate amounts, at the right time, and with appropriate precautions in terms of storage, handling, use, preparation and application, and the cleaning of equipment and disposal (Sweet *et al*., 1990).

1.2 Statement of the Problem

There has been an increase in use of agro-chemicals in farming activities specifically in the four major large scale flower enterprises in Uasin Gishu County; approximately 700 people work in these farms and this exposes them to risk of illnesses that relate to poor handling of agro-chemicals. Lack of awareness on safe handling, disposal and health in use of agro-chemicals hinders public health officials, occupational safety experts, medical personnel, employers and consumers from making decisions that would best protect farm workers from agro-chemicals exposure.

Researches done previously show that most farm workers still apply inappropriate practices while handling agro-chemicals in most flower farms which can greatly contribute to health problems. Therefore to develop more effective approaches for protecting farm workers from such risks, more research about pesticide use, pesticide-related illnesses, and education is needed. It is from this background that this study sought to assess the levels of awareness on safety and health on use of agro-chemicals in Uasin Gishu County in order to reduce some of the health risks posed by inappropriate use of agro-chemicals based on use, handling and disposal.

1.3 Objectives of the Study

1.3.1 Broad Objective

The broad objective of this study was to perform an assessment of factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County, Kenya.

1.3.2 Specific Objectives

This study was guided by the following objectives;

i. To describe the socio-demographic characteristics of large scale farm workers.
ii. To assess the knowledge, attitude and practice on safe handling of agro-chemicals among large scale farm workers.
iii. To determine the prevalence of self-reported health symptoms related to agro-chemicals exposure among large scale farm workers.
iv. To determine factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County.

1.4 Research Questions

The study sought to provide comprehensive answers to the following questions;

i. What are the socio-demographic characteristics of large scale farm workers?
ii. What are the knowledge, attitude and practices on safe handling of agro-chemicals among large scale farm workers?
iii. How frequent do self-reported health symptoms occur related to agro-chemicals exposure among large scale private farm workers?
iv. What are the significant factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County?

1.5 Justification and Significance of the Study

Knowledge gained from this study will be used by management of other flower farms in Uasin Gishu County and other parts of Kenya to develop procedures to ensure safety, health,

and welfare of workers. Similarly they will be able to provide and maintain facilities, systems and procedures of work that are safe and without risks to health. This will ensure absence of risks to health regarding handling, disposal, transportation, and use of agro-chemicals as provided by OSHA ACT (2007).

Agricultural extension officers and research workers will also benefit from results of this study in order to improve linkages with farmers to advance the use of appropriate modern technology. This will enhance the local inputs for improved agricultural product without causing any health problems so as to improve and even save lives of present and future generations. The study will assist to find out if some policies are adhered to, for example the policy referred to in Article 4 and 11 of ILO Convention and (EMCA, 2000).

1.6 Scope and Limitation of the Study

The study focused on knowledge; attitude and practices on safe handling of agro-chemicals among farm workers who work in four major large scale flower farms. This study also assessed prevalence of self-reported symptoms suffered by large scale farm workers. Self-reported illnesses are not also accurate therefore the study used symptomatic diagnosis of common illness associated with exposure to agro-chemicals.

This study collected on self- reported illnesses for the last one month prior to survey this was reliable since the workers could not recall sicknesses suffered in the past months. However limiting one month before survey also excludes diseases that take long period to develop and show symptoms for example chronic non communicable diseases. The researcher did not have a control group therefore cannot compare and infer causal relationship from the outcome of results. Similarly, the researcher could not assess how the companies dispose unused or expired chemicals and their containers but dwelt on disposal among the farm workers.

Some problems encountered include: difficulty to access the workers in the field, some respondents were unwilling to give information, demanding payments and travelling long distance. The studied population was only limited to the farm workers whereas the effects of the agro-chemicals may be more widespread affecting non-farm workers in the environs.

1.7 Definition of Terms

Agro-chemicals - any substance used to kill, repel, or control certain forms of plant or animal life that are considered to be pests. This study assessed some of the agro-chemicals used by farm workers in large scale private farms their storage, handling and disposal of containers. These companies use pesticides-toxic substances in spraying flowers to reduce pests and weeds in the farms and in many cases they are released intentionally into our environment to kill living things. This includes substances that kill weeds (herbicides), insects (insecticides), fungus (fungicides) and rodents (rodenticides)

Attitude- an enduring and general evaluation or cognitive schema relating to an object, person, group, issue, or concept. Strength and valence can vary, thus, an attitude can be negative or positive. This can also refer to any subjective belief or evaluation associated with an object. The study evaluated attitudes on pesticide use handling and storage for example reporting incidence of diseases related to pesticide use, experiences on application of agro-chemicals, reading labels among others.

Hazard- the acute risk to health (that is, the risk of single or multiple exposures over a relatively short period of time) that might be encountered accidentally by any person handling the product in accordance with the directions for handling by the manufacturer or in accordance with the rules laid down for storage and transportation by competent international bodies. In this study, pesticide handling by farmers is a hazard. These include storage, use and disposal of containers, use of protective gloves and clothing.

Health - According to WHO (1948),health refers to a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" The study assessed frequency of self- reported cases for example skin rashes, respiratory infection, cancer, pregnancy loss, reproductive impairment, eye itching among others symptoms of other diseases will also be relied upon.

Knowledge- the fact or condition of knowing something with familiarity gained through experience or association or acquaintance with or understanding of a science,

art, or technique. This study assessed knowledge on names of agro-chemicals used, illnesses related to agro-chemicals, what to do in case of split, training related to pesticide handling, use of PPD among others.

Practices - actual application or use of an idea, belief, or method as opposed to theories about such application or use. Practices assessed in this study include washing hands after handling agro-chemicals, disposal of containers, following product label, changing clothes after pesticide exposure and taking a shower after handling agrochemicals.

Work based programmes- An educational approach that uses workplaces to structure learning and improve the employees' experiences that contribute to social, economic, and career development. Employers play an active role in shaping the quality of their employees when they participate in programmes like training and seminars. This study sought to find out some of the programmes employees undertake at work that help reduce agrochemical exposure and improve on good work practices

Safe handling of agro-chemicals- this include proper transportation, storage, disposal, mixing and loading, application, record keeping, among others. In this study farm worker protection and high standards of working prevents health hazards and also helps to reduce risks spreading to the community as well as illnesses among staff which increases the cost of company

Self-reported illnesses–refers to frequently reported assessment of health status of individuals. This study assessed some of the illnesses reported by the farm workers in the field which are related to handling of agro-chemicals one month prior to survey. Some of the illnesses assessed in this study include; respiratory diseases, reproductive complications, burns and sensations, skin diseases, excessive sweating among others.

CHAPTER TWO

LITERATURE REVIEW

2.1 Types of Agro-chemicals and Use

According to Warren**(**1998), tremendous benefits have been derived from the use of pesticides in forestry, public health and the domestic sphere and, of course, in agriculture, a sector upon which the economy is largely dependent the USA. Agro- chemicals assist farmers in protection of crop losses and yield reduction.

Vector-borne diseases are most effectively tackled by killing the vectors. Insecticides are often the only practical way to control the insects that spread deadly diseases such as malaria, resulting in an estimated 5000 deaths each day (Ross, 2005). The transport sector makes extensive use of pesticides, particularly herbicide which are used to maintain the turf on sports pitches, cricket grounds and golf courses. Insecticides protect buildings and other wooden structures from damage by termites and wood boring insects. In the same study, the high risk groups exposed to pesticides include production workers, formulators, sprayers, mixers, loaders and agricultural farm workers.

WHO (2003), has made an Essential Drug List (EDL), classifying the pesticides into five groups according to their health hazards; I a = extremely hazardous; I b = highly hazardous; II = moderately hazardous; III = slightly hazardous; U = Unlikely to present acute hazard in normal use as shown in the table below. The hazards described are the acute risks to one's health (i.e. the risk that emerges from a single exposure over a short period of time). The EDL is primarily based on oral and dermal threat.

2.2 Knowledge on Safe Use of Agro-chemicals

Agro-chemicals have a capacity to contaminate organisms, soil and water, due to their high volatility, it is estimated that only 0.1% of total applied agro-chemicals attains its intended goal while the other 99.9% is discharged as an air pollutant. The agro-chemicals applied in the green houses travels an average distance of 1500 miles, adding significantly to global warming and air pollution (Anon, 2003). According to Royal Horticultural Society (2004), most of the agro-chemicals can give rapid control of pests and diseases which can in turn

destroy some of the plants and harm human beings. When used they improve the quality and yield of flowers, fruits and vegetables.

According to study conducted in Gaza strip, Palestine, when the farm workers were questioned about their knowledge regarding pesticide associated toxicity symptoms, most knowledge was of a burning sensation in the eyes, face, watering of eyes, chest pain, itching/skin irritation, headache, and dizziness (Safi and Yassin, 2002). Most men and women denied having received formal training on the use of pesticide; such knowledge suggests that farm workers experienced these symptoms in situ. Most of these symptoms are considered to be common manifestations of acetyl cholinesterase inhibition. (ATSDR, 1993)

The majority of the interviewed farm workers in Gaza strip knew that wearing protective gear can protect the body from the adverse health effects of agro-chemicals, but no one took precautions unless they knew about the measures. As concluded by the interviewer, the reason for not using protective gear, among farm workers who knew the benefit of the gear, could be attributed to carelessness, discomfort, cost, or unavailability of protective devices. These findings are in consistent with the study done from Sri Lanka and USA, whereby the percentage of the farm workers who are against the use of agro-chemicals are higher than those who agreed with agro-chemical use (Sivayoganathan *et al*., 1995). The same study found that lack of knowledge of the other alternatives for pest control was the justification for the continuous use of agro-chemicals. Although a low percentage of the interviewed farm workers store agro-chemicals in the home, this practice still puts children and adults at risk.

Wesseling *et al.,* (1997) reported that the high percentage of farm workers who dispose of the empty containers on the garbage site or along the street could put the general population at risk. Such practice was considered to be one of the main problems associated with pesticide use and its management in developing countries. The prevalence of mixing two or more agro-chemicals was high among the interviewed farm workers and correlated with the prevalence of self-reported toxicity symptoms associated with agro-chemicals. Similarly, younger farm workers reported the highest self-toxicity symptoms, the younger farm workers often express themselves better than older ones, who sometimes hesitate to complain. However, huge percentage of men and women denied to having received formal education with the percentage within sex accounting for (80%) who denied in men and 85% in women.

It can be concluded that lack of formal education has contributed greatly to the misuse of agro-chemicals and their applications.

According to study done at Lake Naivasha basin, a high percentage of the interviewed flower farm workers believed that they could not influence the decision to use or not to use agro-chemicals as most of them felt that such suggestions may not be taken kindly by most employers. Similarly, workers expressed some concern about solvent exposure and burns but most felt that these hazards were "usual part of the job" and little could be done to improve health and safety on the job (Kahiu, 2011).

Kenya Economic Survey, 2013, indicates that horticultural sector has slightly increased 3.9% in terms of commodity production for the last two years therefore a lot of emphasis is done to ensure that every county increases its production this means a lot of inputs including agro-chemicals will be used. Pesticide labels are not a guarantee to safe use of agrochemicals by farmers, they are always printed in wrong language or English and many farmers are illiterate. Most of symbols or instructions are not clear to users and are therefore ignored unless a knowledgeable person or pays attention to them. As many as 60% of Kenyan farmers in Kiambu who were interviewed could not read and understand instructions given on pesticide containers Mwanthi (1993).

Therefore findings of the above studies clearly suggest that it is necessary to reduce possible health and environmental risks associated with pesticide use by documenting risk perceptions and knowledge as well as developing ways to address safe use storage handling and disposal of agro-chemicals in order to at least minimize the hazards of occupational pesticide exposure especially in developing countries**.**

2.3 Practices on Safe Handling of Agro-chemicals among the Farmers

A broad variety of factors play a role in shaping farmers' actual agro-chemicals practices since they act rationally within the context of their available resources and socioeconomic objectives (Rola and Pingali, 1993). Presently, agrochemicals are currently the cheapest and most effective means to for pest control in the short run. The supply agents have been subsidized by the government to accelerate national crop production. Moreover, the popularity of chemical agrochemicals stems from their rapid action and prolonged duration (Food and Agriculture Organization of the United Nations, 2008).

In less developed countries, adequate protective clothing is often neglected for reasons of discomfort and/or high cost. No national regulations require farmers working with agro-chemicals to observe specific precautions (Wilson and Tisdell, 2001). Proper pesticide waste disposal is also an important part of responsible pesticide use. Release or uncontrolled discharge of pesticide waste into the environment can harm people and contaminate environment (Damalasb *et al.*, 2008).Empty pesticide containers may often retain unacceptable quantities of pesticide residue if not rinsed properly (Miles *et al.*, 1983).

Ngaruiya (2004) asserts that farming of flowers employs many people on aspects of floriculture, such as spacing, spraying, and pruning plants for optimal flower harvest; and post-harvest treatment, storage, preservation and packaging. Nyakundi *et al*.,(2011), concludes that farmers rely mainly on commercial sources for information about agro-chemicals, along with the influence of suppliers, whose goal is to maximize their sales volumes, resulting in down -playing the negative impact of agro-chemicals.

In addition, surveys from selected areas of Rift and Central provinces of Kenya shows that personal protection equipment is inadequate and personal hygiene is poor (Nyakundi, 2011). This finding indicates a correct knowledge of pesticide routes of absorption, where skin absorption and inhalation has been reported to be the most important. This finding is consistent with many other studies regarding handling of pesticide by rural farmers (Burleigh *et al.*, 1998; Berg, 2001; Matthews *et al*., 2003; Isin and Yildirim, 2007).

As in many other developing countries where empty pesticide containers are highly valued and sold or exchanged as storage containers for other materials, the majority of farmers sell containers to buyers who picked up the waste from the community. It is unclear what the buyers do with such containers. Damalasb *et al*., (2008), strongly against such practices, recommend puncturing empty containers to prevent reuse.

In tropical countries like Mexico, the extensive use of organo-chlorine has great implications regarding their persistence in the environment and subsequent human contamination. DDT is useful in sanitation as the insecticide of choice in the combat of susceptible malaria vectors. Because of DDT's volatility and widespread propagation, the main route of human exposure in tropical areas consists of inhalation of contaminated air and skin contact. An alternative route of human exposure consists of consumption of contaminated food during handling of agro-chemicals and especially food of animal origin

In regards to pesticide acquisition, proximity to stores is most important factor influencing farmers' practices. The most frequently mentioned source of agro-chemicals are mainly agro-chemical shops in the community. Contrary to concerns regarding the influence of commercial personnel on farmers' pesticide use patterns, salespersons from agro-chemical companies are rarely mentioned as a source of pesticide information. This may be because of the small size and isolation of the farm area surveyed, which makes the survey areas unattractive for company sales persons. Unfortunately, knowledge alone rarely translates into practice (Murray and Tayler, 2000).

Research done in British Columbia indicates that farm workers frequently do not use personal protective equipment (PPE) often because it is not provided (Moore2004; Quandt, Hernandez Valero, Grzywacz, Hovey, and Gonzales 2006).Verduzco and Lozano (2003) found that 4 percent of Mexican respondents who had applied agro-chemicals during their last season in Canada did not wear a respirator and that almost half did not wear protective clothing.

Farm workers are often ignorant of potential health risks of pesticide exposure, sometimes because employers fail to inform and educate their workforce (Arcury *et al*., 2001; Hennery, 2008; Sakala1987). In addition to occupational exposure, farm workers are also exposed to potentially harmful chemicals because they are housed in locations that expose them to drift or over spraying as well as to residues taken home on skin, clothing, etc. (Arcury *et al*.,2005; Quandt *et al*.,2006). Much remains unknown regarding the extent and impact of acute and prolonged chemical exposure among farmworkers due to poor reporting systems, the reluctance of farmworkers to report poisonings, barriers to seeking medical treatment, and a lack of physician training in recognizing and treating pesticide-related illnesses(Hansenan Donohue, 2003).

2.4 Farmers' Attitude on Handling of Agro-chemicals

Lack of adequate knowledge, practice and poor attitude on agro-chemicals classification systems, application rates, re-entry periods, mixing and storage result in farmworkers making poor decisions and exercise improper practices (Sekiyama *et al*., 2007).

Research shows that health and environmental hazards of agro-chemicals can be evaded by awareness, education and changing farmer's attitude and behaviour concerning pesticide use (Dasgupta, *et al*.,2005). Therefore, the first step in developing pesticide's health

and environmental hazard reduction policy is to set up the extent of the problem by investigating farmer's attitudes and behaviour regarding pesticide use (Koh *et al.*,1996).

According to (Hayes and Laws, 1991), inappropriate use of agro-chemicals can seriously affect human health and the environment. According to estimates by the United Nations Environment Program, pesticide poisoning injuries affects 1.5 million agricultural workers a year. At least 20,000 workers die from exposure to agro-chemicals every year, most of them in developing countries. Chemically polluted run-off from fields has contaminated surface and ground waters, damaged fisheries, destroyed freshwater ecosystems, and created growing "dead zones" in the ocean (World Bank, 2004)**.**

High percentage of farm workers interviewed in Gaza Strip believed that their bodies could develop resistance against agro-chemicals. This is not only the attitude of farm workers in the Gaza Strip, but also the attitude of farm workers in the West Bank (Saleh, 1995). Such attitudes may further encourage farm workers to be insensitive towards the use of protective measures.

Ward (1993, 1995) and Beck (l992) suggested that use of agro-chemicals is a social fiction. Moreover, there are no objective or agreed restrictions of safety in relation to agro-chemicals, because of the infinite number of possible combinations of agro-chemicals in the human body, including those of farmers who are directly exposed to them, or consumers who ingest them in food and water.

The criteria for the safe and effective use of agro-chemicals established through research in laboratories tend to be far-removed from the farmer's everyday decisions and practices in both industrialized and less industrialized countries. In addition, the recommended levels of pesticide use does not allow for the complex social factors that influence their actual use (Wynne, 1996).

2.5 Health Problems Associated with Agro-chemicals

2.5.1 Health Problems in Developed Countries

The health effects associated with agro-chemicals are divided into acute poisoning and chronic effects. Acute pesticide poisoning is health effects or sickness appearing just after a

single or multiple doses of agro-chemicals. This includes a variation in reactions of different target organs for example neurological, dermal or respiratory. Chronic poisoning occurs steadily after prolonged exposure to agro-chemicals. Development of cancer and reproductive abnormalities has been evident among many people who have gone through a long-term exposure to agro-chemicals (Yan *et al*., 2002).

Agricultural workers are exposed to a variety of chemical, physical, and biological hazards in the process of cultivating and harvesting crops and/or raising livestock (Litchfield *et al*., 1999). In addition to agro-chemicals, occupational exposure to solvents, metals, engine exhaust, welding fumes, and grain dusts are prevalent in agriculture (Coble *et al*., 2002; Shaver and Tong 1991). However, the potential health effects of agricultural pesticide exposures are of particular interest, as these chemicals are designed to have adverse biological effects on target organisms. In the USA a study conducted by researchers at the Public Health Institute, the California Department of Health Services, and the UC Berkeley School of Public Health in July 2007 found a six fold increase in risk factor for autism spectrum disorders (ADS) for children of women who were exposed to organo-chlorine pesticides. In addition, children who live in homes where their parents use agro-chemicals are twice as likely to develop brain cancer versus those that live in residences in which no pesticides are used (ATSDR, 2009).

To address this concern, the Agricultural Health Study (AHS) was initiated in 1993 to explore the potential health effects of pesticide exposures in commercial pesticide applicators in North Carolina. Physical injury, mortality, respiratory disorders, neurologic symptoms, retinal degeneration, diabetes, menstrual cycle characteristics, hearing loss, Parkinson's disease, changes in serum androgen are some of the results from AHS and other researches done so far in developed countries (Hoppin *et al*.,2002).

According to research done in agricultural area of Missouri, fertile men who handled pesticides have been shown to have sperm counts about 40% lower than men in three urban US areas, and to also have higher urinary concentrations of atrazine, alachlor and diazinon (Swan *et al*., 2003). Differences among the groups remained significant after controlling for potential confounders such as abstinence time, smoking, and age, which suggest that these chemicals may have contributed to the reduced semen quality seen in the men

Majority of the agro-chemicals used in agricultural activities have been commonly known as agents of human diseases and environmental pollution. It has been observed that their long term, low dose exposure is increasingly linked to human health effects such as immune-suppression, hormone disruption, disabilities, diminished intelligence, reproductive abnormalities and cancer (Wiles, Davies and Campbell, 1998). Pesticide residues in food are also common global problems (Abinash and Singh 2009).

Ministry of public health in Thailand reported pesticide related health effects in most parts of the world in the year 2007, of about 1,452 pesticide poisoning incidents. The true number is likely to be higher as reported incidents include only those individuals with symptoms severe enough to require medical attention and with access to healthcare. Majority of farmers using agro-chemicals tested by the Ministry of Public Health in 2006 had unsafe levels of cholinesterase depression, a marker of pesticide exposure (Thailand National Statistical Office, 2003). In addition, under diagnosis and under reporting of acute pesticide poisonings are well-recognized issues in developing countries and may also contribute to higher than recorded pesticide poisoning incidents (Ngowi *et. al*., 2007). Engel *et al*., (2005) examined breast cancer incidence among farmer wives in Montreal, Canada. They found out that breast cancer incidence was common among women who reported ever applying agro-chemicals relative to the general population and strong associations were not detected for specific agro-chemicals. However, other women, who were matched for age and date of diagnosis, had a range of other cancer.

Research undertaken in Pakistan on pesticide use by farmers indicate that 82% of Farmers experienced health impairment after mixing and spraying pesticide and that they believed that they are at risk while using pesticide. The common symptoms included eye irritation, neurological headaches, vomiting, skin irritation, respiratory infections and reproductive impairment, cancer, fever among others. Therefore many people are not aware of these hazards and measures to reduce chances of further poisoning (Habeeb, 1996).

Exposure to agro-chemicals and other chemicals, plants and infectious agents, as well as chronic exposure, contributes to a high incidence of skin problems and disease among farm workers (Arcury and Quandt 2007; Larson 2001). A lack of protective clothing and the absence of hand washing facilities at worksites also contribute to skin disorders (Hansen and Donohue2003; Hennebry, 2008)

Employers are required to carry out appropriate risk assessment in relation to the safety and health of workers and on the basis of these results adopt preventive measures to ensure that under all conditions of their intended use, all agricultural activities and comply with prescribed safety and health standards. In addition, employers should ensure that adequate training and comprehensive instructions on safety and health including information on hazards and risks associated with their work (ILO, 2006).

2.5.2 Health Problems in Developing Countries

The findings of Franc and Cruiz (2001) in a study in Ecuador indicate that one of the reasons for rising conflicts between flower farms and surrounding communities were the smell released from the floriculture industries during the application of agro-chemicals.

This led to passing into law a requirement that flower farms or companies must be distance of 1000m from the residential areas and 20% of their lands be set aside for green areas and fences. The introduction of strict laws such as EU Directive 91/4/EEC which emphasizes the requirement of Maximum Residues Levels(MRL's) for specific acting ingredients combination of horticultural crops that enter EU member states.

According to study conducted in Gaza strip, regarding toxicity symptoms associated with agro-chemicals, common self- reported toxicity symptoms among farm workers were burning sensation in the eyes and face, dizziness, breathlessness and chest pain, itching/skin irritation, and headache. Similar data were reported in many countries, including the neighbouring ones. Cole, (1997) and Gomes, (1998)

Studies conducted in Ugandan small scale farmers indicate that the main problems reported by farmers were skin irritation, headache, extreme tiredness, blurred vision and dizziness which are consistent with other studies (Matthews, 2007). The study also revealed that many of the farmers in Pallisa and Wakiso districts did not know enough about how to use and handle agro-chemicals. As reported in other studies the small scale farmers have some knowledge of the names and effects of the agro-chemicals they use but lack knowledge about mixing and of the color coding of agro-chemicals (Jors *et. al*., 2006)

According to research carried out in northern part of Tanzania, 68% of farmers reported having felt sick after routine application of agro-chemicals. Pesticide-related health problems that were linked with agro-chemicals use include skin problems and nervous system disturbances (dizziness and headache). The study concluded that there is a wide range of agro-chemicals being used for pest management and vector control in agricultural areas, but many farming communities in northern Tanzania are not adequately informed about the hazards associated with the agro-chemicals. Therefore farmers use agro-chemicals without full understanding of their impact on human health and the environment (Ngowi, 2007).

Nyamu *et.al*.,(2012) identified in a study of patients admitted at Kenyatta National Hospital (KNH) with poisoning over the period between January 2002 and June 2003 that, agro-chemicals and industrial chemicals were the two most important poisoning agents, accounting for 43% and 24% of poisoning, respectively with Organophosphates accounting for 57.4% for most cases. Data analysis showed that 58.9% of poisoned patients were males and the rest being females and at least two cases of poisoning are seen daily. The higher incidence may be because males are more exposed to strain and occupational hazards compared to females. The major organophosphate encountered was Diazinon; however poisoning cases as a result of Amitraz also formed a significant portion. In terms of age most poisoning cases occur among young adults (ages 21-30) followed by children aged 0-5 years.

A study conducted in Mexico, showed that pregnancy involves the transfer of lipids and lipoproteins from maternal tissues through placenta to fetus. This process results in carry-over of persistent organo-chlorine agro-chemicals through the placenta and their presence in lipid-rich tissues of the fetus Waliszewski *et al.,* (2001).The subsequent metabolic transformation in the fetus is low, due to poor enzymatic activity in the developing organism. Due to the estrogenic and anti-androgenic activity of DDTs, their passage through the placenta and the subsequent fetal exposure can be considered a risk factor to the fetus, which can contribute to congenital malformations of external genitalia. In the same study there was further detection of high amounts of DDT (102 mg/kg) in adipose tissue obtained during the autopsy of a still-born baby (Waliszewski *et al.*, 2001).

2.6 Gender and Exposure to Agro-chemicals

Agro-chemicals exposures in developing countries are aggravated by economic policy changes associated with structural adjustment programs and globalization. Majority of

women in these countries, particularly in the agricultural sector, are increasingly exposed. Since they are concentrated in the most marginal positions in the formal and informal workforces, and production is organized in a gender-specific way, and opportunities for women to control their exposures are limited (Fatuma, 2008)**.** According to article 18 of ILO (2006), measures should be taken to ensure that the special needs of women agricultural workers are taken into account in relation to pregnancy, breastfeeding and reproductive health. However, data from developing countries show that: women's exposures to agro-chemicals are significantly higher than is recognized; poisonings and other pesticide-related injuries are greatly underestimated for women. Similarly, gender-discriminatory and erroneous risk perception increases women's exposures. The gap in knowledge on gender-specific exposures and effects is related to gender biases in the nature of health workers' practices and surveillance (Leslie *et al*., 2002).

According to Bellingham (2013), preconception and prenatal exposure to toxic chemicals is a critical in health for both women and men of childbearing age. Similarly, men and women of reproductive age can encounter toxic chemicals at home, in the community, and in the workplace. Chemicals get into the body through breathing, eating, drinking, and/or penetration of the skin. Furthermore, once toxic chemicals enter the body, the reproductive health impacts can be varied, and can manifest across the lifespan of individuals and future generations.

Organo-chlorine agro-chemicals, due to their lipophilic nature and high persistence, accumulate in food chains and in the human body, especially in lipid-rich tissues, such as adipose tissue. The presence of organo-chlorine pesticide residues in human adipose tissue has recently caused concern due to their anti-androgenic and estrogenic properties and their effects on sexual activity and development of breast cancer (Waliszewski *et al*., 2001). Organo-chlorine when absorbed by expectant women are distributed almost uniformly in the bloodstream of the maternal organism and pass through the placenta to the developing fetus, where they accumulate in the lipid-rich tissues and form the first contamination source for the developing organism.

2.7 Laws/Policies Governing Agro-chemicals Use

Entrenched in Section 42 of Constitution of Kenya (2010), every person has the right to a clean and healthy environment which includes a right to have environment protected for the

benefit of present and future generation through legislative and other measures. In addition to this the International Federation of Gynecology and Obstetrics (FIGO) joins other leading reproductive health professional societies in calling for appropriate action to prevent harm. FIGO recommends that reproductive and other health professionals advocate for policies to prevent exposure to toxic environmental chemicals, work to ensure a healthy system for all, make environmental health part of health care, and champion environmental justice (Di Renzo *et. al*., 2015).

Recently there has been little legal guidance on protecting the environment. Ref However, in 1999 new legislation was enacted to cover a wide range of environmental issues. Implementation of the act has yet to take place and the extent to which it will affect the KFC code has yet to be fully gauged. The Kenyan flower industry continues to come under considerable criticism from environmentalists worried that pollution and over-exploitation of natural resources will permanently degrade the natural environment.

ILO convention Article 16, states that employers are required to ensure that the workplaces, machinery, equipment and processes under their control are safe and without risk to health and also chemical, physical and biological substances under their control are without risk to health as well as provide adequate protective clothing and protective equipment to prevent risks of accidents or of adverse effects on health. Similarly employers should provide for measures to deal with emergencies and accidents, including adequate first-aid arrangements.

Representatives of workers in the undertaking co-operate, get appropriate training and give information to employer in the field of occupational safety and health; and may consult their representative organizations about such information provided they do not disclose commercial secrets. In addition, workers are supposed to be consulted by the employer on all aspects of occupational safety and health associated with their work. For this purpose, technical advisers may be brought in from outside the undertaking (ILO, 2006).

Similarly, is of importance that a worker reports to his immediate supervisor in any situation which he has reasonable justification to believe presents serious danger to his life or health, until the employer has taken remedial action. If necessary, the employer cannot require workers to return to a work situation where there is serious danger to life or health.

Investigations involving possible health and environmental hazards, have led governments of many countries to ban DDT, or to restrict the minimum accepted values of their residues in food stuffs (PAHO, 1995). In the 1980's, banned DDT reappeared, being recommended by WHO as the pesticide of choice in the combat of malaria vectors susceptible to DDT in tropical areas (WHO, 1984).

In Kenya, Pest Control Products Board (PCPB) was formed in 1983 through an act of parliament to regulate the distribution use, sale, storage and licensing of manufacturers handling agro-chemicals. Some of the regulations include safe ways of disposal, storage design and layout of premises as well as testing and providing assistance as well as training to staff in relevant work (Kenya, 1985). Packaging should not mislead the use on concerning handling agro-chemicals, value, safety, quality or composition.

2.7.1 Knowledge Gap

Much remains unknown regarding the extent and impact of acute and prolonged agrochemical exposure among farm workers due to poor reporting systems, the reluctance of farm workers to report poisonings, barriers to seeking medical treatment, and a lack of physician training in recognizing and treating pesticide-related illnesses(Hansenan Donohue, 2003).Several studies done on use of agrochemicals by the farmers do not provide sufficient information on safe handling which directly or indirectly contributes greatly to health and safety of farm workers.

This study assessed levels of awareness on safe handling of agrochemicals by the farm workers in Uasin Gishu County. This was large scale farm study which focused on level of awareness on safety and health on use of agrochemicals and singles out some of self-reported symptoms ever suffered by farm workers while working on the farm. Its findings address the need to put up measures to ensure that farm workers follow the required regulations and proper practices to improve on knowledge, attitude and practices during working period as well as makes use of appropriate equipment to reduce agrochemicals exposure.

2.8 Theoretical Framework

The study was based on Piaget's theory of Cognitive development. The Social learning theory operates on the premise that except for elementary reflexes: people are not born with inborn repertoire of behaviour. Hence they are supposed to learn them. Bandura, (1977), in Bee (1975), underscores this by contending that new response patterns can either be acquired by direct experience or by observation. According to him therefore, the environment is the major cause of drug taking behaviour we observe. The theory states that people learn new behaviours largely through learning and observing. Bandura has argued that a full range of social behaviors from competitiveness to nurturance is learned by watching other people perform those actions. In this regard, farmers are likely to learn how to use pesticide from training and observing other farmers doing it; then they can be sure that young people who admire them will copy their behaviour.

The Social learning theory however has been criticized mainly for taking the individual as a passive recipient of stimuli in the environment (Bee 2001, Hardey and Heyes, 2002). The Cognitive theory of Piaget is therefore adopted in this study to cater for this shortcoming.

The theory states that cognition is the ability of the individual to adapt to his or her environment and the subsequent organization of the mind. The theory further postulates that cognitive ability or thinking is the result of the acquisition retrieval, application and evaluation of the formation by the individual.

According to the theory therefore, the mind of a person is not simply a passive receiver of information but an active processor of experience. Individual perceptions and perceived benefits among farm workers farmers on use of agro-chemicals and they may go ahead to ignore them because of" just part of the farming attitude.

As shown in figure 1 below, one therefore through the mind does not simply react or respond to experiences but actively changes and adapts to the world. This can explain why in some instances farm workers who are not trained on use of agro-chemicals are unlikely to use protective equipment.

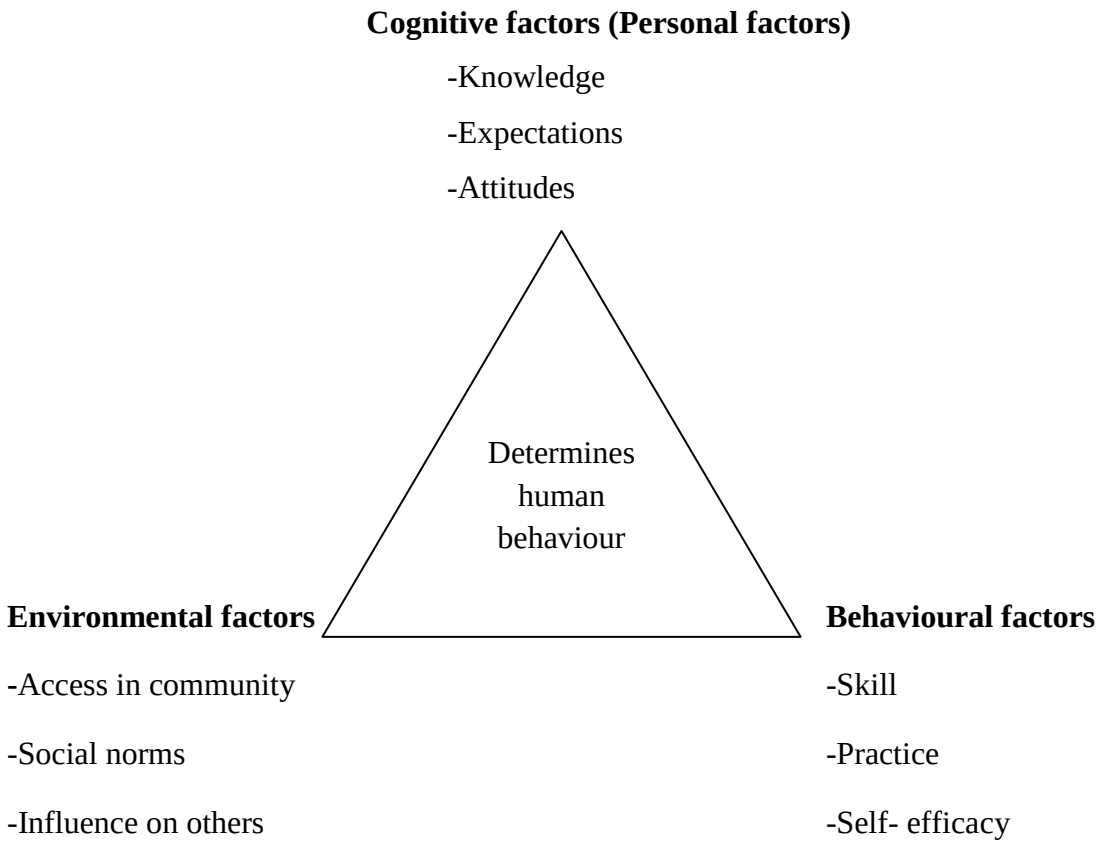


Figure 1 Social Learning Theory

Source: Bandura A. (1977)

2.9 Conceptual Framework

Independent variables include individual characteristics like education, age, gender marital status among others these factors directly influence handling of agrochemicals which in turn leads to illnesses among farm workers. Other factors like knowledge attitude, and practices among others play a key role in determining safe handling of agro-chemicals as well as rate of exposure among the farm workers. Farm workers who have had experiences over time in

the farm get used to their practices and may ignore some of the current programs and policies.

Similarly those with low levels of education may not read the labels and instructions given on the agro-chemicals use handling and disposal and this may lead to adverse health effects. Intervening variables include work based programs which should be adapted by the large scale farms include training; consistent enforcement and supervision implementing policies ,regulatory requirements providing necessary equipment's giving off days among others.

When these programs are adequately followed they can reduce self-reported symptoms as a result of agrochemical use. All the above factors will have direct relationship between health problems reported and some of the safety measures in handling agro-chemicals which if followed can reduce such cases.

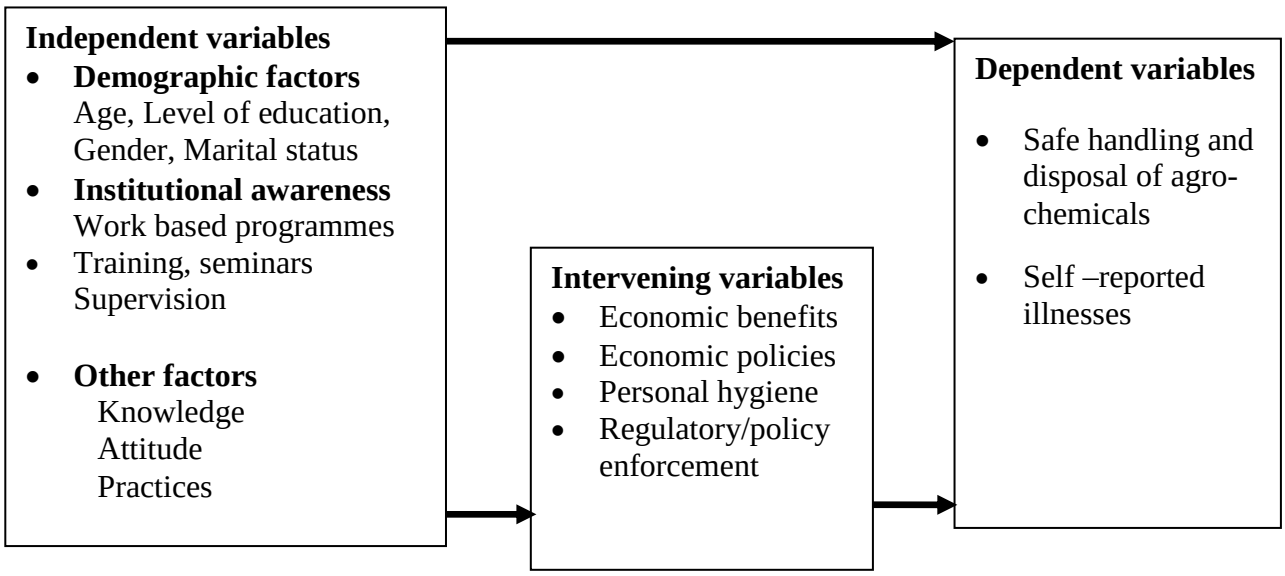


Figure 2 Conceptual framework

Source: Author

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Description of the Study Area

3.1.1 Physical Environment

Uasin Gishu County lies in the mid-west of the Rift Valley between longitudes 34 degrees 50‟ east and 35 degrees 37‟ West and latitudes 0 degrees 03‟ South and 0 degrees 55‟ North. The county shares common borders with Trans Nzoia County to the North, Elgeyo Marakwet County to the East, Baringo County to the South East, Kericho County to the South, Nandi County to the South West and Kakamega County to the North West. It covers a total area of 3,345.2 Sq. Km with arable land covering 2,995 Km^2, 332.78 is non-arable (hilly and rocky). The County is a highland plateau ranging from 1500m – 2700m above sea level and soils range from red brown loam to clay. Rainfall averages 900mm to 1200mm per annum with its peak in May and October, temperatures range from 8.40c to 26.20c (a mean of 180c). Figure 3 below shows selected flower farms in Uasin Gishu County and also the total number of workers in each farm is shown in table 3.1.

Table 3.1: Location of Selected Flower Farms

Farm	Sub County	Location	Population
Zena	Ainabkoi	Kipsinende	700
Asis	Ainabkoi	Kipsinende	750
Equator	Moiben	Kimumu	750
Majimazuri	Soy	Moi’s bridge	800

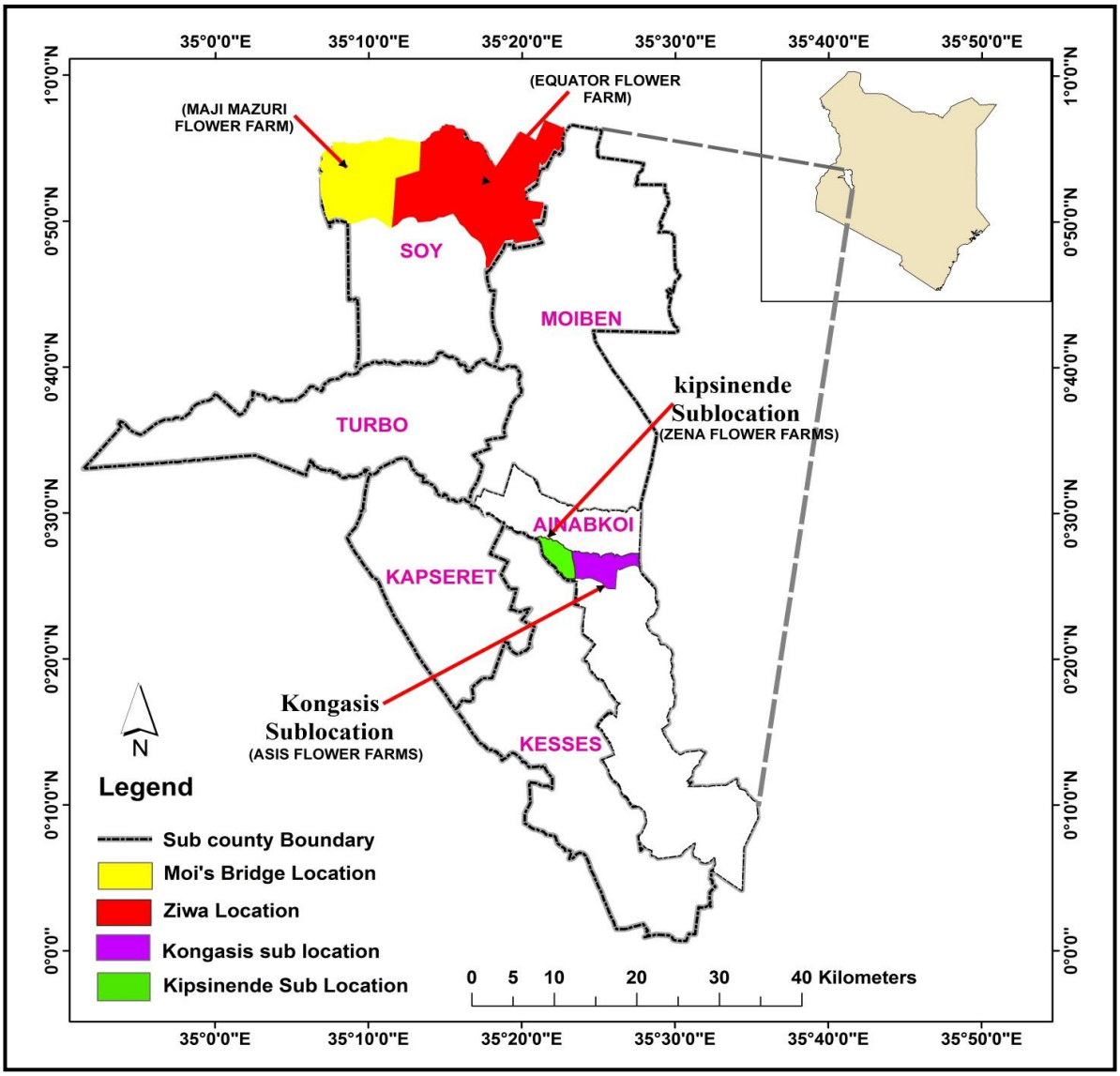


Figure 3 Locations of Selected Flower Farms in Uasin Gishu County

Figure 3 above shows the location of the four farms in Uasin Gishu County, Maji Mazuri farm is located in Soy sub county while equator farms borders Moiben and Soy sub county the other two farms Zena and Asis are found in Ainabkoi sub county in Kipsinende and Kongasis location respectively (UGCIDP, 2013-2018).Table 3.1 below shows location and population of selected flower farms in Uasin Gishu County.

Figure 3: Location of Selected Flower Farms in Uasin Gishu County

3.1.2 Demography and Health Status

According to the 2009 Population and Housing Census, the total population of Uasin Gishu County stood at 894,179. At an inter-censual population growth rate of 3.8%, the total population is projected to grow to 1,211,853 by 2017. The population growth rate is higher than the national growth rate at 2.9%. The population density is 267 persons per sq. Km. which is expected to increase to 362 persons per sq. km. by 2017. This will have implications on the average size of land holding.

In 2012, the population age group between 0 to 14 years was 41.4% of the total; while the economically active age group of between 15 and 64 years accounted for 55.7% of the total. This implies that the County has a high dependency ratio and a high potential for labour force. The age group under one year is projected to grow from 29,175 in 2009 to 39,539 by 2017, while that aged between 2 and 5 years is expected to grow from 162,559 in 2009 to 220,311 by 2017. This implies that the County must expand child and maternal health services (UGCIDP, 2013)

Currently, the burden of disease in Uasin Gishu County is mostly attributable to respiratory infections (20.7%), malaria (43.3%), skin diseases, diarrhoea and stomach-ache (9.6%), TB, heart ailments, HIV/AIDS, cancer, diabetes and mental disorders. These diseases affect the productivity of the people through loss of productive hours due to illness. In addition, most of the households spend a substantial proportion of their income on treatment. The exact magnitude of the burden of disease in the County requires to be established through specialized national or regional studies. The table below shows some of the cases reported in percentage since 2011 in Uasin Gishu County.

Table 3.2Top Ten Causes of OPD Morbidity in Uasin Gishu County (2011-2013)

Disease	Number of cases 2011(percentage)	2012	2013
Diseases of the respiratory system	18.5	18.96	22.06
Clinical malaria	16.9	14.5	8.8
Diseases of the skin	6.3	6.6	6.67
Confirmed malaria	3.43	4.69	4.28
Typhoid fever	2.49	3.06	3.64
Accidents	2.90	2.75	2.6
Pneumonia	2.55	2.94	2.87
Diarrhoea	2.1	2.38	2.11
Dental disorders	2.3	2.01	1.91
Urinary tract infections	1.84	1.9	2.11
Other cases	40.5	39.9	38.3

Source: Uasin Gishu County Health Strategic and Investment Plan (2013).

3.1.3 Economic Activities

According to Uasin Gishu development plan of 2013-2018 ,Uasin Gishu County has a rich agricultural resource base with 80% of the land tenure being privately owned (6500 acres).The value of horticulture production in the County has increased from Ksh.2 billion to 4 billion for the last two years. Private ownership of land has encouraged investment in permanent and long term improvements of development on farms. Agriculture supports over 80% of the rural population of Uasin Gishu County in terms of household income and food security. The Moi International Airport and two airstrips located in Uasin Gishu have encouraged the expansions of horticultural sector in the region. The average farm size in Uasin Gishu is 2-10 acres with a wide range of crop and livestock enterprises. Characteristics of agricultural sector varies widely from predominantly small scale with low external inputs to highly mechanized large scale farming with very high levels of external inputs(UGCIDP, 2013)

Characteristics of agricultural sector varies widely from predominantly small scale with low external inputs to highly mechanized large scale farming with very high levels of external inputs. Uasin Gishu has a rich agricultural resource base with 80% of the land tenure being privately owned. Private ownership of land has encouraged investment in permanent and long term improvements of development on farms. Small scale farming subsector (0-30 acres) accounts for 75% of the total agricultural produce. However the County has not exploited its

potential. Production of main food crops and livestock has generally been low. Farmers depend on rain-fed agriculture and that production costs for most crops are high due to high input costs especially fertilizers, poor and long marketing chains consisting of many players for the different commodities making them inefficient and unresponsive to the process needs.

3.2 Research Design

This was a cross-sectional survey conducted in December 2015 - January 2016.The researcher was assisted by one assistant to collect information from133 respondents using standard questionnaire (Appendix I). Data obtained included socioeconomic and demographic characteristics of the workers, knowledge and attitude of agrochemicals, practices and safe handling etc. The study received ethical approval from National Commission for Science Technology and Innovation NACOSTI (Appendix II). To ensure accuracy of data collected, the research assistant underwent training and instrument pretested before the survey.

3.3 Target Population and Sampling Frame

The study targeted large scale farm workers who handle agrochemicals in Uasin Gishu County. The study was cross- sectional which involved the large scale farm workers handling agro-chemicals. The sampling frame was constituted from the list of workers in each sampled flower farm as shown below.

Farm	Population
Zena	700
Asis	750
Equator	750
Majimazuri	800

3.4 Sample Technique and Size

Two stage sampling design was used; stage one was purposive sampling that targeted the scale large private flower farms located in Uasin Gishu County. Stage two was probability sampling to select a sample of respondents from a list of employees in each farm. The total numbers of Farm workers who work in different departments in the farm were approximately

700. It is from this list that those who handle agrochemicals about 200 were selected using the following formula in each farm (Yamane, 1967).

To get the sample size, Taro Yamane's formula was used, that is:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n=Sample size

N=Population size

e=Level of precision (95% confidence level- standard error 0.05)

$$n = \frac{200}{1 + 200(0.05)^2}$$

=133 farm workers, therefore 32 workers were picked from each large scale flower farm.

3.5 Data Collection

The researcher was assisted by one assistant to collect information from133 respondents using standard questionnaire (Appendix 1). The instrument used for this study was closed ended questionnaire which was administered to respondents including large scale farm workers in order to achieve the objectives of the study. The questionnaire was used to solicit background information, knowledge, attitude and practices on safe use of pesticide. The last section was designed to record some of the self-reported health symptoms of large scale farm workers as result of agro-chemical use.

3.6 Data Analysis Methods

Primary data was coded entered and analyzed using computer package SPSS version 20. Descriptive statistics mainly involved generation of frequency distribution tables as well as bar charts and pie charts for categorical variables whereas for numerical variables this included computation of means and standard deviations. Inferential statistics was done by computing Pearson Chi-squared statistics together with the associated p value. A result was deemed significant if the p value was less than 0.05. Table 3.2 below gives a summary of how each objective was analyzed.

Table 3.2: Summary of Data Analysis

Research question	Key variables	Analysis
1. To describe the socio-demographic characteristics of large scale farm workers.	❖ Gender ❖ Age ❖ Marital status ❖ Education level ❖ Duration of work ❖ Work shift	❖ Descriptive statistical analysis
2. To assess the knowledge, attitude and practice on safe handling of agro-chemicals among large scale farm workers.	❖ Agro-chemicals used ❖ Training ❖ Handling, ❖ Storage and ❖ Disposal of unused, containers or expired agro-chemicals. ❖ Cleaning ❖ Use of PPD ❖ Washing clothes, ❖ Disposal of waste containers ❖ Women and use PPD	❖ Descriptive statistical analysis
3. To determine the prevalence of self-reported health symptoms related to agro-chemicals exposure among large scale farm workers.	❖ List of problems like ❖ eye itching, ❖ respiratory infection Pregnancy problems etc.	❖ Descriptive statistical analysis .
4. To determine factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County.	❖ Demographic variables and objective 2 variables	❖ Inferential statistical analysis main involving Chi – square tests

Source: Author

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents analysis and findings of the study as set out in the research objective and research methodology. The study findings study sought to reduce the health impact of unsafe handling of agro-chemicals by assessing compliance with legal requirements by large scale flower farm workers in Uasin Gishu County. The study sought to collect data from 133 large scale private farm workers from four selected flower farms in Uasin Gishu County, a total of 125 respondents responded constituting 94% of the respondents' rates. The response rate was adequate for analysis and reporting.

4.2 Socio Demographic Characteristics

The demographic feature of the respondents enables the researcher and the readers to understand the respondents in relation to the topic under study. The demographic information includes respondents' gender, age, marital status, level of education, duration of work and the work shift.

4.2.1 Gender of the Respondents

The researcher sought to establish the gender of the respondents. It was found that 53% (66) were male and 47% (59) were female. It was evident that the flower industry has been a source of employment for both men and women who are in most cases marginalized from other job opportunities and therefore find themselves in casual jobs (Fatuma, 2008).

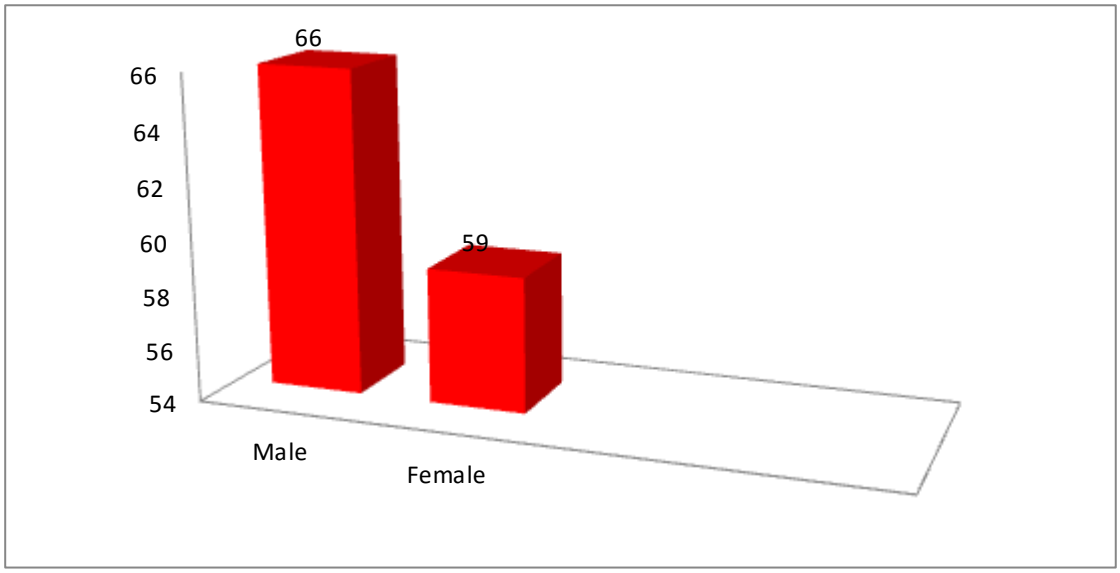


Figure 4: Gender of Respondents

Source: Survey Data, 2015

4.2.2 Age of Respondents

The age of the respondents was considered as an important aspect of the study since younger farm workers often express themselves better than older one, who sometimes hesitate to complain. Figure 4 illustrates the age of the respondents. It is evident that 67.2% of them are between 25 and 30 years of age, 30% are below 24 years and 0.8% of the respondents are above 50 years.

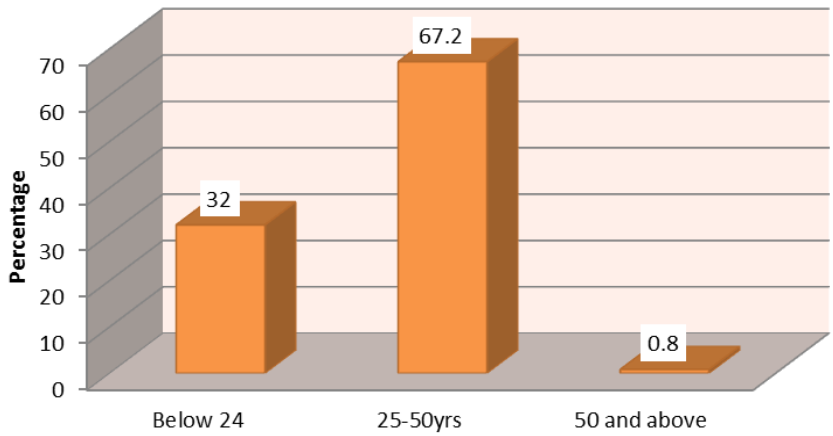


Figure 5: Age of Respondents

Source: Survey Data, 2015

4.2.3 Marital Status of the Respondents

The researcher found it necessary to establish the marital status of the respondents. Farm workers who are married make use of family planning methods and therefore attend maternal clinics for checkup and birth delivery Figure 5 illustrates that 58.4% of the respondents are married, 40% of them are single and 1.6% are divorced. This could help in detecting any illnesses caused by agro-chemicals exposure as well as prevent further exposure by practicing good working practices like use of PPD while working in the farms.

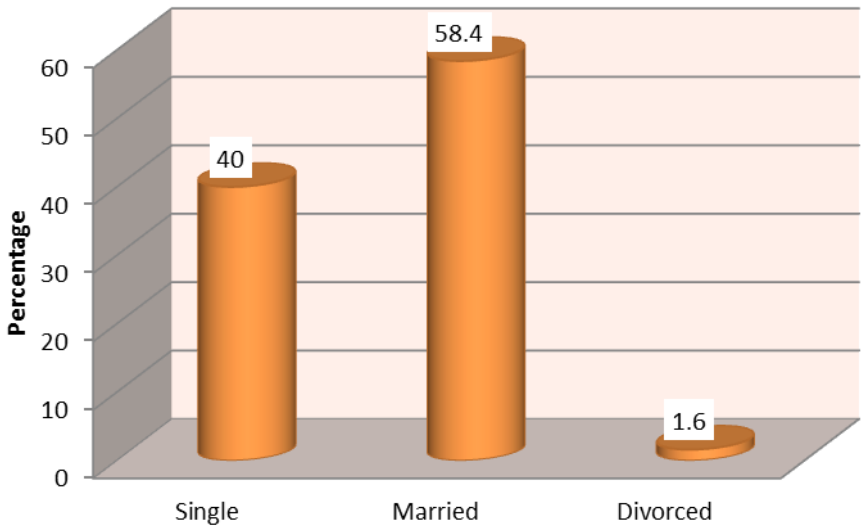


Figure 6: Marital Status of Respondents

Source: Survey Data, 2015

4.2.4 Level of Education of the Respondents

The level of education of the respondents was sought by the researcher since lack of formal education has contributed greatly to the misuse of agro-chemicals and their applications (Nyakundi, 2012). Figure 6 shows that 58% (58) of the respondents attained secondary level of education, 31% (31) tertiary and 11% (10) primary level of education.

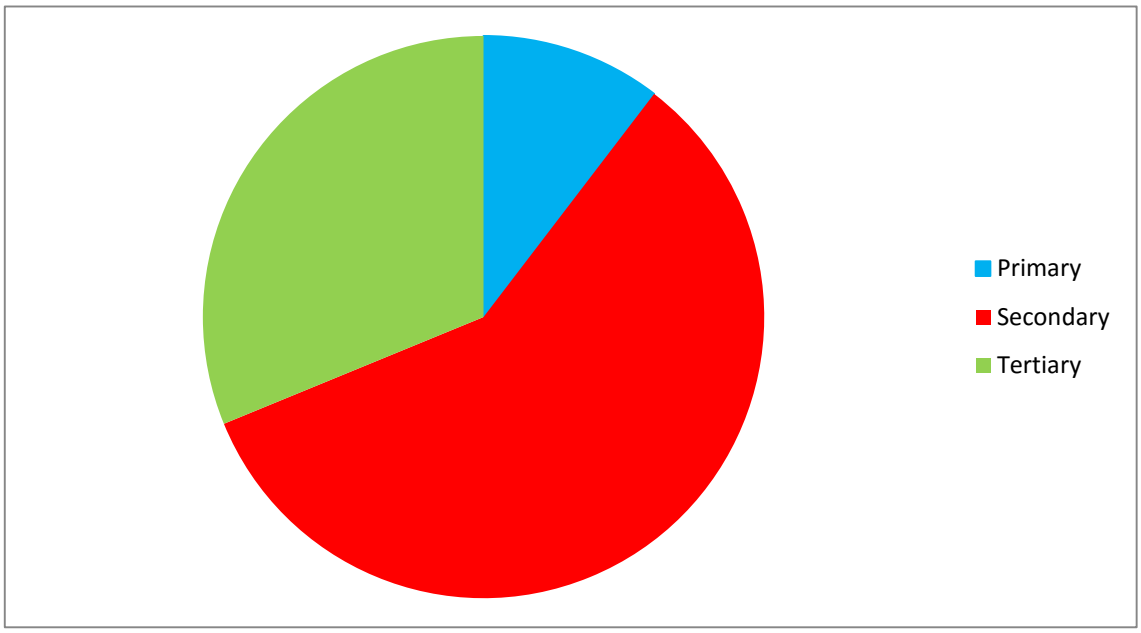


Figure 7: Level of Education of the Respondents

Source: Survey Data, 2015

4.2.5 Duration of Work among Respondents

The duration of work for the respondents was put into account by the researcher. Figure 7 shows that 52.8% of the flower farm workers have worked for a year, 28.8% for 2 years and 18.4% of the workers have worked for 3 years. In a nutshell, most of the workers had worked with the farm for more than a year and this is important to understand responses on a wider knowledge based on the farm operations e.g. trainings or change of duties.

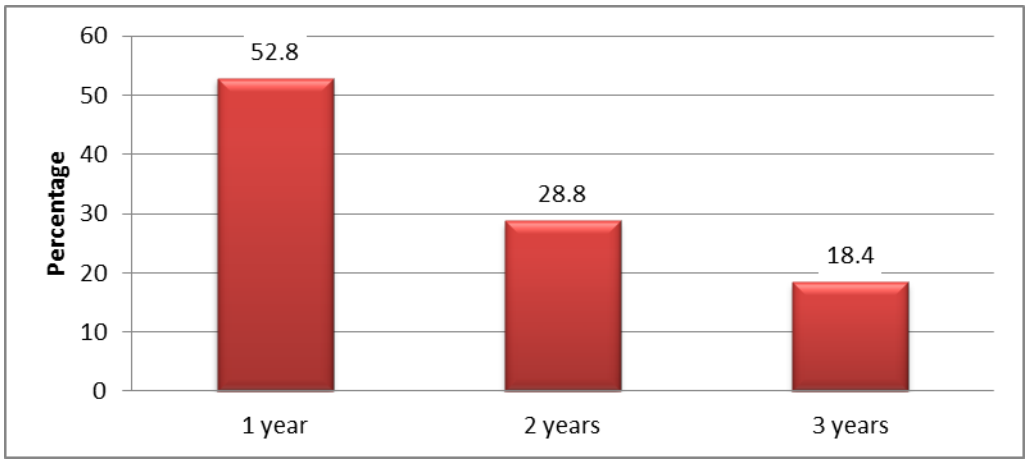


Figure 8: Duration of Work among Respondents

4.2.6 Work Shift among Respondents

The work shift of the respondents was established by the researcher. Results showed that 72% (90) of the respondents work full time and 28% (35) half day. This distribution provided a diversified base of information.

4.3 Knowledge, Attitude and Practices on Safe Handling of Agro-chemicals

4.3.1 Knowledge on Handling of Agro-chemicals

4.3.1.1 Agro-chemicals Used in the Farm

The researcher sought to establish the agro-chemicals used in the farm. Table 4.1 illustrates the findings of the study. From the findings in the table, 33.6% (42) of the respondents use acephate, 7.2% (9) tetradifon, 0.8% (1) aldicarb, 2.4% (3) piperophos and 56% (70) other agro-chemicals.

Table 4.1: Agro-chemicals used in the Farm

Chemical	Frequency	Percent
Aldicarb	1	0.8
Piperophos	3	2.4
Acephate	42	33.6
Tetradifon	9	7.2
Others	70	56.0
Total	125	100

Source: Survey Data, 2015

4.3.1.2 Knowledge on Classes of Agro-chemicals Used

The researcher sought to establish if the respondents had knowledge on other classes of agro-chemicals used. Results showed that 58% (73) of the respondents had knowledge on the classes of agro-chemicals used. However, 42% (52) did not have knowledge on other classes of agro-chemicals used within the farm.

4.3.1.3 Participation in Seminars or Training

Participation in training and seminars is important in ensuring that farm workers get information on awareness especially on use of agrochemicals, safe handling as well as illnesses that result from inappropriate practices. It was found that 53.6% of the respondents have participated in such seminars within the farm and 46.4% outside the farm. This means they may not be keen on awareness and knowledge on health and safety issues in regards to the use of agro-chemicals since they still suffer illnesses as a result of exposure. Concurrently, ATSDR, (1993) report states that most men (48) and women (34) denied having received formal training on the use of agro-chemicals hence they experienced symptoms that are considered to be common manifestations of acetyl cholinesterase inhibition

4.3.1.4 Necessity of Undertaking Medical Check-ups during Working Period

The researcher sought to establish if the respondents had knowledge on necessity of undertaking medical checkups during working period. Based on the results in figure 8, majority (82%) of the respondents have knowledge on the necessity of undertaking medical checkups during working period.

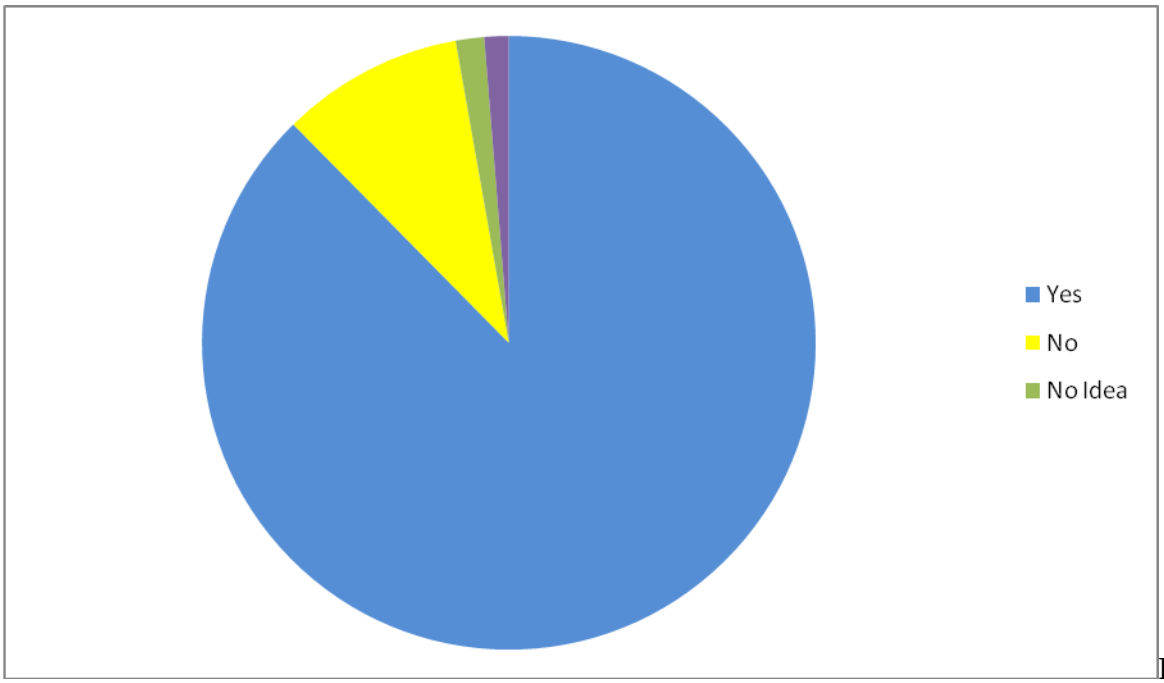


Figure 9: Necessity of Undertaking Medical Check-ups during Working Period

Source: Survey Data, 2015

4.3.1.5 Time to Undertake Medical Check-ups

It is essential to undergo routine health checkups, medical checkups before handling of agro-chemicals as well as on the onset of symptoms. The results on medical checkups are as presented in table 4.2. The results in the table shows that 79.2% (99) of the respondents undergo routine/regular health checkups, 20% (25) before handling of agro-chemicals and 0.8% (1) on the onset of symptoms. Generally, routine health checkups are done though medical checkups on the onset of symptoms are negligible.

Table 4.2: Medical Checkups

Time for Medical Check-up	Frequency	Percent
Before handling of agro-chemicals	25	20.0
With the onset of symptoms	1	0.8
Routine/regular health checkups	99	79.2
Total	**125**	**100**

Source: Survey Data, 2015

4.3.2 Practices on Safe Handling of Agro-chemicals

4.3.2.1 Post Exposure Practices

This section of the analysis sought to establish the ways to help a colleague during pesticide spill. Table 4.3 shows that 68% of them wash, 18.4% (23) drink water, 8% (10) go to the health center and 5.6% (7) of the respondents have no idea of what to do during a pesticide spill. Significant percentages (68%) of the farmers wash their hands after exposure to pesticides. There is however a challenge where some of farm workers are unaware of the measures to undertake after exposure to agro-chemicals. There is thus need for more training on post exposure practices so as to reduce the risks associated with agro-chemicals exposure.

Table 4.3: Post Exposure Practices

Post Exposure Practices	Frequency	Percent
Washing	85	68.0
Drink water	23	18.4
Go to health center	10	8.0
No idea	7	5.6
Total	**125**	**100**

Source: Survey Data, 2015

4.3.2.2 Level of Information on use of Agro-chemicals

The results in table 4.4 shows the level of literacy of the farmers in regards to agro-chemicals use. As evidenced in the table, 80.8% (101) of the respondents read and understand information written on agro-chemicals packages, 91.2% (114) of the respondents follow labels of agro-chemical containers and 89.6% (112) of the respondents are instructed or trained on handling of agro-chemicals. On the whole, farm workers have the requisite knowledge to comprehend the information written on agro-chemical packages and follow the instructions on how to handle the agro-chemicals.

Table 4.4: Level of Information on use of Agro-chemicals

	Frequency	Percent
Read and understood information written on agro-chemicals packages	101	80.8
Follow labels of agro-chemicals containers	114	91.2
Instructed or trained about handling of agro-chemicals?	112	89.6

Source: Survey Data, 2015

4.3.2.3 Nature of Training

The researcher found it necessary to establish the kinds of training the respondents have undergone. The results in table 4.5 shows that the respondents have undergone training on handling (13.6%), spraying (49.6%), and risks associated with agr0-chemical exposure (35.2%) and others (1.6%).

Table 4.5: Nature of Training

Nature of Training	Frequency	Percent
Handling	17	13.6
Spraying	62	49.6
Risks associated with agro-chemicals exposure	44	35.2
Others	2	1.6
Total	**125**	**100**

Source: Survey Data, 2015

4.3.2.4 Decontamination

The researcher enquired from the respondents whether they take a shower after spraying. It was found that a majority (92%) of the respondents take a shower after spraying. This suggests that farmers were sensitive towards the use of protective measures.

The researcher also sought to establish if the respondents change clothing before and after pesticide exposure. Results showed that 86% (108) of the respondents change clothing before and after agro-chemical exposure though 14% (17) of the respondents confirmed that they do not. There is thus need for more intensified training on protective measures with regard to pesticide use so that farm workers are aware of the importance of change of clothing before and after agro-chemical exposure.

The researcher sought to establish if respondents separate clothes when washing. It was established that 77% (97) of the respondents separate clothes when washing. However, 23% (29) of the respondents do not separate clothes when washing.

4.3.2.5 Disposal of Agro-chemicals

The researcher enquired from the respondents whether they dispose containers after use. Results showed that 38.4% (48) of the respondents dump containers after use, 33.6% (42) of them keep them in store and 17.6% (22) of them burn containers after use. Practices such as keeping the containers in the store after use as well as dumping are not safe practices. This is because they put the general population at a risk. In line with the results, Wesseling (1997) reported that the high percentage of interviewed farm workers who dispose of the empty containers on the garbage site or along the street could put the surrounding communities at risk.

4.3.3 Attitude on Safe Handling of Agro-chemicals

The researcher found it necessary to establish the respondents' attitude on safe handling of pesticide. Table 4.6 presents the results. The farmers strongly agreed that agro-chemicals can have negative impact on health (78%).They were also in agreement that the use of PPD can reduce agro-chemical exposure (55%). Also, they were in agreement that health risks can be reduced if proper practices are implemented (57%). Moreover, the respondents were in agreement that proper storage of agro-chemicals help in reducing health risks (56%). Despite this, the farmers were in agreement that both men and women should put on personal protective devices while handling agro-chemicals (66%). Furthermore, the respondents disagreed that women are more exposed to agro-chemicals than men (66%). Finally, the respondents denied that during spraying they always sneeze/ have chest problem (56%). Cognate to the results, Dasgupta, *et al*., (2005) infer that health and environmental hazards of agro-chemicals can be evaded by awareness, education and changing farmer's attitude and behaviour concerning pesticide use. Nevertheless, a report by Saleh (1995), shows that farmers in the Gaza strip believe that their bodies could develop resistance against agro-chemicals.

Table 4.6 Attitude on Safe Handling of Agro-chemicals

		SA	A	D	SD	U
Agro-chemicals can have bad /negative impact on health	Scores	78	16	21	0	10
	%	62.4	12.8	16.8	0	8
Use of PPD can reduce pesticide exposure	Scores	15	55	31	0	24
	%	12	44	24.8	0	19.2
Health risks can be reduced if proper practices are implemented.	Scores	57	49	5	9	5
	%	45.6	39.2	4	7.2	4
Proper storage of pesticide help in reducing health risks	Scores	41	56	6	2	20
	%	32.8	44.8	4.8	1.6	16
Women should not put on personal protective devices while handling agro-chemicals	Scores	8	33	31	39	14
	%	6.4	26.4	24.8	31.2	11.2
Both men and women should put on personal protective devices while handling agro-chemicals	Scores	66	44	5	10	10
	%	52.8	35.2	4	8	6
Women are more exposed to agro-chemicals than men	Scores	5	15	70	29	6
	%	4	12	56	23.2	4.8
During spraying i always sneeze/have chest problem	Scores	16	12	56	22	19
	%	12.8	9.6	44.8	17.6	15.2

4.4 Self-Reported Illness Related To Handling of Agro-chemicals

4.4.1 Agro-chemicals and Health

The respondents were asked if they believe agro-chemicals can have any bad/negative effect on their health. A majority (94%) of the respondents believe that agro-chemicals can have negative effect on their health. This suggests that the farm workers were aware of the health risks posed by exposure to agro-chemicals.

4.4.2 Reported Illnesses

The researcher sought to establish if the respondents had symptoms for the last one month after spraying or handling agro-chemicals. Table 4.7 illustrates the results. The results were such that 65.6% (82) of the respondents had reported skin conditions including rash, itch,

irritation and color change,15.2% (19) had nasal symptoms, 6.4 %(8) eye conditions, 10.2% (12) respiratory symptoms including cough/chest pain/tightness and 1.6% (2) had pregnancy complications. However, there were no symptoms of diarrhea and vomiting. Majority had skin and nasal symptoms implying direct contact and inhalation are the main routes of pesticide related ill health. In line with the results, prior studies (Hansen and Donohue2003; Hennebry (2008) show that lack of protective clothing and the absence of hand washing facilities at worksites contribute to skin disorders associated with agro-chemical use. In addition, studies conducted in Ugandan small scale farmers indicate that the main symptoms reported were skin irritation, headache, extreme tiredness, blurred vision and dizziness which are consistent with other studies (Matthews, 2007).

Cole(1997) and Gomes (1998) reported in a study conducted in Gaza strip regarding toxicity symptoms associated with agro-chemicals, that toxicity symptoms among farm workers were burning sensation in the eyes and face, dizziness, chest pain, skin irritation, and headache.

Table 4.7 Reported Illnesses

Reported Illness	Frequency	Percent
Skin conditions (Burns, rash , colour change)	82	65.6
Diarrhea and/vomiting	0	0.0
Nasal symptoms	19	15.2
Eye conditions	8	6.4
Respiratory symptoms	2	1.6
Pregnancy complications	14	10.2
Any other (specify)	1	0.8

Source: Survey Data, 2015

4.4.3 Steps Taken Regarding the Symptom

The steps that the respondents took regarding the symptoms were also put into account by the researcher. Table 4.8 presents the results. From the findings, 92.8% (116) of the respondents had sought medical treatment, 5.6% (7) had changed duties and 1.6% (2) of the respondents had not taken any step. This infers that measures are in place to safeguard the health of farm workers in case they suffer from exposure to agro-chemicals.

Table 4.8: Steps Taken Regarding the Symptom

Steps Taken	Frequency	Percent
Sought medical treatment	116	92.8
Changed duties	7	5.6
None	2	1.6
Total	**125**	**100**

Source: Survey Data, 2015

4.4.4 Place of Treatment

The researcher put into account where the respondents received treatment. Table 4.9 illustrates the results. Based on the findings, 51.2% (64) of the respondents had received treatment in the company health facility, 30.4% (38) in a public health facility, 15.2% (19) in a private health facility and 3.2% (4) of the respondents had received treatment from a traditional (herbal) medicine provider.

Table 4.9: Place of Treatment

Place of Treatment	Frequency	Percent
Company health facility	64	51.2
Private health facility	19	15.2
Public health facility	38	30.4
Traditional (herbal) medicine	4	3.2
Total	**125**	**100**

Source: Survey Data, 2015

4.4.5 Illnesses Suffered while Working on Farm.

Table 4.10 illustrates the ailments the respondents have suffered from since they started working on the farm. From the results, 36.8% (46) of women of reproductive age have suffered a miscarriage, 12% (15) still birth, 6.4% (8) inability to conceive and 2.4% (3) of the women had children with deformity. Cognate to the results, Yan *et al*., (2002) infer that reproductive abnormalities have been evident among many people who have gone through a long-term exposure to agro-chemicals. Studies have also shown that under diagnosis and underreporting of acute pesticide poisoning have contributed contribute to higher than recorded pesticide poisoning incidents (Ngowi *et al*., 2007).

Table 4.10: Illnesses Suffered while Working on Farm

Illness Suffered	Frequency	Percent
(For women of reproductive age) Inability to forebear children	8	6.4
(For women of reproductive age)Child with birth deformity	3	2.4
(For women of reproductive age) Still birth	15	12
(For women of reproductive age) Miscarriage	46	36.8

Source: Survey Data, 2015

4.5 Factors Affecting Level of Awareness on Safety and Health in use of Agro-chemicals

This section deals with inferential statistics to determine factors affecting level of awareness on safety and health in use of agro-chemicals among large scale flower farm workers in Uasin Gishu County. Analysis mainly involved Chi – square tests between demographic factors and various variables for knowledge, practices and attitude of use of agro- chemicals.

4.5.1 Association between Demographic Factors and Knowledge on Classes of Agro-chemical Used

The study found it paramount to assess the association between gender, age, level of education, duration and knowledge on other classes of pesticide used using chi square at 0.05 (level of significance). Findings are presented in table below.

Table 4.11: Associations between Demographic Factors and Knowledge on Other Classes of Agro-chemical Used

		Knowledge the classes of pesticides			Chi-Square	P value
		Yes	**No**	**Total**		
Gender	Female	35	24	59	0.039	0.843
	Male	38	28	66		
	Total	73	52	125		
Age	Below 24	18	22	40	4.866	0.008
	25-50yrs	54	30	84		
	50 and above	1	0	1		
	Total	73	52	125		
Level of education	Primary	6	7	13	1.347	0.510
	Secondary	42	31	73		
	Tertiary	25	14	39		
	Total	73	52	125		
Duration of work	1	40	26	66	1.618	0.445
	2	18	18	36		
	3	15	8	23		
	Total	73	52	125		

Source: Survey Data, 2015

The association between demographic factors and knowledge on the pesticide use was analysed using Pearson Chi-Square and results are presented as follows.

The χ^2 test shows that there is no significant correlation between the gender and the knowledge on the use of the pesticides (χ^2= 0.039, p = 0.843). This would indicate that both sexes had the same level of knowledge on pesticide use and thus any effect from the pesticide use cannot be associated to the gender differences but to other factors. The χ^2 test shows that there is significant correlation between the age of the respondents and the knowledge on the use of the pesticides (χ^2= 4.866, p = 0.008). This suggest that the knowledge on the pesticide use increases with the increase in the age of the user a fact that it attributable to the time that an individual has spent on learning how to use the agro-chemicals. The χ^2 test shows that there is no significant correlation between the levels of education and the knowledge on the use of the pesticides (χ^2= 1.347, p = 0.510). This suggest that the level of education does not influence how one uses the agro-chemicals, therefore the knowledge on agro-chemical use could be gained though other factors. The χ^2 test shows that there is no significant correlation between the time duration of work and the knowledge on the use of the pesticides (χ^2= 1.618,

p = 0.445). This suggest that the time duration does not influence how one uses the agro-chemicals, therefore the knowledge on agro-chemical use could be gained though other factors.

4.5.2 Relationship between Demographic Variables and Agro-chemical Spillage

Cross tabulations in table 4.12 were used to study the relationship between demographic variables and Agro-chemical spillage. Chi-square (χ^2) tests of independence established that there was no significant relationship between gender and agro-chemical spillage on the body (χ^2 = (1.197, p>0.05).This means that gender is not related with agro-chemical spillage on the body and that both male and female farmers are at a risk of spilling agro-chemicals on their body.

Further, chi-square (χ2) value of (1.304) at (p =0.861) level of significance reveals no significant relationship between age and agro-chemical spillage on the body. This indicates that agro-chemical spillage on the body has no association with the age of the individual. This suggests that farm workers irrespective of their age are at risk of agro-chemical spillage on their body.

Similarly, marital status is not significantly related with agro-chemical spillage on the body (χ^2 = (4.098, p=0.550).This indicates that spillage of agro-chemical on the body is not dependent on the marital status.

Furthermore, the level of education has no significant relation with agro-chemical spillage on the body (χ^2 = (5.458, p=0.243). This suggests that the level of education is not associated with agro-chemical spillage on the body.

Table 4.12: Relationship between Demographic Variables and Agro-chemical Spillage

		Spill pesticide on body			
		Yes	No	Chi-Square	P value
Gender	Female	33	26	1.197	0.550
	Male	36	30		
	Total	69	56		
Age	below 24	22	18	1.304	0.861
	25-50yrs	46	38		
	50 and above	1	0		

Marital status	Single	23	26	4.098	0.393
	Married	45	28		
	Divorced	1	1		
Level of education	Primary	1	12	5.458	0.243
	Secondary	54	19		
	Tertiary	14	25		

Cross tabulations were also used in table 4.13 to study the relationship between demographic variables and preventive practices. Specifically, age had a significant relationship with the use of protective equipment χ^2= (18.351), p=0.019).Age dictates the use of protective equipment in that older farm workers tend to ignore the use of protective equipment as opposed to younger farmers. It could be attributed to their belief that they have developed resistance to agro-chemicals after frequent exposure to them.

Further results indicated that the level of education had a significant relationship with the use of protective equipment χ^2= (34.638), p= 0.001).The more educated individuals are, the higher the likelihood of them making use of protective equipment such as overalls and hats.

However, the marital status had no significant relationship with the use of protective equipment χ^2= (12.494), p= 0.131). This indicates that the use of protective equipment is not dependent on the marital status.

Finally, the duration of work has a significant relationship with the use of protective equipment χ^2= (22.806), p= 0.004).This is true since farm workers that have worked with agro-chemicals for long tend to be ignorant of potential health risks of pesticide exposure. However, the general trend is that majority of the farm workers frequently do not use personal protective equipment. Consistently, Wilson and Tisdell, (2001) posit that in less developed countries; adequate protective clothing is often neglected for reasons of discomfort and/or high cost. This situation is further worsened by lack of national regulations requiring farmers working with agro-chemicals to observe specific precautions. A lack of protective clothing and the absence of hand washing facilities at worksites also contribute to skin disorders (Hansen and Donohue 2003; Hennebry 2008).

Table 4.13 Preventive Practices

		Spraying what protective equipment do you use					Chi-Square	P value
		Glove	Coverall	hat	Boots	None		
Age	below 24	1	3	1	4	31	18.351	0.019
	25-50yrs	4	0	0	0	80		
	50 and above	0	0	0	0	1		
	Total	5	3	1	4	112		
Marital status	Single	4	3	1	8	42	12.494	0.131
	Married	1	0	0	0	68		
	Divorced	0	0	0	4	2		
Level of education	Primary	3	0	0	0	10	34.638	0.001
	Secondary	0	0	0	0	73		
	Tertiary	2	3	1	4	29		
Duration of work	1yr	1	3	0	0	62	22.806	0.004
	2yrs	4	0	1	4	27		
	3yrs	0	0	0	0	23		

Source: Survey Data, 2015

4.5.3 Demographic Variables on Training Place

Chi-square was used to study the relationship between demographic variables and training place. The findings are as presented in table 4.14. Chi-square (χ^2) tests of independence established that there was no significant relationship between gender and training place χ^2= (1.028), p=0.311).This means that the gender of the respondents had no influence on the training place.

Similarly, age had no significant relationship with the training place χ^2= (4.471), p= 0.1707).This suggests that the age of the farm worker did not influence whether they were trained within the farm or outside the farm.

However, the marital status had a significant relationship with the training place χ^2= (13.586), p= 0.001).This was so because married farm workers preferred training within the farm as opposed to outside the farm. Their preference could be attributed to family obligations.

Also, the duration of work had a significant relationship with the training place χ^2= (6.320), p=0.042).This implies that the duration of work leads to preferential choice of a particular training place, in most cases, training within the farm.

Furthermore, the level of education had no significant relationship with the training place χ^2= (2.204), p= (0.332). This indicates that the choice of the training place is not dependent on the level of education.

Table 4.14: Demographic Variables on Training Place

		Within the farm	**Outside the farm**	**Chi-Square**	**P value**
Gender	Female	48	11	1.028	0.311
	Male	58	8		
	Total	106	19		
Age	below 24	30	10	4.471	0.107
	25-50yrs	75	9		
	50 and above	1	0		
Marital status	Single	36	14	13.586	0.001
	married	69	4		
	divorced	1	1		
Level of education	primary	12	1		
	secondary	59	14	2.204	0.332
	Tertiary	35	4		
Duration of work	1yr	51	15	6.320	0.042
	2yrs	33	3		
	3yrs	22	1		

4.5.4 Demographic Variables on Washing of hands after Handling Agro-chemicals

Cross tabulations was used in table 4.15 to study the relationship between demographic variables and the washing of hands after handling agro-chemicals. Chi-square (χ^2) tests of independence established that there was no significant relationship between gender and the washing of hands after handling agro-chemicals (χ^2 = (0.261, p=0.311).This means that gender is not related with the washing of hands after handling agro-chemicals.

Further, chi-square (χ2) value of 1.066 at p = 0.107) level of significance reveals no significant relationship between age and washing of hands after handling agro-chemicals.

This indicates that washing of hands after the use of agro-chemicals has no association with the age of the individual.

Similarly, the level of education is not significantly related with the washing of hands after handling agro-chemicals (χ^2 = (3.707, p=0.332).This was also the case with the duration of work and the washing of hands after handling agro-chemicals (χ^2 = (5.118, p=0.042).

However, marital status had a significant relationship with the washing of hands after handling agro-chemicals (χ^2 = (18.092, p=0.001).This could mean that personal hygiene among those married is high. This is because there are chances that they could poison other family members if they do not adhere to washing of hands after handling agro-chemicals.

Table 4.15 Demographic Variables on washing of hands after handling Agro-chemicals

		Yes	No	Total	Chi-Square	P value
Gender	Female	53	6	59	0.261	0.609
	Male	61	5	66		
	Total	114	11	125		
Age	below 24	35	5	40	1.066	0.587
	25-50yrs	78	6	84		
	50 and above	1	0	1		
	Total	114	11			
Marital status	Single	39	11	50	18.092	0.001
	Married	73	0	73		
	divorced	2	0	2		
	Total	114	11	125		
Level of education	Primary	13	0	13	3.707a	0.157
	secondary	68	5	73		
	tertiary	33	6	39		
	Total	114	11	125		
Duration of work	1yr	61	5	66	5.118a	0.077
	2yrs	30	6	36		
	3yrs	23	0	23		
	Total	114	11	125		

Source: Survey Data, 2015

4.5.5 Relationship between Change Clothing before and after Agro-chemicals Exposure and participation of workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

Chi-square was used in table 4.16 to study the relationship between change of clothing before and after pesticides exposure and participation of workers in seminars or training courses related to the safe handling of pesticides. Chi-square (χ^2) tests of independence established that there was a significant relationship between the two variables (χ^2 = (13.933, p<0.0).This suggests that training enhanced farmers knowledge on the importance of changing clothing before and after agro-chemical exposure.

Table 4.16 Relationship between Change Clothing before and after Agro-chemicals Exposure and Participation of Workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

	Participation of workers in Seminars or Training Courses Related To the Safe Handling of Pesticides		Total	Chi-Square	P value
	Yes	No			
Wash hands after handling pesticides	Yes	67	47	114	13.933	0
	No	0	11	11		0
	Total	67	58	125		

Source: Survey Data, 2015

4.4.9 Relationship between Change Clothing before and after Agro-chemicals Exposure and Participation of workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

Cross tabulations were used in table 4.17 to assess the relationship between the change of clothing before and after agro-chemical exposure and knowledge on the classes of agro - chemicals. The results revealed that the change of clothing before and after agro-chemical exposure had no significant relationship with knowledge on the classes of agro-chemicals (χ2 = 0.241, p=0.623).This could mean that the change of clothing before and after agro-chemical exposure was not influenced by the knowledge on the classes of agro-chemicals.

Table 4.17 Relationship between Change Clothing before and after Agro-chemical Exposure and Participation of workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

		Knowledge the classes of pesticides		Total	Chi-Square	p-v
		Yes	No			
Change clothing before and after pesticides exposure	Yes	64	44	108	.241	0.623
	No	9	8	17		
	Total	73	52	125		

Source: Survey Data, 2015

4.5.6 Demographic Variables on Consumption of food/use of tobacco during work with Agro-chemicals

Chi-square (χ^2) tests of independence in table 4.18 established that there was no significant relationship between gender and consumption of food or the use of tobacco during work with pesticides ($\chi 2$ =1.477, p= (0.224).This meant that gender did not influence the consumption of food or the use of tobacco during work with agro-chemicals.

Also, marital status had no significant relationship with consumption of food or the use of tobacco during work with agro-chemicals ($\chi 2$ =1.153, p= (0.562).This implies that the consumption of food or the use of tobacco during work with agro-chemicals is not dependent on the marital status.

Similarly, level of education had no significant relationship with consumption of food or the use of tobacco during work with agro-chemicals ($\chi 2$ =3.352, p= 0.169). This suggests that the level of education does not influence whether a farm worker consumes food or uses tobacco during work with agro-chemicals.

However, age had a significant relationship with consumption of food or the use of tobacco during work with agro-chemicals ($\chi 2$ = (14.498, p=0.001).This implies that the age of the farm worker dictates the consumption of food or the use of tobacco during work with agro-chemicals. It could be that as farmers get older, they tend to ignore potential health risks of consuming food or using tobacco during work with agro-chemicals.

Likewise, duration of work had a significant relationship with consumption of food or the use of tobacco during work with agro-chemicals ($\chi 2$ = (6.105, p=0.047).This meant that continuous exposure to agro-chemicals had an influence on how farm workers consumed food or used tobacco during work with agro-chemicals.

Table 4.18 Demographic Variables on Consumption of food/use of tobacco during work with Agro-chemicals

		Do you eat/ drink /smoke tobacco during work with agro-chemicals?			Chi-Square	P value
		Yes	No	Total		
Gender	Female	14	45	59	1.477	0.224
	Male	10	56	66		
	Total	24	101	125		
Age	below 24	0	40	40	14.498	0.001
	25-50yrs	24	60	84		
	50 and above	0	1	1		
	Total	24	101	125		
Marital status	Single	8	42	50	1.153	0.562
	married	16	57	73		
	divorced	0	2	2		
	Total	24	101	125		
Level of education	primary	0	13	13	3.552	0.169
	secondary	15	58	73		
	Tertiary	9	30	39		
	Total	24	101	125		
Duration of work	1yr	16	50	66	6.105	0.047
	2yrs	2	34	36		
	3yrs	6	17	23		
	Total	24	101	125		

Source: Survey Data, 2015

4.5.7 Demographic Variables on Keeping of Meals Near Agro-chemicals WShen Spraying

Table 4.19 below shows the relationship between the demographic variables and keeping of meals near agro-chemicals when spraying. The results revealed that gender had no significant relationship with keeping of meals near agro-chemicals while spraying ($\chi 2$ = (2.113, p=0.146).This suggests that the gender of the farmer worker does not influence whether he/she keeps meals near agro-chemicals when spraying.

Also, the marital status had no significant relationship with keeping of meals near agro-chemicals when spraying ($\chi 2$ = (4.705, p=0.095).This implies that the marital status of the farm worker does not dictate whether he/she keeps meals near agro-chemicals when spraying.

Similarly, the level of education had no significant relationship with keeping of meals near agro-chemicals when spraying ($\chi 2$ = (3.529, p=0.171).This suggests that the level of education has no influence on keeping of meals near agro-chemicals when spraying.

However, age had a significant relationship with keeping of meals near agro-chemicals when spraying ($\chi 2$ = (13.758, p=0.001).This suggests that the age of the farm worker dictated whether the farm worker keeps meals near agro-chemicals when spraying.

Similarly, duration of work had a significant relationship with keeping of meals near agro-chemicals when spraying ($\chi 2$ = (11.035, p=0.04).This meant that frequent exposure to agro-chemicals had an influence on whether the farm workers kept their meals near agro-chemicals when spraying.

Table 4.19 Demographic Variables on Keeping of Meals Near Agro-chemicals When Spraying

		Do you keep meals near agro-chemicals when spraying?			Chi-Square Statistic	P value
		Yes	No	Total		
Gender	Female	14	45	59	2.113	0.146
	Male	9	57	66		
	Total	23	102	125		
Age	below 24	0	40	40	13.758	0.001
	25-50yrs	23	61	84		
	50 and above	0	1	1		
	Total	23	102	125		
Marital status	Single	5	45	50	4.705	0.095
	married	18	55	73		
	divorced	0	2	2		
	Total	23	102	125		
Level of education	primary	0	13	13	3.529	0.171
	secondary	14	59	73		
	Tertiary	9	30	39		
	Total	23	102	125		
Duration of work	1	19	47	66	11.035	0.004
	2	1	35	36		
	3	3	20	23		
	Total	23	102	125		

Source: Survey Data, 2015

4.5.8 Relationship between Demographic Variables and Use of Water Near Agro-chemicals Treated Areas

Chi-square was used to study the relationship between demographic variables and use of water near agro-chemicals treated areas. The results are as presented in table 4.20. Chi-square (χ^2) tests of independence established that there was a significant relationship between gender and use of water near agro-chemicals treated areas ($\chi 2$ = (9.106, p=0.03).This indicates that the gender of the farm worker influenced the use of water near agro-chemicals treated areas.

There was also a significant relationship between the duration of work and use of water near agro-chemicals treated areas ($\chi 2$ = (7.073, p=0.029). This suggests that the knowledge on use

of water near agro-chemicals treated areas increases with the duration of work. However, marital status had no significant relationship with the use of water near agro-chemicals treated areas (χ (4.376, p=| 0.112). This implies that the use of water near agro-chemicals treated areas is not dependent on the marital status.

Also, age had no significant relationship with the use of water near agro-chemicals treated areas ($\chi 2$ = (4.460, p=0.108). This indicates that the use of water near agro-chemicals treated areas has no association with the age of the individual. Furthermore, the level of education had no significant relationship with the use of water near agro-chemicals treated areas ($\chi 2$ = (5.257, p>0.072). This could mean that the use of water near agro-chemicals treated areas is not dependent on the level of education.

Table 4.20 Relationship between demographic variables and use of water near agro-chemicals treated areas

		Yes	No		Chi-Square Statistic	P value
Gender	Female	23	36	59	9.106	0.003
	Male	10	56	66		
	Total	33	92	125		
Age	below 24	6	34	40	4.460	0.108
	25-50yrs	27	57	84		
	50 and above	0	1	1		
	Total	33	92	125		
Marital status	Single	18	32	50	4.376	0.112
	married	15	58	73		
	divorced	0	2	2		
	Total	33	92	125		
Level of education	primary	6	7	13	5.257	0.072
	secondary	21	52	73		
	tertiary	6	33	39		
	Total	33	92	125		
Duration of work	1	21	45	66	7.073	0.029
	2	11	25	36		
	3	1	22	23		
	Total	33	92	125		

Source: Survey Data, 2015

4.5.9 Relationship between Sources of water near Agro-chemicals treated areas and participation of workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

Cross tabulations were used in table 4.21 to assess the relationship between the use of water near agro-chemicals treated areas and participation of workers in seminars or training courses related to the safe handling of agro-chemicals. The results revealed that there was a significant relationship between the two variables (χ^2 = (22.615, p=0.001).The results meant that participation of farm workers in training on safe handling of agro-chemicals enhanced their awareness on the importance of drinking or getting water near agro-chemicals treated areas.

Table 4.21 Relationship between Sources of Water near Agro-chemical treated areas and Participation of Workers in Seminars or Training Courses Related To the Safe Handling of Agro-chemicals

		Participation of workers in Seminars or Training Courses Related To the Safe Handling of Agro-chemicals			Chi-Square	P value
		yes	no	Total	22.615	0.001
Sources of water near agro-chemicals treated areas	yes	6	27	33		
	no	61	31	92		
	Total	67	58	125		

Source: Survey Data, 2015

4.5.10 Relationship between Change of clothing before and after Agro-chemical Exposure and participation of workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

Chi-square was used to study the relationship between change of clothing before and after agro-chemicals exposure and participation of farmers in seminars related to safe handling of agro-chemicals. The results are as presented in table 4.22. Chi-square (χ^2) tests of independence established that there was no significant relationship between the two variables

($\chi 2$ = (0.241, p=0.623).This suggests that training related to safe handling of agro-chemicals had no influence on change of clothing before and after agro-chemicals exposure.

Table 4.22 Relationship between Change of clothing before and after Agro-chemical Exposure and participation of workers in Seminars or Training Courses Related to the Safe Handling of Agro-chemicals

		Knowledge the classes of agro-chemicals		Total	Chi-Square	
		Yes	No			
Change clothing before and after agro-chemicals exposure	Yes	64	44	108	0.241	0.623
	No	9	8	17		
	Total	73	52	125		

Source: Survey Data, 2015

4.5.11 Demographic Characteristics on Necessity of Undertaking Medical Checkups during the Working period

A chi-square test was carried out to determine the degree of association between necessity of undertaking medical checkups during the working period and the demographic characteristics of the respondents.

The result in table 4.23 show that there is a significant relationship between the gender and the necessity to undertake medical checkups during the working period (χ^2 = (20.467, p=0.02).This implies that the male respondents found it necessary to undertake medical checkups during working period compared to their female counterparts.

Further, there was a significant relationship between marital status and the necessity of undertaking medical checkups during working period χ^2= (27.831), p= 0.01).From the results, those that were married deemed it more necessary to undertake medical checkups compared to those that were single. This could be attributed to the fact that farm workers that are

married make use of family planning methods hence they attend maternal clinics. This in turn helps in detecting any illness associated with exposure to agro-chemicals.

However, the level of education had no significant relationship with necessity of undertaking medical checkups during the working period χ^2= (10.247), p= 0.106). This suggests that the level of education does not influence the uptake of medical check-ups during the working period.

To sum up, the duration of work had a significant relationship with the necessity of undertaking medical checkups during working period χ^2= (10.755), p= 0.029).The results indicate that the more one uses the agro-chemicals, the less likely they are to undertake medical checkup. This is because they may get used to their practices hence ignoring to undertake medical checkups.

Table 4.23 Demographic Characteristics on Necessity of Undertaking Medical Checkups during Working Period

		Necessary to undertake medical checkups				
		Yes	No	No idea	Chi-Square	P value
Gender	Female	39	10	10	20.467	0.002
	Male	64	1	1		
	Total	103	11	11		
Marital status	Single	43	6	1	27.831	0.001
	married	60	3	10		
	divorced	0	2	0		
	Total	103	11	11		
Level of education	primary	13	0	0	10.247	0.106
	secondary	55	8	10		
	tertiary	35	3	1		
	Total	103	11	11		
Duration of work	1yr	52	4	10	10.755	0.029
	2yrs	29	6	1		
	3yrs	22	1	0		
	Total	103	11	11		

Source: Survey Data, 2015

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides the summary of the findings from chapter four, and it also gives the conclusions and recommendations of the study based on the objectives of the study.

5.2 Summary

5.2.1 Socio Demographic Factors of the Respondents

The researcher sought to establish the gender of the respondents. It was found that 53% (66) were male and 47% (59) were female. It was evident that the flower industry has been a source of employment for both men and women who are in most cases marginalized from other job opportunities and therefore find themselves in casual jobs (Fatuma, 2008).

The age of the respondents was considered as an important aspect of the study since younger farm workers often express themselves better than older one, who sometimes hesitate to complain. It is evident that 67.2% of them are between 25 and 30 years of age, 30% are below 24 years and 0.8% of the respondents are above 50 years. Farm 58.4% of the respondents are married, 40% of them are single and 1.6% are divorced. This could help in detecting any illnesses caused by agro-chemicals exposure as well as prevent further exposure by practicing good working practices like use of PPD while working in the farms.

The level of education of the respondents was sought by the researcher since lack of formal education has contributed greatly to the misuse of agro-chemicals and their applications (Nyakundi, 2012). 58% (58) of the respondents attained secondary level of education, 31% (31) tertiary and 11% (10) primary level of education. The duration of work for the respondents was put into account by the researcher, 52.8% of the flower farm workers have worked for a year, and 28.8% for 2 years and 18.4% of the workers have worked for 3 years. In a nutshell, most of the workers had worked with the farm for more than a year and this is important to understand responses on a wider knowledge based on the farm operations e.g. trainings or change of duties. Results showed that 72% (90) of the respondents work full time and 28% (35) half day. This distribution provided a diversified base of information.

5.2.2 Knowledge on Safe Handling of Agro-chemicals among Respondents

These study findings have revealed that some farm workers are aware of the agro-chemicals used in the farm. Though majority (53.6%) of the respondents had participated in training courses related to the safe handling, a significant (46.4%) percentage of the respondents had not received training. Despite this, the respondents were aware of other ways of pest control such as fostering beneficial organisms, disrupting pest's life cycle, modifying climate and genetic resistance. Moreover, on a positive note, the respondents have knowledge on the necessity of undertaking medical checkups during working period.

Moreover, Majority 94% of the respondents believe that agro-chemicals can have negative effect on their health. This suggests that the farm workers were aware of the health risks posed by exposure to agro-chemicals.

5.2.3 Attitude on safe handling of agro-chemicals among large scale private farm workers

The results of the analysis have established the respondents' attitude on safe handling of agro-chemicals. The results indicate that agro-chemicals can have negative impacts on health. Therefore, both men and women should put on personal protective devices while handling agro-chemicals. Also, proper storage of agro-chemicals helps in reducing health risks. As well, the use of PPD can reduce agro-chemicals exposure. However, farm workers disagreed that women are more exposed to agro-chemicals than men and that they always sneeze/have chest problem while spraying. In a nutshell, the health risks posed by agro-chemicals can be reduced if proper practices are implemented.

5.2.4 Practices on safe handling of agro-chemicals by large scale private farm workers

The study assessed practices on safe handling of agro-chemicals by the large scale private farm workers. It is clear that the respondents have spilled agro-chemicals before. They are also aware of how to help a colleague during agro-chemicals spill. Some of the ways to help those that have spilled agro-chemicals on their body include giving them water to drink and taking them to the health center. Knowing the importance of wearing protective gear, the respondents made use of protective equipment such as gloves, coveralls, boots and hats in order to protect themselves from the adverse health effects of agro-chemicals. However, most of this equipment is not used by the workers. Other than the use of protective equipment, the

respondents were able to read and understand information written on agro-chemicals since some were trained on handling of agro-chemicals.

5.2.5 Frequencies of self-reported health symptoms related to agro-chemicals exposure among large scale private farm workers

Farm workers that handled agro-chemicals or sprayed experienced; skin conditions (65.6%) e.g. itching, burns, irritation and colour change, nasal symptoms (15.2%), eye conditions (16.4%),respiratory symptoms (11.2) e.g. cough chest pain, skin and pregnancy complications(1.6%). There was however no symptom of diarrhea and vomiting. The farm workers who had these symptoms seek medical treatment while others change duties. For women of productive age, 1.6% reported ever suffering from miscarriage, still birth, inability to conceive and conceived children with deformity. Majority had skin and nasal symptoms implying direct contact and inhalation are the main routes of agro-chemicals related ill health. In line with the results, prior studies (Hansen and Donohue2003; Hennebry (2008) show that lack of protective clothing and the absence of hand washing facilities at worksites contribute to skin disorders associated with agrochemical use.

5.2.5 Factors Affecting Level of Awareness on Safety and Health in use of Agro-chemicals

Results show that there is no significant correlation between the gender, level of education, duration of work on knowledge on the use of the agro-chemicals .This would indicate that both sexes had the same level of knowledge on agro-chemicals use and thus any effect from the agro-chemicals use cannot be associated to the gender differences but to other factors. However, there is significant correlation between the age of the respondents and the knowledge on the use of the agro-chemicals. This suggest that the knowledge on the agro-chemicals use increases with the increase in the age of the user a fact that it attributable to the time that an individual has spent on learning how to use the agro-chemicals.

There was no significant relationship between gender, marital status, level of education and agro-chemical spillage on the body .This means that gender is not related with agro-chemical spillage on the body and that both male and female farmers are at a risk of spilling agro-chemicals on their body. Level of significance reveals no significant relationship between age and agro-chemical spillage on the body. This indicates that agro-chemical spillage on the

body has no association with the age of the individual. This suggests that farm workers irrespective of their age are at risk of agro-chemical spillage on their body.

Age dictates the use of protective equipment in that older farm workers tend to ignore the use of protective equipment as opposed to younger farmers. It could be attributed to their belief that they have developed resistance to agro-chemicals after frequent exposure to them. Further results indicated that the level of education had a significant relationship with the use of protective equipment .The more educated individuals are, the higher the likelihood of them making use of protective equipment such as overalls and hats. However, the marital status had no significant relationship with the use of protective equipment .This indicates that the use of protective equipment is not dependent on the marital status.

Finally, the duration of work has a significant relationship with the use of protective equipment. This is true since farm workers that have worked with agro-chemicals for long tend to be ignorant of potential health risks of agro-chemicals exposure. However, the general trend is that majority of the farm workers frequently do not use personal protective equipment. Consistently, Wilson and Tisdell, (2001) posit that in less developed countries; adequate protective clothing is often neglected for reasons of discomfort and/or high cost. This situation is further worsened by lack of national regulations requiring farmers working with agro-chemicals to observe specific precautions. A lack of protective clothing and the absence of hand washing facilities at worksites also contribute to skin disorders (Hansen and Donohue 2003; Hennebry 2008).

There was no significant relationship between gender and training place .This means that the gender of the respondents had no influence on the training place. Similarly, age had no significant relationship with the training place .This suggests that the age of the farm worker did not influence whether they were trained within the farm or outside the farm.

However, the marital status had a significant relationship with the training place .This was so because married farm workers preferred training within the farm as opposed to outside the farm. Their preference could be attributed to family obligations. Duration of work leads to preferential choice of a particular training place, in most cases, training within the farm. The choice of the training place is not dependent on the level of education. This means that gender, age, level of education are not related with the washing of hands after handling agro-chemicals. However, marital status had a significant relationship with the washing of hands

after handling agro-chemicals .This could mean that personal hygiene among those married is high. This is because there are chances that they could poison other family members if they do not adhere to washing of hands after handling agro-chemicals.

Gender, marital status and level of education, did not influence the consumption of food or the use of tobacco during work with agro-chemicals. However, age and duration of work had a significant relationship with consumption of food or the use of tobacco during work with agro-chemicals. This implies that the age of the farm worker dictates the consumption of food or the use of tobacco during work with agro-chemicals. It could be that as farmers get older, they tend to ignore potential health risks of consuming food or using tobacco during work with agro-chemicals.

This suggests that the gender and level of education of the farm worker does not influence whether he/she keeps meals near agro-chemicals when spraying. However, age had a significant relationship with keeping of meals near agro-chemicals when spraying. This suggests that the age of the farm worker dictated whether the farm worker keeps meals near agro-chemicals when spraying.

Similarly, duration of work had a significant relationship with keeping of meals near agro-chemicals when spraying. This meant that frequent exposure to agro-chemicals had an influence on whether the farm workers kept their meals near agro-chemicals when spraying. Age, marital status had no significant relationship with the use of water near agro-chemicals treated areas .This indicates that the use of water near agro-chemicals treated areas has no association with the age of the individual.

Furthermore, the level of education had no significant relationship with the use of water near agro-chemicals treated areas .This could mean that the use of water near agro-chemicals treated areas is not dependent on the level of education. There was also a significant relationship between the duration of work as well as gender and use of water near agro-chemicals treated areas. This suggests that the knowledge on use of water near agro-chemicals treated areas increases with the duration of work.

5.3 Conclusion

Knowledge on safe handling of agro-chemicals is of essence to any farmer that uses agro-chemicals. Despite this, a number of the farmers have not undergone training related to safe handling of agro-chemicals. They are therefore at risk of exposure to hazardous agro-chemicals such as Aldicarb. Besides, farmers had knowledge of other alternative methods of pest control such as disrupting pest's life cycle and modifying climate though they continued to use agro-chemicals. Nevertheless, the farmers were aware of the importance of undertaking medical checkups during work periods.

The attitude of farmers on safe handling of agro-chemicals may either encourage them to adopt protective measure or be insensitive towards protective measures. Based on the study findings, it is still uncertain whether women should not put on personal protective devices while handling agro-chemicals. In fact, certain farmers denied that women are more exposed to agro-chemicals than men. However, the farmers believe that proper storage of agro-chemicals help in reducing health risks as well as the use of PPD.

Furthermore, it is clear that private farm workers practice safe handling of agro-chemicals. This is evidenced by use of protective equipment such as gloves, coveralls, boots and hats. The protective equipment protects the farmers from the adverse health effects of agro-chemicals. In addition, farmers' training on safe handling of agro-chemicals has enabled farmers to read and understand information written on agro-chemicals.

Finally, the study has established that exposure to agro-chemicals may result to symptoms such as skin manifestations, nasal symptoms, eye conditions, respiratory symptoms. Other than that, exposure to agro-chemicals through contact and inhalation may be associated with reproductive abnormalities such as miscarriage, still birth and inability to forebear children among female farm workers.

5.4 Recommendations

5.4.1 Recommendations for Action

In light of the aforementioned findings, the following recommendations are made:

1. There is need for intensive training on safe handling of agro-chemicals so that farm workers can read and understand the information written on agro-chemicals as well as training on proper handling of agrochemicals. This can be achieved through continuous education about agro-chemicals safety and health. Farm workers at large should be offered additional education on appropriate methods that can be necessary to prevent or reduce agro-chemicals exposure. With this in place, farm workers will be able to practice proper storage of agrochemicals as well as putting on personal protective devices while handling agro-chemicals.
2. Similarly, medical check-ups should also be consistent and illnesses suffered be treated to save life especially reproductive illness. There should be also change of duties to reduce prolonged exposure to agrochemicals which can cause major harm.
3. With reference to safe handling practices of agro-chemicals, there should be a strict enforcement and supervision of set regulations to reduce cases of exposure while handling agrochemicals. Medical check-ups should be consistent during working period in order to treat illnesses caused as a result of agro-chemical exposure.

5.4.2 Recommendations for Further Research

1. It is recommended that studies be done to assess emergency preparedness among flower farms to handle accidental exposure during working period among farm workers.
2. Also, in order to reduce the adverse effects of agro-chemicals, it is important to assess level of monitoring of safety procedures of any regulatory body i.e adherence to policies for farmers and farms to be is used in day to day activities especially where safe handling of agro-chemicals is concern and observe specific precautions such as wearing protective equipment.
3. This study main objective was to reduce the health impact of unsafe handling of agro-chemicals by large scale flower farm workers in Uasin Gishu County. Thus, future research should attempt to assess social impact of agrochemicals use among adjacent communities.
4. For scholars in future, there is need for a study to identify the environmental and social impact on agro-chemicals for example the adjacent community, water sources, soils among others. Agro-chemicals pose a further hazard for the residents of rural areas or surrounding communities for example air pollution, soil pollution when there is soil

erosion from the farms and water contamination especially where water resources are shared with the communities (Organic Consumer Association, 2008).

5. Moreover, there is need for evaluation and regulation of agrochemicals disposal facilities by the flower farms.
6. Research should be done to confirm the association between agro-chemicals and health outcomes.

REFERENCES

Abinash, P.C. and N. Singh,(2009). Agro-chemicals use and application: An Indian scenario. *J. Hazard Master, 165(1-3): 1-12*

Agency for Toxic Substances and Disease Registry. (1993). Case studies in environmental medicine: cholinesterase inhibiting agro-chemicals toxicity. California: Department of Health and Human Services 1993:3–8.

Alavanja MCR, Sandler DP, Lynch CF, Knott C, Lubin JH, Tarone R, (2005). Cancer incidence in the Agricultural Health Study. *Scand J Work Environ Health*

Arcury, Thomas A., Sara A. Quandt, Altha J. Cravey, Rebecca C. Elmore, and Gregory B. Russell. (2001). "Farm worker reports of agro-chemicals safety and sanitation in the work environment." *American* Journal *of Industrial Medicine* 39:487---498.

Bandura, A. (1977).Social Learning Theory. Newyork: General Learning Press

Beck, Ulrich (l992). *Risk Society Towards A New Modernity*. London: Sage Publications.

Bellingham M, Sharpe RM, Royal College of Obstetricians and Gynaecologists (2013) Chemical Exposures During Pregnancy: Dealing with Potential, but Unproven, Risks to Child Health. In: Scientific Advisory Committee, ed. Scientific Impact Paper No 37. London: Royal College of Obstetricians and Gynaecologists

Berg H. (2001).Agro-chemicals use in rice and rice-fish farms in the Mekong Delta. *Vietnam Crop Prot.,* 20, pp. 897-905.

Burleigh J. R., Vingnanakulasingham V., Lalith W. R. B. (1898). Pattern of agro-chemicals use and agro-chemicals efficacy among chili growers in the dry zone of NE Sri Lanka (System B): perception vs. reality. *AgrEcosystEnviron*, 70, PP 4960.

Calvert, G.M., Karnik, J., Mehler, L., Beckman, J., Morrissey, B., Sievert, J., Barrett, R., Lackovic, M., Mabee, L., Schwartz, A., Mitchell Y., and Moraga-McHaley, S. (2008). Acute agro-chemicals poisoning among agricultural workers in the United States, 1998-2005.*American Journal of Industrial Medicine*, 51(12), 883-898;

Coble J, Hoppin JA, Engel L, Elci OC, Dosemeci M, Lynch CF (2002).Prevalence of exposure to solvents, metals, grain dust, and other hazards among farmers in the Agricultural Health Study. *J Expo Anal Environ Epidemiol*

Cole DC, Carpio F, Math JJ, (1997).Dermatitis in Ecuadorian farm workers. Contact Dermatitis 1997; 37:1–8.

Constitution of Kenya Act (2010)

Das, R., A. Steege, S. Baron, J. Beckman & R. Harrison. (2001). Agro-chemicals related illness among migrant farm workers. United States *Int J. Occup Environ Health Oct-Dec 7(4): 303-12*

Dasgupta, S. & C. Meisner (2005). Health Effects and Agro-chemicals Perception as Determinants of Agro-chemicals Use: Evidence from Bangladesh. (World Bank Policy Research Working Paper.3776).

Di Renzo GC (2015). International Federation of Gynecology and Obstetrics opinion on reproductive health impacts of exposure to toxic environmental chemicals, Int J Gynecol Obstet (2015), http://dx.doi.org/10.1016/j.ijgo.2015.09.002

Donohoe, M. & Hansen, E. (2003). Health issues of migrant and seasonal farmworkers. *Journal of Health Care for the Poor and Underserved*, 14(2), 153-164.

Environment and Management Coordination Act (EMCA) 1999.

Eurostat statistical books (2007): The Use of Plant Protection Products in the European Union – Data 1992 – 2003, Luxembourg

Food and Agriculture Organization of the United Nations, Agriculture and Consumer Protection Department, 2008. Welcome to the page on Integrated Pest Management (IPM). [Cited 2008 Aug 15]. Available from: URL: http://www.fao.org/ag/AGP/AGPP/IPM/ Default.htm

Frank B and Cruiz E. (2001). Flower for justice, implementing the international code of conduct; Friedrch Ebert.

Gomes J, Lloyd O, Revitt DM, (1998).Morbidity among farm workers in a desert country in relation to long-term exposure to agro-chemicals. *Scand J Work Environ Health* 1998; 24:213–19

Green, L. W. (2010). Health Belief Model. Available: <Encyclopedia of Public Health>: retrieved on 16-06-2010

Habeeb, N. (1996). Invisible farmers, Lahore, Pakistan: PAN Malaysia and Khoj, Research and Publication Centre.

Harris, J., (2000). Chemical Agro-chemicals Markets, Health Risks and Residues. CABI, Wallingford.

Hayes, W. Jr. and E. Laws, Jr. (Eds). (l991). *Hand book of Agro-chemicals Toxicology.* Vol.1 General Principles. San Diego: Academic Press.

Hennebry,JennaL.(2006).Globalization and the Mexican---Canadian Seasonal Agricultural Worker Program: Power, Racialization and Transnationalism in Temporary Migration Doctoral Thesis, Sociology, University of Western Ontario, London

Hoppin JA, Umbach DM, London SJ, Alavanja MCR, Sandler DP. (2002). Chemical predictors of wheeze among farmer pesticide applicators in the Agricultural Health Study. *Am J RespirCrit Care Med* 165

International Labour Organization (2006), Summary of study report on decent work in floriculture: Ethiopia, National consultation workshop.

Isin S, Yildirim I. (2007). Fruit-growers' perceptions on the harmful effects of agro-chemicals and their reflection on practices: the case of Kemalpasa, Turkey. *Crop Prot*., 26, pp. 917-22.

Jors E, Morant RC, Aguilar GC, (2006). Occupational agro-chemicals intoxications among farmers in Bolivia: a cross-sectional study. Environ Health

Kahiu Dorothy, (2011). Knowledge, Attitude and Practice of Agrochemicals in Lake Naivasha Basin. Department of Environmental Science, Egerton University, Njoro, Kenya.

Kenya (1985). *The Pest Control Act* .Government Printer, Nairobi.

Koh, D. & J. Jeyaratnam (1996). Agro-chemicals Hazards in Developing Countries. *Science of the Total Environment* 188(Suppl. 1), S78–S85

Lesmes-Fabian, Camilo; Binder, Claudia R. (2013). Agro-chemicals Flow Analysis to Assess Human Exposure in Greenhouse Flower Production.*Int. J. Environ. Res. Public Health* 10, no. 4: 1168-1185.

Lichtenberg, E. & R. Zimmerman (1999). Adverse Health Experiences, Environmental Attitudes, and Agro-chemicals Usage Behaviour of Farm Operators. *Risk Analysis* 19:2.

Lu, C., Fenske, R.A., Simcox, N.J., and Kalman, D. (2006). Agro-chemicals exposure of children in an agricultural community: Evidence of household proximity to farmland and take home exposure pathways. Environmental Research, 84(3), 290-302.

Matthews GA. (2007). Attitudes and behaviours regarding use of crop protection products—A survey of more than 8500 smallholders in 26 countries Crop Protection

Miles J. R., Harris C. R., Morrow, D. C. (1983). Assessment of hazard associated with agro-chemicals container disposal and of rinsing procedures as a means of enabling disposal of agro-chemicals containers in sanitary landfills. *J Environ SciHeal B*, 18, pp. 305-15.

Moore, Graeme. (2004)."Hand---Harvesters of Fraser Valley Berry Crops: New Era Protection of Vulnerable Employees." BC Federation of Labour, Vancouver, BC

Munro, S., S. Lewin, T. Swart, & J. Volmink (2007). A Review of Health Behaviour Theories: How Useful are these for Developing Interventions to Promote Long-term Medication Adherence for TB and HIV/AIDS? *BMC Public Health 7*, 104.

Murray D. L., Tayler, P. L. (2000). Claim no easy victory: evaluating the agro-chemicals industry's global safe use campaign. *World Devel*, 28, pp 1735-49.

Mwanthi M.A and V.N. Kimani. (1993b).Agrochemical: A potential health hazard among Kenyan's small scale farmers in Forget, T. Goodman, A. De Villiers edits impacts of agro-chemicals use on health in developing countries. International Development Centre, Ottawa.

Nejad, L. M., E. H. Wertheim, & K. M. Greenwood (2005), Comparison of the Health Belief Model and the Theory of Planned Behaviour in the Prediction of Dieting and Fasting Behaviour. E- Journal of Social Psychology*: Social Section* 1:1, 63–74.

Ngowi (2007).Agro-chemicals use by smallholder farmers in vegetable production in Northern Tanzania (PUBMED**:** *Crop Prot*. 2007 November; 26(11): 1617–1624). Occupational Safety and Health Act (OSHA, 2007)

Ngowi A.V.F., Wesseling C., London L.(2007). Health Impacts in Developing Countries. In: Pimentel D., editor. *Encyclopedia of Pest Management.Vol. 2*. Taylor & Francis; New York, NY, USA: 2007. pp. 228–231.

Nyakundi W.O, G. Magoma, J.Ochora and A.B Nyende.(2011). Agro-chemicals Use and application patterns among farmers. [Institute of Jomo Kenyatta University of Agriculture and Technology]. Nairobi, Kenya.]

Nyamu, D.G, Maitai C.K, Mecca,L.W,and Mwangangi E.M.(2012).Trends of Acute Poisoning Cases Occurring at the Kenyatta National Hospital, Nairobi, Kenya. *East and Central African Journal of Pharmaceutical Sciences Vol.15* (2012) 29-34

Organic Consumer Association (2008): 30 Agrochemical Products Banned in Nigeria after Deaths, Finland

PAN UK (2003). The Dependency Syndrome: Agro-chemicals use by African smallholders .Agro-chemicals Action Network, London.

Quandt, Sara A.,Maria A. Hernandez---Valero, Joseph G. Grzywacz, Joseph D. Hovey, and Melissa Gonzales.(2006). "Workplace, Household, and Personal Predictors of Agro-chemicals Exposure for Farmworkers." *Environmental Health Perspectives* 14:943-952.

Rola A. C., Pingali P. L. (1993). Agro-chemicals, rice productivity, and farmers' health: an economic assessment. Laguna: International Rice Research Institute, Philippines.

RossG..(2005). Risks and benefits of DDT. The Lancet. 2005;366(9499):1771. [PubMed]

Royal Horticultural Society (RHS),(2004). The use of garden chemicals. The Royal Horticultural Society's Garden, Wisley, Woking, Surrey.

Sakala, Carol. (1987). Migrant and Seasonal Farmworkers in the United States: A Review of Health Hazards, Status, and Policy. *International* Migration *Review* 21:659---687.

Saleh A, Neiroukh F, Ayyash O, (1995).Agro-chemicals usage in the West Bank. Palestine: Applied Research Institute, Jerusalem, 1995:17.

Sekiyama M, Tanaka M, Gunawan B, (2007).Agro-chemicals usage and its association with health symptoms among farmers in rural villages in West Java, Indonesia. *Environ Sci*2007; 14

Sivayoganathan C, and Gnanachandrnn S, Lewis J. (1995).Protective measure use and symptoms among agro agro-chemicals applicators in Sri Lanka. *SocSci Med* 1995; 40: 431–6.

S.M.Waliswezki, A.A.Aguirre, C.S.Silvia(2001). Organochlorine Agro-chemicals Levels in Maternal Adipose Tissue, Maternal BloodSerum,Umbilical Blood Serum, and Milk inhabitants of Veracruz,Mexico.[Institute of forensic Medicine,University of Veracruz,SS Juan Pablo II s/n,Boca de Rio,Ver.C.P.94290,Mexico.

Strecher, V. J. & I. M. Rosen stock (1997). The Health Belief Model In K. Glanz, F. M. Lewis, & B. K. Rimer (eds.) *Health Behaviour and Health Education: Theory, Research, and Practice*. San Francisco: Jossey-Bass.

Swan SH, Kruse RL, Liu F, Barr DB, Drobnis EZ, Redmon JB, Wang C, Brazil C, Overstreet JW. (2003).Semen quality in relation to biomarkers of agro-chemicals exposure. Environ Health Perspect.111 (12):1478-84.

Tak-Sun Yu,I, Lee,N.L and Wong.T,W(2005) Knowledge, Attitude and Practice regarding Organic solvents among printing workers in Hong Kong, *Journal of Occupational Health,2005;47;305-310*

Thailand National Statistical Office. (2003). Agricultural Census. Ministry of Information and Communication Technology*;* Bangkok, Thailand: 2003.

Thoen, R., Jaffee, S. & C. Dolan (2000), Forthcoming, 'Equatorial Rose: The Kenyan-European Cut Flower Supply Chain', in R. Kopiki (ed.), Supply Chain Development in Emerging Markets: Case Studies of Supportive Public Policy, Boston: MIT Press.

U.S. EPA (1992).Regulatory impact analysis of Worker Protection Standard for agricultural agro-chemicals. Washington, DC: U.S. Environmental Protection Agency, Office of Agro-chemicals Programs

Uasin Gishu County Integrated Development Plan 2013

Uasin Gishu County Health Strategic and Investment Plan 2013

Verduzco, Gustavo and Maria Isabel Lozano. (2003)."Mexican Workers' Participation in CSAWP and Development Consequences in the Workers 'Rural Home Communities. "North---South Institute, Ottawa

Ward, Neil. (l993). The agricultural treadmill and the rural environment in the post-productivist era."*Sociologia Ruralis* Vol.33 (3/4):348-364

Warren GF.(1998).Spectacular Increases in Crop Yields in the United States in the Twentieth Century. Weed Tech. 1998;12:752.

Wesseling C, McConnell R and Partanen T. (1997). Agricultural agro-chemicals use in developing countries: health effects and research needs. *Int J HealthServ*1997; 27:273–308

Wesseling C, Ruepert C, &Chaverri F. (2009) Safe use of agro-chemicals .A Developing country's point of view. Encyclopedia of Pest Management, p1-4. *Marcel Dekker Inc.*

WHO (2003), The WHO Recommended Classification of Agro-chemicals by Hazard. In: World Health Organization, ed. Stuttgart, Germany: Wissenchaftliche VerlagsgesellschaftmbH 2009

WHO (2006), World Health Organization. Sound management of hazardous wastes from health care and from agriculture. New Delhi; WHO South- East Asia Regional Office, 2006.

WHO (2003).Agro-chemicals residue in food*:* International program on chemical safety Joint FAO/WHO meeting on agro-chemicals results evaluations 2002, *part 2 Toxicology*

WHO (1948). "Designing the road to better health and well-being in Europe" at the 14th European Health Forum Gastein 7 October 2011, Bad Hofgastein, Austria

Wiles, R. Davies, K. and C Campbell, (1998).Ever exposed organophosphate insecticides in children's food. Environmental working group, Washington.

Wilson C. Tisdell C. (2001). Why farmers continue to use agro-chemicals despite environmental, health and Sustainability costs? *Ecol Econ.*, 39, pp. 449-62.

World Bank, 2004, http://econ.worldbank.org/view.php?id=11803

Wynne, Brian. (1996). *May the sheep safely graze, A reflexive view of the expert-lay knowledge divide.In Lash, Scott, Bronislaw Szerszynski and Brain Wynne (eds.)* Risk, Environment and Modernity. London: Sage Publications.

Yamane Taro. (1967). *Statistics: An Introductory Analysis*, New York, Harper and Row.

Yan e L, Ortiz D, and Calderon. (2002), Overview of human health and chemical mixtures: problems facing developing countries. *Environ Health Perspect* 2002; 110 Suppl 6:901-9.

Yassin MM, Mourad TA, and Safi JM. (2002). Knowledge, attitude, practice, and toxicity symptoms associated with agro-chemicals use among farm workers in the Gaza Strip. *Occup Environ Med 2002; 59 (6):387-*

APPENDIX I: LARGE SCALE FARM WORKERS QUESTIONNAIRE

I am a student at Egerton University pursuing Master degree in Geography. This is an academic study where main purpose is to collect data about levels of awareness on safety and health on use of agro-chemicals among farm workers in the flower industry. These questions are for research purpose only and information you will provide will be treated with confidentiality. Your assistance in answering questions will be highly appreciated.

Date……..…
Signature……..…
Location……..……..

Indicate the following information about your views. Please tick appropriate choice or fill in blank appropriately E. g **[√]**

DEMOGRAPHIC FEATURES OF FARM WORKERS

1. Gender Female ☐ Male ☐
2. Age Below 24 years [ ]
   25-55 years [ ]
   50 and above [ ]
3. Marital status: Single [ ] Married [ ] Divorced [ ]
4. Level of education: Primary [ ] Secondary [ ] Tertiary [ ]
5. Duration of work (years) 1-2 [ ] 2-3 [ ] 5 and above [ ]
6. Work shift: Full time [ ] Half day [ ]

KNOWLEDGE ON SAFE HANDLING OF AGRO-CHEMICALS

7. What are some of the some of the agro-chemicals used in the farm?
   a) Aldicarb [ ]
   b) Piperophos [ ]
   c) Acephate [ ]
   d) Tetradifon [ ]
   e) Others……
8. Do you know the classes of agro-chemicals you use above?
   a) Yes [ ]
   b) No [ ]
   c) No idea [ ]
9. Have you participated in seminars or training courses related to the safe handling of agro-chemicals?
   a) Yes within the farm [ ]
   b) No outside the farm [ ]
   c) If yes how long [ ]
10. Do you know any other ways for pest control rather than agro-chemicals use?

a) Genetic resistance [ ]
b) Modifying climate [ ]
c) Disrupting pest's life cycle [ ]
d) Fostering beneficial organisms [ ]
e) No idea [ ]

11. In your own opinion, do you think it is necessary to undertake medical checkups during working period?
a) Yes [ ]
b) No [ ]
c) No idea [ ]

12. If yes, when do you think it is appropriate?
a) Before handling of agro-chemicals [ ]
b) With the onset of symptoms [ ]
c) Routine /regular health checkups [ ]

PRACTICES ON SAFE HANDLING OF AGRO-CHEMICALS

13. Have you ever spill agro-chemicals on body?
a) Yes [ ]
b) No [ ]

14. How can you help a colleague during agro-chemicals spill?
a) Washing [ ]
b) Drink water [ ]
c) Go to health center [ ]
d) No idea [ ]

15. When spraying what protective equipment do you use?
a) Gloves [ ]
b) Boots [ ]
c) Coveralls [ ]
d) Hat [ ]
e) Mask [ ]
f) Goggles [ ]
g) All of the above [ ]
h) None [ ]

16. Do you read and understand information/instructions written on agro-chemicals packages?
a) Yes [ ]
b) No [ ]

17. Do you follow labels of agro-chemicals containers?
a) Yes [ ]
b) No [ ]

18. Have you been instructed or trained about handling of agro-chemicals?
    a) Yes [ ]
    b) No [ ]

19. What kind of training have you attended?
    a) Handling [ ]
    b) Spraying [ ]
    c) Risks associated with agro-chemicals exposure [ ]
    d) Other [ ]

20. Where did you get your training?
    a) Within the farm [ ]
    b) Outside the farm [ ]

21. Do your wash hands after handling agro-chemicals?
    a. Yes [ ]
    b. No [ ]

22. Do you eat/ drink /smoke tobacco during work with agro-chemicals?
    a) Yes [ ]
    b) No [ ]

23. Do you keep meals near agro-chemicals when spraying?
    a) Yes [ ]
    b) No [ ]

24. Do you sources of water near agro-chemicals treated areas?
    a) Yes [ ]
    b) No [ ]

25. After spraying do you take shower?
    a. Yes [ ]
    b. No [ ]

26. Do you change clothing before and after agro-chemicals exposure?
    a) Yes [ ]
    b) No [ ]

27. Do you separate clothes when washing?
    a) Yes [ ]
    b) No [ ]

28. How do you dispose containers after use?
    a) Burning [ ]
    b) Dumping [ ]
    c) Keep them in store [ ]
    d) Other [ ]

ATTITUDE ON SAFE HANDLING OF AGRO-CHEMICALS

State whether you [5] Unsure [4] Strongly Disagree [3] Disagree [2] Agree [1] Strongly Agree

i. Agro-chemicals can have bad /negative impact on health	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
ii. Use of PPD can reduce agro-chemicals exposure	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
iii. Health risks can be reduced if proper practices are implemented.	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
iv. Proper storage of agro-chemicals help in reducing health risks	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
v. Women should not put on personal protective devices while handling agro-chemicals	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
vi. Both men and women should put on personal protective devices while handling agro-chemicals	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
vii. Women are more exposed to agro-chemicals than men while handling agro-chemicals	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]
viii. During spraying i always sneeze/have chest problem	1-Strongly agree [ ] 2- Agree [ ] 3- Disagree [ ] 4-Strongly disagree[ ] 5- Unsure [ ]

SELF- REPORTED ILLNESSES RELATED TO HANDLING OF AGRO-CHEMICALS

1. Do you believe agro-chemicals can have any bad/ negative effect on your health?
   a) Yes [ ]
   b) No [ ]

2. Have you ever had the following symptoms for the last 6 months after spraying or handling agro-chemicals?
   a) Skin conditions rash / itch/irritation/Colour change [ ]
   b) Diarrhea and/vomiting [ ]
   c) Nasal symptoms (running nose/sneezing) [ ]
   d) Eye Conditions (burning sensation) [ ]
   e) Respiratory symptoms(Cough and /or chest pain/tightness [ ]
   f) Pregnancy complications [ ]
   g) Any other (specify)
   [ ]

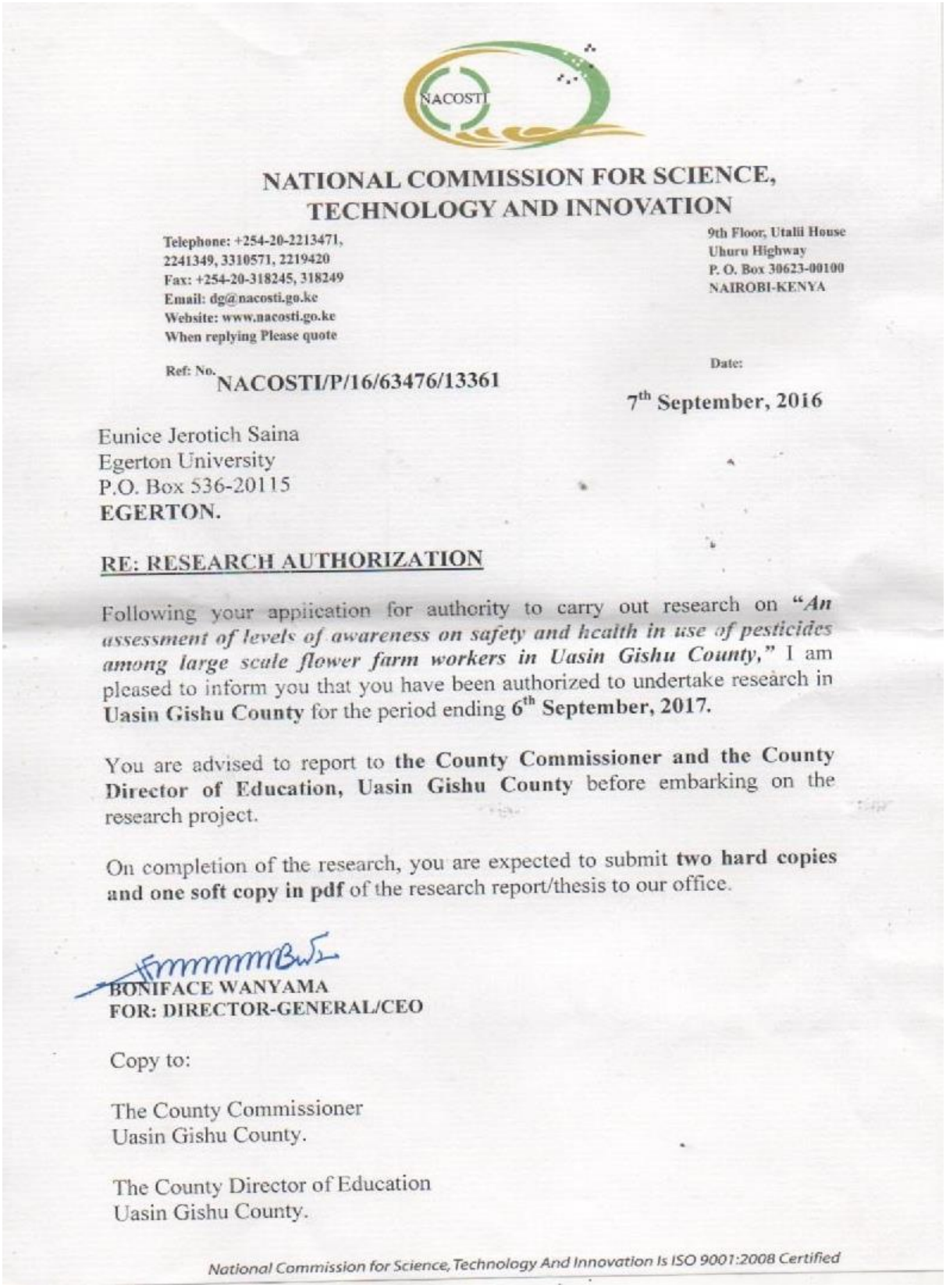
3. What steps have you taken regarding this symptom?
   a) Sought medical treatment [ ]
   b) Changed duties [ ]
   c) None [ ]

4. Where did you receive treatment?
   a. Company health facility [ ]
   b. Private health facility [ ]
   c. Public health facility [ ]
   d. Traditional (herbal)medicine [ ]
   e. Drug store [ ]
   f. Others specify…….

5. Have you suffered any of the following ever since you started working on the farm?(For women of reproductive age)
   a. Inability to conceive [ ]
   b. Miscarriage [ ]
   c. Still birth [ ]
   d. Child with birth deformity [ ]

THANK YOU FOR YOUR PARTICIPATION

APPENDIX II: RESEARCH PERMIT



NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying Please quote

9th Floor, Utalii House
Uhuru Highway
P. O. Box 30623-00100
NAIROBI-KENYA

Ref: No. NACOSTI/P/16/63476/13361

Date: 7th September, 2016

Eunice Jerotich Saina
Egerton University
P.O. Box 536-20115
EGERTON.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"An assessment of levels of awareness on safety and health in use of pesticides among large scale flower farm workers in Uasin Gishu County,"*** I am pleased to inform you that you have been authorized to undertake research in **Uasin Gishu County** for the period ending **6th September, 2017.**

You are advised to report to **the County Commissioner and the County Director of Education, Uasin Gishu County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Uasin Gishu County.

The County Director of Education
Uasin Gishu County.

National Commission for Science, Technology And Innovation Is ISO 9001:2008 Certified