Assessment of pesticide use and disposal in Gida Ayana District, Western Oromia, Ethiopia

A Thesis submitted to the School of Graduate Studies, Department of Zoological Sciences in partial fulfillment of the requirements for MSc. Degree in Biology

By: Dugassa Olani

Advisor: Sisay Dugassa (PhD)

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Abbreviations

BC: Before Christ

DA: Developmental Agents

DDT: DichlorodiphenolTrichloro ethane

FAO: Food and Agricultural Organization

NES: National Environmental Secretariat

UN: United Nations

WHO: World Health Organization

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Abstract

Pesticides are poisonous chemicals used to kill insects, fungus, bacteria and other organisms that affect crops and transmit diseases to the public. They also have veterinary importance – they kill ticks that affect livestock health. The chemicals destroy herbs (weeds) and animals causing harm to the health of the livestock. The Ethiopian agricultural sector has the potential to drive the country's economic development. It ensures food security of its people and brings about industrial transformation. Agriculture is major source of income and occupation in the study area. Promoting sustainability of the sector requires using improved agricultural technologies. Pesticides are such technologies that enable farmers to control pest and weeds in order to increase agricultural yields, and thereby provide a number of benefits to the society. The study is done in Gida Ayana district, West Oromia, Ethiopia. Out of 27 Kebeles of the district, three Kebeles were purposively selected for study. The research design was survey research, and open and closed-ended questions were prepared and distributed to a total of 182 respondents. Of these 156 responded to the questionnaires. The response rate is 85.71%. Based on this comparative study was conducted on pesticides use taking the three Kebeles as units of analysis. The research findings indicated that pesticides are widely used in the study area. Most of these are used against anti-crop pests/insects and weeds in order to increase crop production. About 75.82% of the respondents use pesticides for different purposes. The study further indicated that Glyphosate, Glymax, Glycel, 2, 4-D, and Zura herbicides are largely used in the study area. Majority of the users have no adequate knowledge of the health effects of the pesticides. About 33.5% of the respondents indicated they dispose in the agricultural fields where the chemicals are used. The use of pesticides is not restricted to agricultural fields. They are also used in homes. Improper disposal of the chemicals causes health problems to the people themselves and their livestock. The chemicals also contaminate the environment. Proper disposal of the unwanted pesticides is one of the important tasks of responsible user. Improper disposal can lead to contamination of environment and pesticide users, it is necessary to encourage farmers to use alternative methods of cultivation. Every user of pesticides needs to know the benefits and risks of the chemicals.

Key words: pesticides, Chemicals, Gida Ayana, Pest

1. INTRODUCTION

1.1 Background of the study

Pesticide is a chemical used to control or destroy pests that damage crop plants. Pesticide use is a common performance to control pests and disease in crop cultivation. It is a poisonous substance used in agricultural places and the country side that would never be permitted for industrial and pharmaceutical chemicals (World Book, 1994).

A Pesticide is any chemical or biological agent that kills or reduces the action of plant or animal pests. They are known to be one of the useful and beneficial agents for preventing losses of crops as well as diseases in humans. Pest is an organism that reduces the availability, quality, value or some human resources (i.e., food or health) and a destructive insect or other animals that attacks crops and livestock.

Pesticides are poisonous chemicals by design, they are biocides designed to kill, reduce insects, weeds, fungi, rodents or other organisms that can threaten public health and economy. Pesticides are known by a various names depending on their target, a few of these insecticide, fungicide, and herbicide. Pesticides are used to kill insects, fungus, bacteria and other organisms that are affect crops and also vectors that transmit disease of public health and veterinary importance. It also eliminates or controls herbs (Weeds) and animals causing harm or interference with the production, processing and storage of food and agricultural commodities (World Book, 1994). In many African countries agriculture is considered to be the economic development, Agriculture has been a main stay of the Ethiopian economy. It is the major sources of income and occupation in the study area. Some insects destroy or cause heavy damage to valuable crops such as maize, wheat, barely. Most of the agricultural production in Ethiopia comprises mixed farming (i.e. crop and live stock farming) (NES, 2006).

Crop farming has the tendency to use chemicals especially fertilizers, veterinary chemicals and pesticides, safe storage and disposal of pesticides and fertilizers remain a challenge in agricultural areas. Proper pesticide containers disposal is an important part of responsible pesticides use. Improper disposal can lead to contamination of soil, ground water and surface water, causing serious diseases to animals and humans. Similarly, improper use of Agro-

chemical can create hazards farmers on good pesticide managements for humans and environment (WHO, 2006).

Good pesticide management practices could help to minimize the risks of pesticide poisoning and pollution of the environment. Some of the good management practices need to consider the risks associated with improper use of pesticides. When using pesticides it is necessary to read the instructions on the container for use and waste disposal very carefully. In other words, the instructions on the container are the best mechanism not only to use properly the pesticides, but also elimination of unnecessary application and proper pesticide storage (Amera, 2008).

The actual situation of Ethiopian farmers' pesticide use practices, however, is an upsetting and calls for an intensive work on educating them on good pesticide use management and creating awareness in regard to assessing potential consequences of waste disposal. It is important to initiate the farmers to follow the processes of good pesticide use management. This study is carried out in Gida Ayana District of Western Oromia, Ethiopia.

In Ethiopia, like in any developing country, agriculture is the mainstay of the economy; it has been/is the source of food security for the people and the potential drive for the country's future development. The use of pesticides in agricultural sectors in the country has increasingly become an important aspect of agricultural technology, which is critical for agriculture development, economic growth and poverty reduction (Bwalya 2010). In light of population growth the use of pesticides is necessary to increase food crop production (FAO, 2012). Sustainable food crop production requires agricultural technologies. Pesticides constitute important technologies that enable farmers to control pests and weeds when producing crops (Kateregga 2012). Pests also cause damage by spreading diseases (Wilson and Tidal, 2001).

The need for rapid expansion of agricultural production has resulted in an increased demand for agrochemicals in Ethiopia. Hence, pesticides have become essential inputs for plant, livestock and public health protection (NES, 2006).

The use of pesticides in agriculture sector in Ethiopia has also become an important aspect of agricultural technology necessary for development of agriculture sector, economic growth and poverty reduction (Bwalya 2010).In fact, pesticides are used for a variety of other purposes in Ethiopia. They are sprayed in homes for controlling cockroaches, mosquitoes, rats, fleas, ticks

and others harmful to human and livestock health. In addition, pesticides prevent the outbreak of diseases through control of rodent and insect vectors. Despite these benefits, however, they have serious side effect on the environment also (Agrawal *et al.*2010; Mengistie*et.al* 2014).

Agriculture is also the major source of income and occupation of the people in the study area. It, therefore, is possible to say the output of the study can be used as a benchmark for understanding the benefits and the risks associated with using pesticides. The findings of the research can also be additional data source for those interested in doing further and in-depth study on the subject under study. Both graduate and undergraduate students may find it relevant for their academic work. In short, the findings of the study, despite its limitations, may also help fill the gap in the literature.

The study is limited to three Kebeles because of limited resources and time to undertake the study on a wider scale. In spite of this, however, the study is expected to have accomplished the following:-

►It provides users with useful information to minimize using pesticides in the study area.

►It could serve as an important source of data for those who want to carry out further research on the subject under investigation in the study area.

►The result of the study would serve the community in giving awareness to protect themselves and their livestock from health problems caused by exposure to pesticides, and

►It could provide additional and valuable information for government and non-government agencies entrusted to implementing for application of pesticides in the study area as per the overall pesticides' use policy.

The study seeks to understand and explain the farmer’s pesticide use practices and related procedures in Gida Ayana District of West Oromia, Ethiopia. In doing this, the study 1) has conducted survey research on three Kebeles; 2) secondary sources of data are also used in order to test the validity of the information obtained from the survey research.

1.3 Objectives

1.3.1. General Objective.

The general objective of the study is to evaluate farmers' use and disposal of pesticides in Gida Ayana district, in Western Oromia, Ethiopia.

1.3.2. Specific Objectives.

The specific objectives of the study include the following:

1. To assess the extent of use of pesticides in Gida Ayana district.
2. To identify problems associated with the use of pesticides.
3. To assess how excess and obsolete pesticides are disposed in the study area.
4. To assess the disposal mechanisms of pesticide containers in the study area.

1.3 Organization of the study

In this study, the materials were organized into five chapters. The first chapter includes an introduction, objectives of the study and organization of the study. The second chapter contains a review of previous studies. The third chapter is about methods and procedures used for the study, description of the study area, development of the study questionnaires, selection of sample size, collection of data and data analysis. The fourth chapter is on survey results and discussion. The fifth and the final chapter is conclusion and recommendations of the study.

2. LITERETURE REVIEW

2.1 Historical background to pesticides use

The use of pesticides dates back to the times of Ancient Romans where people used to burn sculpture for controlling weeds. A Roman naturalist urged the use of arsenic as an insecticide (Margni *et al.* 2002). Humans since the BC have utilized pesticides to protect their crops. The First known pesticides was elemental sulfur dusting used in ancient Mesopotamia. By the 15th century, toxic chemicals such as arsenic, mercury and lead were being applied to crops to kill pest. A short history of pesticide use describes that the use of chemicals to control insects possibly dates back to the classical Greece and Rome. The Chinese were using chemical insecticides like arsenic and nicotine at least by the 16th century (Margni *et al.* 2002).

Globally, the use of pesticides in food production is common to many farmers using commercial pesticides for pest control to increase yield and improve quality; and the world health organization (WHO) reports that 20% of pesticide use in the world is concentrated in developing countries (PANG, 2012).

2.2 Importance of Pesticides

The term pesticide covers a wide range of compounds, including insecticides, herbicides, rodenticides, molluscides, nematodes, plant growth regulators etc. The problem associated with pesticides is mostly marked in rural areas that use different types of pesticides like herbicides and insecticides. Pesticides can be biological or chemical based up on application method. Most pesticides work by poisoning pests. A systematic pesticide moves inside the plant by absorption (Elzinga, 2004).

Pesticides are used to control organisms that are harmful to human and livestock health. Pesticides kill mosquitoes that can transmit diseases like yellow fever and malaria. They can also kill bees, wasps or ants that can cause allergic reactions and causes high exposure to health risks (Jansen 2008). Herbicides can be used to clear road side, weeds and trees. They can also kill invasive weeds that may cause environmental damage (World Book, 1994). Herbicides are commonly applied in ponds and lakes to control algae and plants such as water grasses that can interfere with activities like swimming and fishing that cause water to look or unpleasant smell.

Uncontrolled pests such as termites and mould can damage structures such as houses. Pesticides are used in grocery stores and food storage facilities to manage rodents and insects that infest food such as grain. Each use of a pesticide carries some associated risk (World Book 1994). Wide spread application of pesticides can eliminate food sources and certain types of animals, thereby causing the need to relocate the animals, to change their diet or starve them. Proper use of pesticides decreases the associated risk. Poisoning may also occur due to the use of DDT and other chlorinated hydrocarbons by entering the human food chain when animal tissues are affected.

It is estimated that DDT and other chemicals in the organophosphate class of pesticides have saved seven million human lives since 1945 by preventing the transmission of diseases such as malaria, sleeping sickness and typhus, however, the use of DDT is not always effective(kettle, 1995). Pesticides also prevent outbreaks disease by controlling rodent and insect vector, and thereby contribute to improved human health. Deaths of millions of people around the world have been prevented through insecticide mediated killing of disease vectors (Ross 2005). Of course, pesticides can be dangerous to consumers, workers, and close by standers during manufacture, transport during and after use due to high exposure and unsafe application causes health risks of users (Williamson *et al.* 2008).

Pesticides help to control a variety of organisms. Most disinfectants used in homes, hospitals and restaurants contain pesticides, some of which only last long enough to control the target pest while the others remain in the environment. According to the WHO and the United Nations (UN) environmental program estimates, each year three million workers in agriculture in developing world experience severe poisoning from pesticides, about 18,000 of who die (WHO, 2006).

Farmers' occupational exposure to pesticides occurs in manufacturing process, such as mixing, loading, packaging and storing. Workers involved in pest control in agriculture and vector borne disease prevention programs are usually exposed to pesticides during mixing and spraying (Grube *et al*. 2011).

Therefore, the effects of exposure to pesticides result in human health problem. The causal factors contributing to acute occupational pesticides poisoning include sloppy handling, lousing preparation and spraying of highly toxic pesticides or high concentrations of spraying every row,

direct contact with sprayed crops, going forward into the wind during spraying, lack of personal protection and poor personal hygiene (WHO, 2006).It is argued that exposure to pesticides is associated with long term health problems such as respiratory problems, memory disorders, dermatologic condition, cancer depression, neurological deficits and birth defects (Williamson *et al.*2008). This is despite the fact that pesticides also preserve the beauty of recreational areas by controlling weeds and preventing structural damages associated with termite's infestations. Moreover, herbicides and insecticides are used to preserve the control vectors that cause diseases (Aktar *et al*.2009).

2.2.1 Pesticides of agricultural importance

Agricultural population use pesticides to protect their crops from damages caused by pests. Pesticides are also used as plant growth regulator, defoliant, desiccant or agent of thinning fruit, preventing premature fall of fruit and substances applied to crops either before or after harvest to protect the commodity from deteriorations during storage and transport (Mulualem, 2005).As literature shows, worldwide, 40% of agricultural product is lost due to plant diseases, weeds, and pests collectively (Ross, 2005). That means that if there would have been no pesticides, crop losses would have been even more. Moreover, these crop-saving substances not only protect the crops from damage rendered by pests, but they also increase the yields of crops considerably.

2.2.2 Importance of Pesticides for Public Health

Pesticides are useful not only for control of pests from affecting crops, but also to prevent them from transmitting diseases to people and animals. People use pesticides where pests are a major problem to human health. Insects are probably the major pests that transmit serious diseases such as malaria and typhus. Therefore, pesticides are also used in homes and other buildings to control pests such as ants, flies, cockroaches and termites (Elzinga, 2004). Elzinga further argues that ticks, rodent and insect- borne diseases such yellow fever, typhoid fever and typhus have been kept in control by the effective use of pesticides.

2.2.3. Importance of Pesticides for Veterinary Health

Pesticides are used to control threats caused by external parasites to health of domestic animals. They are effective control against ticks, lice, blow flies, biting flies, itching mites, screw worms and other external parasites affecting veterinary health. They also protect animals from biting fly and strikes for a certain period of time. Pesticides differ according to their effects on various

organisms, and, therefore, selective pesticides are absorbed by organisms in lower level of food chain (Parker, 1980).

In Ethiopia, pesticides are widely used for a variety of purposes. In addition for controlling agricultural fields from being affected by pests, pesticides are used in homes in the form of sprays, poisons and powders for controlling cockroaches, mosquitoes, rats, fleas, ticks and other harmful bugs(Margni *et al*. 2002).

To wind up, pesticides use, as has been above discussed has both benefits and risks. The degree of benefits and risks depends on whether or not the pesticides are used properly and improperly. If pesticides are used and pesticides wastes are disposed properly the benefits could more than the risks. As research has revealed, for example, about one-third of the agriculture products are produced by using pesticides (Liu *et al*. 2002). As a result, agricultural sector consumes significant amount of pesticides – approximately 85% of the estimated 2.9 million tones are used each year globally (Raven *et al.,* 2008). It is estimated approximately 9000 species of insects and mites, 50,000 species of plant pathogens and 8000 species of weeds damage crops worldwide (Pimentel, 2009).

Pesticides' use especially is at a rapid rate in developing countries, where the livelihood of major of the people based on agriculture. None use of pesticides would shortage of food security there. The developing nations utilize about 20% of total pesticides applied worldwide. Despite the increasing application of tons of pesticides worldwide, however, more than 40% of all potential food production and another 20% of the harvested crop is lost to pests (Palette and Pimentel 2000). This indicates that farmers of the developing countries need to use more pesticides to ensure food security. Ethiopia is a developing country, whose economy is largely dependent on agriculture. Hence, Ethiopia needs high yield varieties of crops to ensure food security, which requires increased use pesticides, with proper management indeed (Ngowi, 2007).

At the same time, pesticides' use is also important for public health and the health of domestic animals. 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 disease such as malaria, resulting in an estimated 500 deaths each day (Ross, 2005). Disease control strategies are

crucially important also for the livestock, on which the livelihood of the significant portion – the pastoralists – of the Ethiopian population is based.

2.2.4 Empty pesticide containers disposal

Empty pesticide containers must be disposed properly to prevent accidents and to protect the environment. Empty containers such as bottles, cans, plastics, metals, bags and leaks have to be properly collected and placed in one area and disposed as soon as used. They should be shaken clean and must be burned in a sanitary area where organisms cannot reach.

Figure 1: Empty pesticide container and unwanted pesticides that were irresponsibly stored

Source: Fish, F.M 2005, Understanding safety data sheet language.PI-35. Gainesville: University of Florida Institute of food and agricultural Sciences

3. MATERIALS AND METHODS

3.1 Description of the study area.

The study was conducted in Gida Ayana District which is one of the seventeen Districts of the East Wollega zone, Oromia, Ethiopia. Gida Ayana District is located in Western part of Ethiopia. It is bounded with Abe-Dongoro and Kiramu districts in the East, Limmu and Ebantu district in the West, Guto-Gida district in the south and Amahara Regional State in the North. It has a distance of 442 kilometers from Addis Ababa capital city of Ethiopia.

The District has 22 rural Kebeles and 5 town Kebeles. Maize, Sorghum, Millets, Wheat and, Teff are widely cultivated in the area. Different agro-ecological zones in district include: Moderate highland (Woinadega) 48%, Highland (Dega) 2% and Desert (Bereha) 50%.

The basic objective of this study was to evaluate how excess pesticides and empty pesticide containers are disposed of in safe manner in the study area. The data needed for the study has been obtained from field research using survey research design. A set of questionnaires as was prepared and distributed to respondents, the majority of which were pesticide-user farmers. Secondary sources of data were also used in order to test the validity of the information obtained from the survey research. Both were found useful to organizes and present the Thesis.

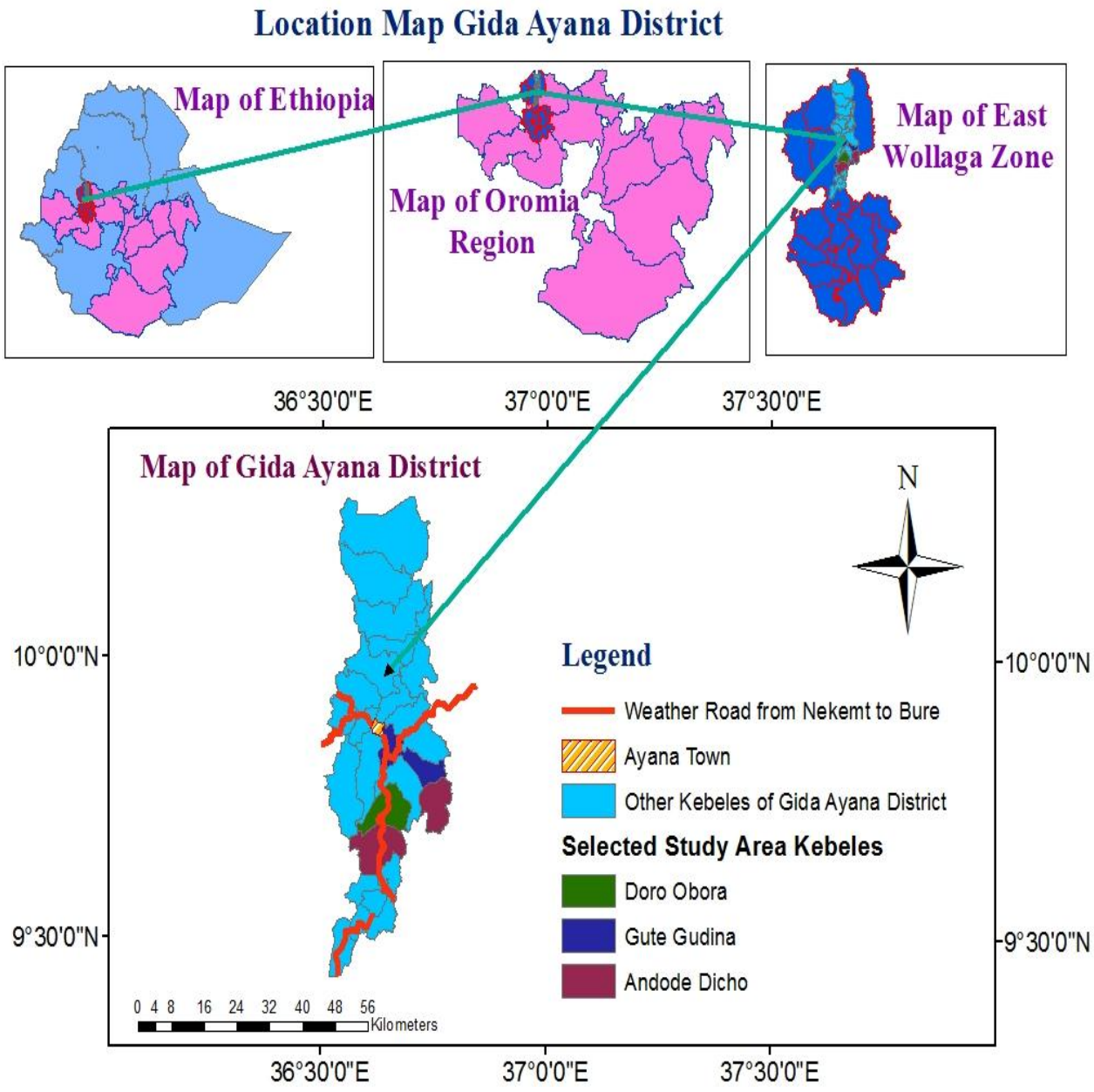

Figure 2: The Location Map of study area
Source: Ethio-Gis (2014)

3.2 Development of the questionnaires

At the beginning of the development of the questionnaires, it was determined that to fulfill the objectives of the study. The questionnaires would be given to farmers, agricultural extensions and health extensions. Farmers were the biggest pesticide user group in the District (in the study area) in terms of size that they would be the group with the biggest problem with unwanted pesticides and empty pesticide container disposal.

3.3 Study population and sample size

The sources of population were includes farmers, Developmental Agents (DA) or agricultural extensions and heath extensions in Gida Ayana District. The information was collected from farmers (participants) as primary source in the study area.

3.4 Data collection tools

Basically, two methods of questions were given to the respondents with considered, face to face interviews and written questionnaires. The data were collected by means of a structured questionnaires administered, through personal interviews (through a farm survey by face-to-face interviews with farmers) and field observations. The questionnaires were developed according to the objectives of the study.

The questionnaires were developed in English and latter translated into local language (Afan Oromo) for data collection. Before data collection, the questionnaires were pretested on selected number of farmers in the study area. The data were collected for information on knowledge of pesticide, training received, habit of reading the labels on pesticide bottle, hygiene practice, personal protective equipment, on methods of mixing and spraying and disposing of unused pesticides. Field observation was also carried out to gather information on pesticide use and dispose empty containers.

The data collected also includes life-style factors such as age, sex, education and occupational status of respondents. Manners of using pesticides, disposing of empty pesticide containers and problems that would happen as a result exposure to pesticides were examined and explained.

3.5 Sampling procedure & sample size

In order to collect data related to the research problems and research objectives the researcher followed different techniques of sampling. Accordingly in the study area there are 27 Kebeles, three Kebeles were selected purposively with criteria of having relatively using large amount of pesticides in agricultural area. The main reason for selecting three Kebele's is the fact that they were ideally suitable to make the comparative study due to their location and for analysis of the need to solve the problem indicated in limitation part of this thesis. Households also selected randomly from chosen Kebeles and the proposed data was collected according to the aim of the study. A cross-sectional study was conducted from September 2018 to August 2019.

Purposive sampling technique was employed to determine sample size from three Kebeles total of 2600 householders. Of these1162 from Andode Dicho Kebele, 845 from Gute Gudina Kebeles, and 593 from Doro Obora Kebele, then the researcher used from Kothari (2004) formula in order to determine a sample size.

This simplified formula shows that 95 % confidence level, and expected to be efficient and manageable to reduce time and budget costs. Because it provides medium sample size which is not too long or too small as far as large number of household concerned in this particular study areas. The total sample size of population (n) was calculated by the formula:

$$n = \frac{Z^2 pqN}{e^2(N-1)+Z^2 pq} = n = \frac{(1.96)^2(0.15)(1-0.15)(2600)}{(0.05)^2(2600-1)+(1.96)^2(0.15)(1-0.15)} \approx \mathbf{182}$$

Where n = total Sample size

Z= is values of standard variant at 95 % confidence interval (Z=1.96)

N = is the total number of Households (2600)

P = is proportion of value estimated (0.15)

e =0 .05 (since the estimate should be within 5% of the True vales)

q = 1- p =0.85

Based on relevant character sties of the population and the resources available for the study sample developmental agents (DA) and health extension workers from each Kebeles were selected purposively.

For the total number of house holders systematic random sampling techniques were used throughout each sequence level in sample selection. Random sampling method was applied to select the respondents.

Table 1: Total household population and sample size in each Kebele

No	Kebele	Total No. of households	Sample size	Remark
1	Andode Dicho	1162	81	
2	Gute Gudina	845	59	
3	Doro Obora	593	42	
Total		**2600**	**182**	

Source: Gida Ayana Agricultural office (2010)

3.6 Methods of data Analysis

Data were analyzed using quantitative method. The closed ended questionnaires were tabulated and analyzed using quantitative method. The statistical analysis used in the study was varying depending on the type of variable and information required. However the survey was based on formal respondents in terms of socio-demographic, educational and pesticide factors, Multi-response analysis also used for variables needs to be ranked. Quantitative data gathered from open-ended questionnaires were short listed to identify the major effects of pesticides on human and livestock and empty pesticide containers and unwanted pesticides disposed off. Finally, the results of analysis and interpretation of the data obtained were discussed and summarized to give recommendations.

4. RESULTS AND DISCUSSIONS

4.1 RESULTS

The set of questions prepared and distributed was concerned with the attitudes towards pesticides and information needed on pesticides and pest control. The results indicated that farmers apply pesticides without instructions (orientation) of extension workers. They simply buy pesticides from shops and store the chemicals using unsafe storage facilities. They lack adequate safety instructions. Moreover, they do not use protective equipment when using and disposing empty pesticide containers unsafely. Farmers are the biggest pesticide-user group in the study area and, are also the biggest group facing problems associated with inappropriate ways of pesticides use and empty pesticide containers disposal.

In order to do the research, small-scale sample questionnaires were administered to 182 people of different walks of life in the study area. Out of these 156 (85.72%) volunteered and responded; from whom 123 (67.18%) were males, while the remaining 33 (18.13%) were female respondents. Out of the questionnaires that were distributed, 24 were not returned and 2 were invalid responses. The respondents' age range from 22-73 years (minimum being 22 and maximum 73), with an average of age 42.5. Of the respondents 30 (16.48%) have not received formal education where as 72 (39.56%) can read and write and 54(29.67%) completed primary and secondary school. As the results of the survey indicated, pesticides have been/are readily available and used widely for crop production. The types of pesticides used include Glycel, Glyphosate, Glymax, Aura 2, 4-D and Zura herbicides, and they have been found effective in protecting crops against broad-leaved weeds.

Plate**3:** Shows the crop before herbicides were sprayed

Plate4**:** Shows the crop after herbicides were sprayed

The majority (54.39%) of the respondents reported that they have been using pesticides in crop production, while the remaining (21.43%) have been using pesticides for other purposes, in addition to for crop production.

Table 2: General information regarding respondents

Variable		Number (%)
1	**Sex**	
	Male	123 (67.58)
	Female	33 (18.13)
2	**Level of Education**	
	Illiterates	29 (15.93)
	Read and Write	73 (40.1)
	Primary School	42 (23.97)
	Secondary School	12 (6.59)
3	**Occupation (profession)**	
	Farmer only	112 (61.53)
	Farmer & Trader	30 (16.48)
	Farmer & Civil servant	14 (7.69)

As shown in Table3, from 182 respondents 150 (82.41%) farmers and 6 (3.29%) extension workers are familiar with pesticides.

Table4**:** Attitudes of the population on pesticides in the study area

Familiarity with pesticides	Number of respondents							
	Farmer				Extension workers			
	Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%
	150	82.41	-	-	6	3.29	-	-

Purposes of pesticide utilization

From among the respondents using chemical pesticides, 127 (69.78%) indicated that they use for weeds control, 83 (45.60%) for insects control, 73(40.10%) for rats control, and 54 (29.67%) for other purposes, such as against fleas, cockroaches, bed bags termites and mosquitoes etc.

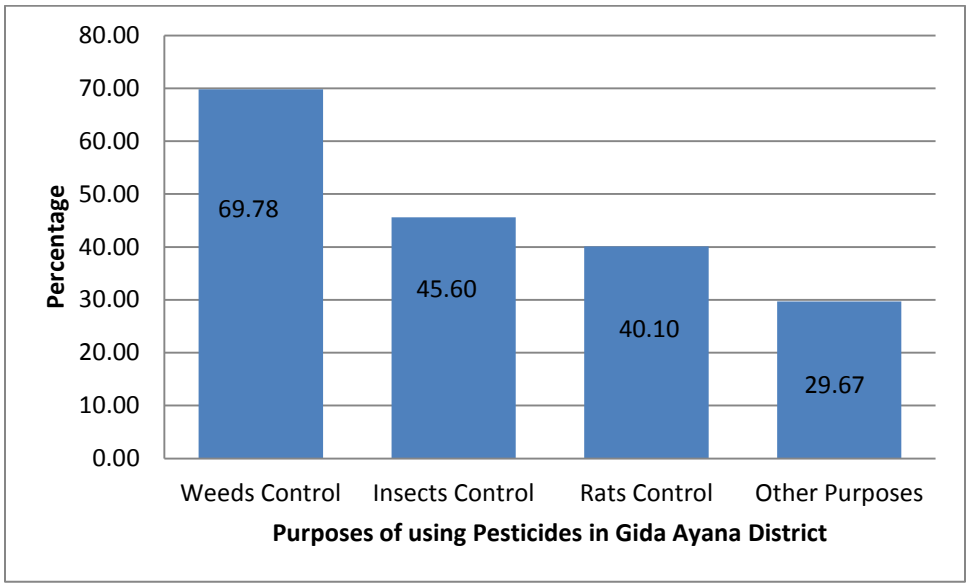

Figure 5: Utilization of pesticides in the study area**.**

As shown in Table 4, out of 182 respondents 52, (28.57%) said they did have orientation on the use of pesticides whereas 104 (57. 14 %) said they did not have.

Table 5: Orientation on the use of pesticides

Do you have orientation about the risks and hazards of pesticides?	Number of respondents			
	Yes		No	
	No.	%	No.	%
	52	28.57	104	57.14

The survey indicated that majority of the users of pesticides think that their knowledge of procedures in using pesticides is not adequate. As Table 5 shows, while 40 (21. 97 %) of the respondents had adequate orientation about the risks of pesticides, 98 (53. 84%) said they had no. This shows that large number of users of pesticides needs information, technical support and pesticides use procedure for pest control. By the contrast, pesticides users who feel their knowledge of pesticides use is adequate is small in number, and that means more farmers need to get orientation and training service from extension workers as well as other concerned bodies. The concerned bodies are places from where users get pesticides are farmers union (community service), agricultural bureau and private shops or veterinary shops for pest control and domestic animals health, respectively.

Table 6: Adequate knowledge of users of pesticides for pest control

Do you have an adequate knowledge of using pesticides for pest control?	Number of respondents			
	Yes		No	
	No.	%	No.	%
	40	21.97	98	53.84

Users' Knowledge of types of Pesticides they use

Table 6 shows whether or not respondents know the types of pesticides they use at different stages of crop production. Accordingly, whereas 18 (9.89%) said they do not use pesticides for crop production purpose, 138(75.82%) respondents, the majority, indicated they use different types of pesticides.

Table 7: knowing the types of pesticide that they use

Do you know the types of pesticides you use?	Number of respondents			
	Yes		No	
	No.	%	No.	%
	138	75.82	18	9.89

Types of pesticides used in the study area

Table 7 indicates the most frequently used types of pesticides by farmers in the study area. These were/are Glycel, Glyphosate and Aura 2, 4-D are accounting for 134 (73.62%) each, Glymax for 138 (75.82%), Zura herbicides for 108 (59.34%) and Megaban for 68 (37.36%). Butrazin 48SC and Roach killer are also used occasionally.

Table 8: Pesticides used by farmers in the study area

Pesticides used by farmers	Number	Percent
Glycel	134	73.62
Glyphosate	134	73.62
Glymax	138	75.82
Aura 2,4-D	134	73.62
Zura herbicides	108	59.34
Megaban	68	37.36

Major crops produced in the study area

All farmer respondents were growing more than one kind of crop on their farmlands. As Figure 6 indicates Maize, Sorghum, Millet, Teff and Wheat are the major crops produced in the study area. Maize is produced by the majority 138 (75.82%) of the respondents, Sorghum by 111 (60.98%, Millet (Daguza) by 78 (42.85%), Teff by 52 (28.57%) and other crops by 33 (18.13%).

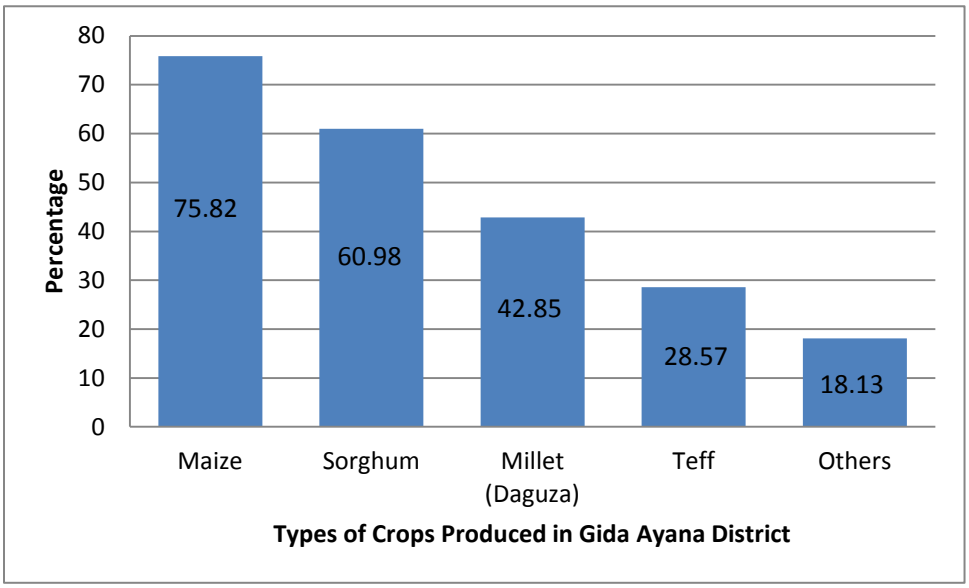

Figure 6: Graph 2 Crops produced in the study area

Using pesticides for Crops and Livestock

As Figure 6 shows, majority of the respondents used pesticides on their crops and livestock. From the total number (182) of respondents, 138(75.82%) said they were using pesticides for crops and livestock whereas 18 (9.89%) responded they were not using pesticides.

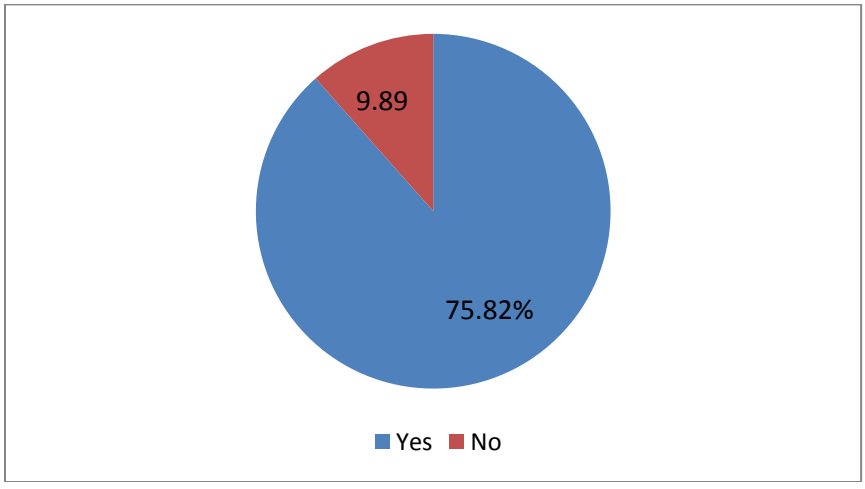

Figure 7 **:** The using of pesticides on their crops and livestock

Occupational status of users

The most users of pesticides are farmers that depend only on agriculture for living. As Figure 8, indicates, 119 (65.38%) are farmer users, 23 (12.63%) are engaged in both farming and trade activities and 14 (7.69%) are civil servants in addition to farming.

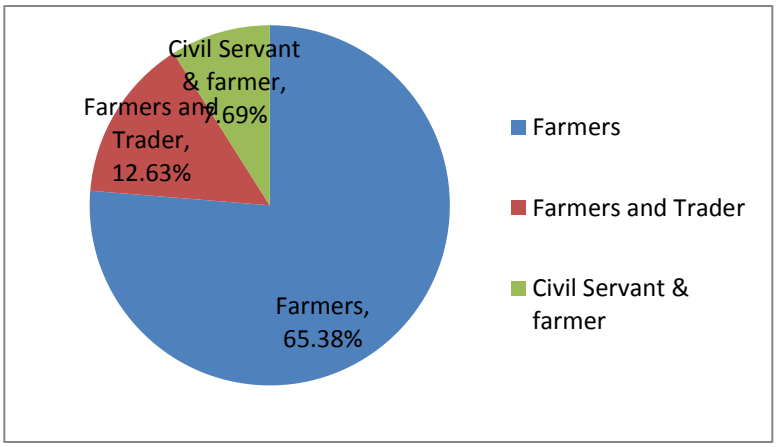

Figure 9: Showing occupation of the respondent

Problems occurred due to using pesticides

Using pesticides entails some health problems. As Table 9 shows, 94 (51.64%) respondents indicated that health problems occur after using the chemicals. The health problems they experienced were different, the major of which included headache, loss of appetite, vomiting, skin and eye irritation, respiratory problems such as asthma and swelling of legs.

Table 10: Health problems occurred due to Exposure of pesticides

Problems occurred after use of pesticides.	Number	Percentage
Headache	29	15.93
Loss of appetite	12	6.59
Skin irritation (itch)	11	6.04
Asthma	8	4.39
Vomiting	21	11.53
Eye irritation	7	3.84
Respiratory problem	4	2.19
Swelling of legs	2	1.09
Total	94	51.64

This means that large number of pesticide users have been reported to have experienced health problems after pesticide use. The problems are mainly because of wrong ways of storing excess pesticides and disposing empty pesticide containers.

The majority of users do not have adequate awareness (knowledge) how to carefully store excess pesticides and dispose empty pesticide containers after usage. As Table 11, for example, indicates from among the respondents about 95 (52.19%) store the excess pesticides for the next season, 23 (12.63%) sell to others who want, 6 (3.29%) give to others without any payment and 14 (7.69%) store with care out of reach of children, animals and others.

Table 12: Methods of restoring excess pesticides

What they do with left-over pesticides	Number	Percent
Storing for the next season	95	52.19
Selling to others	23	12.63
Giving to others without payment	6	3.29
Storing with care out of reach of others	14	7.69
Total	138	75.82

Disposal of Empty pesticide containers

Regarding methods of disposal of pesticides containers the three Kebeles of study indicated significant variations. Table 13, for example, indicates that of the total 61 (33.51%) respondents, 28 (15.38%) of Andode Dicho, 13 (7.14%) of Doro Obora and 20 (10.98%) of Gute Gudina said they leave the containers in the fields where used. Similar variations have also been indicated in other methods.

Table 14**:** Container disposal methods in the three unit of study Kebeles

Methods used	Andode Dicho	Doro Obora	Gute Gudina	Total
Leave in field where used	28 (15.38%)	13 (7.14%)	20 (10.98%)	61(33.51%)
Use for other substances	13 (7.14%)	8 (4.39%)	11 (6.04%)	32(17.58%)
Store in homes	7 (3.84%)	6 (3.29%)	9 (4.94%)	22(12.08%)
Store in other places	12 (6.59%)	3 (1.64%)	8 (4.39%)	23(12.63%)
Total	60(32.96%)	30(16.66)	48(26.37%)	138(75.8)

The variations, it has been observed, were because of varied users' awareness about the health problems associated with pesticides use. It is important to note that about 33.5% of the respondents said that they leave empty pesticides containers on the fields where they were used. This is common method of disposing excess pesticides and containers in the study area.

Disposal system of unwanted pesticides in the study area

As Table 11 indicates, respondents that use pesticides for crops reported they feel there should be a system for storing excess pesticides and disposing empty pesticide containers in the study area.

Table 15: Disposal system of excess pesticides

Need for Empty containers and excess pesticides disposal system	Number of respondents			
	Yes		No	
	No.	%	No.	%
	138	75.82	-	-

All respondents want to get empty pesticide containers disposed but they differ on paying fee for the disposal. As Table 16 shows, while 24 (13.18%) of the respondents expressed willingness to paying fee, 114 (62.63%) – the majority– were unwilling to pay fee.

Table 17: Willingness to pay fee for disposal

Paying a fee to dispose empty pesticide container and excess pesticides	Number of respondents			
	Yes		No	
	No.	%	No.	%
	24	13.18	114	62.63

Quantity of pesticide containers disposed

The number of empty pesticide containers disposed is increasing from year to year. Respondents confirmed this. Of the respondents 91 (50%) indicated that they dispose six to ten empty pesticide containers annually whereas 47 (25.82%) dispose only three to five containers yearly.

Table 13 indicates that 63(34.61%) respondent said they would dispose empty containers while 75(41.2%) said they would not dispose empty containers.

Table 18: Empty pesticide containers to be disposed at the time of the survey

Empty container and excess pesticides be disposed	Number of respondents			
	Yes		No	
	No.	%	No.	%
	63	34.61	75	41.2

Utilization of protective measures

Of the total number of respondents, 108(59.34%) said they use protective measures, while 30 (16.48%) said they do not use protective measures. Table 19 indicates this.

Table 20: Safety measure Utilization

Do you use safety measures when you spray pesticides?	Number of respondents			
	Yes		No	
	No.	%	No.	%
	108	59.34	30	16.48

As Table 21 has indicated, from 108 safety measure user respondents 58 (31.86%) use cotton overall, 6 (3.29%) use hand gloves, 9 (4.94%) use hat, 28(15.38%) use boots and 7(3.84%) use eye glass; whereas 30 (16.48%) use no safety measure at all.

Table 22: A list of equipment used as safety measures in the study area

Name of Equipment used as safety measures	Number	Percent
Normal clothes	30	16.48
Cotton overall	58	31.86
Gloves	6	3.29
Hat	9	4.94
Boots (Shoes)	28	15.38
Eye glass	7	3.84
Total	138	75.82

Reading labels on containers for instructions

Of the 182 respondents, 29 (15.93%) said that they could read labels on containers, but only 19 (10.43%) could understand and follow instructions. In general, the majority 109(59.89%) of them, however, could not read labels on the containers at all.

Returning empty container to the place of purchase

According to the survey results indicated by Table 16, out of the total 182 (100%) respondents, only 13 (7.14%) respondents return empty pesticide containers to the place of purchase, whereas 125 (68.68%) of the respondents do not.

Table 23: Users' returning empty container to places of purchase

Returning empty pesticide containers to places of purchase	Number of respondents			
	Yes		No	
	No.	%	No.	%
	13	7.14	125	68.68

The extent to which respondents agree or disagree concerning proper system of disposal of empty pesticide containers, using them for other purposes or returning to the places of purchase has health risk to humans, animals as well as damage to the environment at large.

Regarding the risks or harms this cause to humans, animals and environment, about 96(52.74%), 38(20.87%), 12(6.59%) and 10(5.49%) of the respondents replied strongly agree, agree, undecided and disagree respectively. There, no response of strongly disagree. It was also indicated in question No. 22 of the table in the Appendix (last page), 68(37.36%), 70(38.46%), 6(3.29%), 4(2.19%) and 8(4.39%) of the respondents reply strongly agree, agree, undecided, disagree and strongly disagree, respectively. As it was shown in item 3 of the same table concerning reuse of empty pesticides can cause harm and poisoning, about 43(23.62%), 29(15.93%), 27(14.83%), 34(18.68%) and 23(12.63) of the respondents reply strongly agree, agree, undecided, disagree and strongly disagree respectively.

Regarding disposing pesticides properly and protect the environment, about 109(59.89%), 4(2.19%), 25(13.73%) and 18(9.89%) of the respondents reply strongly agree, agree, undecided and strongly disagree respectively. As it was indicated in item 5 of the same table regarding personal protective equipment utilization that can reduce pesticide exposure, about 111(60.98%), 18(9.89%), 16(8.79 %), 2(1.09%) and 9(4.94%) of the respondents strongly agree, agree, undecided, disagree and strongly disagree respectively.

The problems (damage) from pesticide use include sickness to humans, livestock and damages to honey bees. The major health effects on humans because of pesticide use in the study area include headache, asthma, diarrhea and burns and damages on skins. Pesticide sellers and farmers need training and technical assistance for most proper use of the chemicals and regulated containers disposal methods.

4.2 DISCUSSIONS

This study has been done to assess the status of pesticide use and disposal of empty containers in Gida Ayana district. It is the first of its kind on the subject in the study area. The survey was conducted on a small-scale group of farmers, most of which were/are users of pesticides for crop production, livestock and other purposes as well in Gida Ayana district.

The survey results indicated that pesticides, which include Glycel, Glyphosate, Glymax, Aura and, Zura 2, 4 -D herbicides, are readily available and largely used in crop production. In spite of this, however, no systematic and in-depth research has been done on the topic/ problem in the

study area. It is possible to say this is the first in-depth analysis on the problem under study in Gida Ayana district so far.

As indicated by survey results shown above, majority of the respondents are familiar with pesticides. The respondents said that they know the positive effects of pesticides. They know that pesticides are used to destroy unwanted weeds and reduce vectors that cause different diseases, but they did not know the negative effects of pesticides on their personal health, health of their livestock and the environment.

Despite using different types of pesticides, the respondent farmers do not even properly follow instructions from extension workers and concerned bodies. The responses from agricultural extensions, health extensions and farmers have been systematically (statistically) interpreted and used as essential data. The data were then reported by the use of frequency counts and percentage.

As the survey results indicted, majority of the users of pesticides have no adequate knowledge about the health problems that the chemicals cause on themselves and their livestock. This shortfall is despite the fact that the chemicals have been widely used in the study area. For example, in the three Kebeles mentioned above where this survey was carried out, about 90% are fully dependent on farming, and about 85.7% of the total 182 respondents said that they were using pesticides for different purposes. In other words, majority of the respondents occasionally use pesticides for different purposes. In addition to improve crop yields by destroying insect pest and weeds, they also use pesticides against vectors that cause different diseases affecting human beings and animals. Neither the health center nor the agricultural bureau gives attentions for such health problems of pesticides in the study area.

As the survey results further indicated, majority of the respondents were affected due to pesticide exposure or mismanagement. Some of the problems occurred were headache, loss of appetite, asthma, eye irritation and vomiting.

Some of the respondents were using pesticides according to instructions of extension workers from agricultural sector whereas most respondents were using pesticides without any instruction because either they were not getting or following instructions. This indicates that the farmers' awareness is different from Kebele to Kebele's; implying they need persistent training and

awareness giving to the farmers by extension workers and concerned bodies. Those who use pesticides without instruction, exposed to pesticides during mixing, spraying and handling or mismanagement of pesticides. As the respondents suggest that more than half of the participants (respondents) have no training on the uses of pesticides from concerned bodies.

This survey also indicated that majority of pesticide users have no adequate knowledge on correct procedures of pesticides use. Large number of users requires education or technical support on pesticide use and empty container disposal from extension workers or concerned bodies. Pesticides are available mostly in farmers' union – community service agents receive and distribute the chemicals to users –, private shops and veterinary pharmaceutical shops. Regarding utilization, 75.82% of the study respondents use different types of chemical pesticides at different stages. And the types of pesticides frequently used by farmers in the study area were identified. From the different types of crops produced in the study area, the main ones, as indicated in figure 6, are Maize and Sorghum. The majorities of the respondents in the study area use pesticide for their crops and livestock. Regarding empty pesticide container disposal, the survey also indicated that about 33.5% were left in the fields where they were used , 17.57% used for storing other substances, 11.52% were stored in homes and 12.62% were stored in other places which is indicated in Table 10. In some farms observation were conducted to verify farmers report and I observed farmers, as shown by Plate 3, discarding empty pesticide containers on the farmlands.

Plate 3: Showing improper disposal of empty containers

Plate 4 indicates pesticide users' unsafe way of storing empty containers in homes.

Plate 4: Showing unsafe storing of empty containers in homes

As respondents stated, about 75.82% of pesticides users need to get adequate awareness and training about appropriate disposal procedures of empty and unwanted pesticide containers in the study area. The amount of pesticides used in Gida Ayana district has been increasing. It is also indicated that majority of users are aware of the need to utilize protective equipment – as safety measures (Table 15). But a few users do not use safety measures. This is indicated by Plate 5.

Plate 5: A user spraying pesticide without using any safety measures

None use of safety measures is for a number of reasons. First, it could be due to lack of adequate awareness of the effects of pesticides. Second, it could be due to lack of money needed to buy protective equipment. As it has been stated above, about 10 (5.49%) of the respondents could read but do not understand the labels on the containers while 19 (10.43%) could read and understand labels on pesticide containers. Plate 6 shows user reading the labels on pesticide containers for instructions how to use pesticides.

Plate 6: Showing reading instruction from the container

As to what to do with unused pesticides respondents stated that majority of the users store them for the next season while others sell to those who want to use. Important to note here regarding the disposal of empty/ unwanted containers also is that about 13.18% of the respondents were willing to pay a fee to those who help in disposing the containers whereas 62.63% of the respondents were not willing. Large number of the users could not return empty pesticide containers to the sellers. Half of the respondents feel were not exposed to problems as a result of improper disposal of empty pesticides containers. Respondents mentioned that headache, asthma, diarrhea and burns on the skins as the major health problems in the study area. Be that as it may, financial incentives are needed to encourage returning empty containers to sellers.

5. CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSIONS

The following conclusions were drawn based on the survey results and discussions. The study was conducted to understand how pesticides were/are used in Gida Ayana District of Western Oromia, Ethiopia. Pesticides are poisonous chemicals used for the purpose of killing pests and weeds in order to increase crop production and thereby to ensure food security for the people. Using the chemicals can also cause health problems to people and their animals. Some of the health problems the survey results indicated include headache, loss of appetite, asthma, skin itching and eye irritation. Careless handling of the chemicals and improper disposal of containers can cause different types of diseases. A large number of pesticide users indicated that they were exposed to those health problems, which occurred after they used pesticides. This shows that there are both benefits and risks associated with pesticides use.

The benefits and risks associated with pesticides use have been identified and adequately discussed in the thesis. In my view the risks could be reduced and the benefits could be maximized if the awareness of pesticides users is created and improved through frequent training programs and orientation workshops. In other words, to reduce potential and actual health and environmental effects associated with pesticide use, it is necessary to carefully read labels on pesticide containers and follow instructions of extension workers of agricultural and health bureaus.

Farmers were/are the biggest pesticide user group in the study area and the biggest to be exposed to the side-effects of using pesticides. This is due to careless ways of storing the chemicals and disposing empty pesticide containers. The survey results indicate that farmers who use pesticides without any safety measures were most exposed to the consequent health problems as well.

In addition to the survey results, empty pesticide containers were found spread out on open grazing fields in the study with potential health effects to humans and domestic animals as well as consequences for the environment. The respondents agree that there should be careful system of storing excess pesticides and disposing empty pesticide containers in the study area. But the majority of them were not willing to pay a fee required for empty pesticide containers disposal.

Using pesticides is in order to increase agricultural yields for the benefits to the society. But the issue of hazards posed by pesticides has not been given attention to by users in the study area. The use of pesticides is serious threat to biodiversity, which is the natural system up on which living organisms depend.

5.2. RECOMMENDATIONS

In light of the major problems described above regarding the use of pesticide and disposal of empty containers the following measures are forwarded as recommendations.

1. Careful pesticide containers disposal is an important role of a responsible pesticide user. Careless disposal measures can lead to contamination of the soil and ground water, thereby causing serious health problems for pesticide users.

2. It is important to create and promote awareness of the pesticide users about the side-effects of pesticides. This could be done through organizing frequent training and orientation-workshop programs.

3. Organizing training and orientation-workshop programs are duties of concerned bodies such as agricultural and health sectors in the study area. Important is also all pesticide users have to be accessible to the training and workshop opportunities without any form of discrimination.

4. Using pesticides in appropriate quantity needed for crop production the livestock health is necessary not only to reduce financial costs, but also to minimize the various risks associated with excess chemicals and their empty containers. It is also important to plan for the quantity of pesticides to purchase.

5. Last but not least, it is necessary to encourage farmers to use alternative methods of cultivation, including growing diversified vegetables as well as and crop rotation. This can help to avoid the risks of using chemicals to the health o the people and their livestock.

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Appendix

Interview and Questionnaires on Pesticide use and Disposal

Addis Ababa University School of Graduate Studies, Department of Zoological Sciences

Questionnaire filled by respondents

Profession: _____

Date: _____

Place(Kebele): _____

Title: *Assessment of pesticides Use and Disposal in Selected Kebeles of Gida Ayana district Western Oromia, Ethiopia*.

Instructions:

The purpose of this questionnaire is to gather information on the title indicated above. Dear respondents since the reliability of this survey depend on the objectivity of your response; you are kindly requested to offer your response based on the truth and genuine information.

Direction:

1.Do not write your name.

2. Put tick mark (√) on the space provided.

3. When written response is required, please make a brief comment.

4. Respond all questions precisely and genuinely.

1. Personal information

1.1 Name of your Kebele _____1.2 Sex: Male □ Female □

1.3 Age: Below 20 years□ 22-27years □28-33 years □ 34-39 years 40-45□ 46-51□

52-57 years□ 58-63 □ 64-69 □ 70-75□ and above 76 □

1.4 Educational statuses:

1. Illiterate____

2 .Read and write_____

3. Literate, grade completed_____

General knowledge about pesticides

1. Are you familiar with pesticides? A/ Yes B/ No

2. For what purpose do you use pesticides?

_____

_____

_____

3. Do you have any orientation (training) about the risks and hazards of pesticides from agricultural bureau or health center? A/ YesB/ No.

4. In order to manage your pesticide use and disposal do you think that your knowledge on pest control procedure is adequate? A/ Yes B/ No

5.From where do you get (buy)pesticides?

_____

_____

_____

6. Do you know the names of any pesticides that you use? A/ Yes B/No

7. If reply question No.6 Yes, please specify the names (the types of pesticide you uses frequently)_____

_____

_____

8. What are the types of crop you cultivate (more than one response is possible)?_____

_____

_____

9. Do you use chemical pesticides on your crops and live stock? A/ Yes B/ No

10. Do you have an occupation other than farming? A/ Yes B/ No

11. As pesticide user do you know problems related to the exposure (misuse) of the pesticides? A/ Yes B/ No

12. If reply to question 11 is yes what problems associated with pesticide misuse?

_____

_____

13.After you complete a pest control job with a pesticide, what do you do with the pesticide that is sometimes left-over in the container?

_____

_____

_____

14. How do you most frequently dispose of your empty pesticide containers?

A. Leave in field where used

B. Use for storing other substances

C. Store in homes

D. Store in other places

15.Do you feel that there is a need for an unwanted pesticide and empty pesticide container disposal system in Gida Ayana district? A/ Yes B/ No

16. In order to have empty pesticide containers and unwanted pesticides disposed of in a safe manner, would you be willing to pay a fee? A/Yes B/No

17. Approximately how many empty pesticide containers did you dispose in a year?

Total numbers of empty container disposed_____

18. Do you presently have any pesticides on hand that you would like to dispose off?

A/ Yes B/ No

19. As pesticide user, do you read the label on the container and use any personal protective equipment that reduces pesticide exposure? A/ Yes B/ No

20. If you reply question No.19 Yes, can you mention the personal protective equipment that can reduce pesticide exposure?

_____

_____

_____

21. Would you return empty pesticide containers and unwanted pesticides to the place of purchase if the seller encouraged you? A/ Yes B/ No

22. To what extent do you agree on the following statements (rate your answer based on the scale).

1. Strongly disagree **4. Agree**

2. Disagree **5. Strongly agree**

3. Undecided

	1	2	3	4	5
1. Most pesticides cause some risk or harm to humans, animals or the environment.					
2. Most pesticide exposures occur in the work place.					
3. Reuse of empty pesticide containers can cause harm and exposure to pesticides and poisoning.					
4. Disposing of pesticides properly can help to protect the environment.					
5. Personal protective equipment use can reduce pesticide exposure and poisoning.					

23. Have you ever had any of the damage (problems) from using a pesticide? A/ Yes B/ No

24. If you reply to question No.23 yes what types of problems have you experienced?_____

_____

_____

Thank You!