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# AGROCHEMICAL POISONING AMONG SMALL SCALE TOBACCO GROWERS IN ZVIMBA DISTRICT, MASHONALAND WEST, ZIMBABWE

BY

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**Abstract**

Globally, the use of pesticide is growing day by day, the use of agrochemicals in agriculture have become inevitable in modern day agriculture. Evidence has shown that correct use of agrochemicals can directly increase both the yields and quality of crops that are produced. Tobacco is one such crop where there is extensive use of agrochemicals. Research has shown that improper handling and use of these chemicals can have devastating health effects. The study aimed to investigate the knowledge and practices of small- scale tobacco growers in Zvimba District on agrochemical use for the period 2017 to 2020. An analytical cross sectional study design was used. All the farmers who were registered with the TIMB in the selected district were eligible for enrolment in the study. The study enrolled 84 participants who were then administered structured questionnaires. Data was analysed using STATA Version 16 for Windows. Use of poisonous agrochemical which has purple and red triangles was still prevalent at 19% and 23% respectively. 92% of the respondents cited that they have lockable units for storage of agrochemicals. Age of respondents and years of experience in use of agrochemicals was associated with having a higher score on knowledge with OR=1.8 (95% CI: 1.17, 2.41) and 2.9(1.71, 3.41) respectively. Having received training on use of agrochemicals was also associated with attaining a higher score on knowledge with OR=2.9(1.71, 3.41). With regard to personal hygiene, 19% reported that they wash their working clothes after a spraying session and 39% indicated that they do a full body wash. Use of personal protective equipment was poor with less than 10 % reporting correct and adequate use of PPE. Lack of knowledge on the importance of PPE and the economic burden that is associated with purchasing it were the most mentioned barriers to use of PPE. Most respondents cited that it was expensive and viewed that they think it was something they could do without.

**Keywords**: agrochemical, small scale farmer, pesticide

## Declaration

I declare that this dissertation proposal is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it be submitted to another university for the award of a degree

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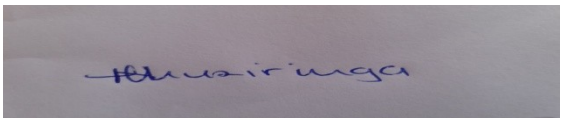
| Natasha V. Muziringa |  |
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| Mr E Chikaka |  |

## Copyright

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- Ward Councillors and AREX officers.

## Dedication

I dedicate this work to Kumbie and my two girls Hannah and Channah. Thank you for your unwavering support.

## List of Acronyms and Abbreviations

| | |
|---|---|
| AUREC | Africa University Research Ethics Committee |
| DNA | Deoxyribonucleic acid |
| EMA | Environmental Management Agency |
| EPA | Environmental Protection Agency |
| IFPRI | International Food Policy Research Institute |
| LC | Lethal Concentrations |
| LD | Lethal Dose |
| LMIC | Low to Medium Income Countries |
| MRLs | Maximum Allowable Concentrations |
| NGOs | Non Governmental Organisations |
| NSSA | National Social Security Authority |
| PPE | Personal protective equipment |
| TIMB | Tobacco Industry and Marketing Board |
| UNEP | United Nations Environmental Program |

WHO World Health Organization

## Definition of keywords

1. Agrochemical- Any chemical used that is used in agriculture which includes chemical fertilizers, herbicides, and insecticides. This term can be interchangeably used with the term pesticide

2. Pesticide–refers to any substance or mixture of the substances that are manufactured to prevent, destroy, repel, or mitigate pests or any compound or mixture of substances that is intended for use as a plant regulator, defoliant. It also includes nitrogen fertilisers and stabilizers.

3. Small Scale Farmer - refers to any person that is a registered tobacco grower using a land which is less or equal to four hectares.

## Contents

## List of Tables

## List of Figures

## List of Appendices

# CHAPTER 1: INTRODUCTION

## 1.1 Introduction

Agrochemicals incorporate synthetic fertilizers, hormones, or other chemical growth agents that are used to increase productivity. In agriculture, insects and animals are a severe plant risk that can cause huge losses. Thus agrochemicals are widely used because of their ability to protect crops from damages of pests and diseases at the same time fertilizers and growth agents provide essential nutrients for plant growth. Therefore agrochemicals improve the quantities and quality of agricultural products.

Agrochemicals are an integral component of modern farming as they play a significant role in improving agricultural produce per unit area. The indiscriminate and excessive application of agrochemicals is one of the main environmental and public health challenges. Improper use of agrochemicals mainly pesticides has resulted in secondary pest outbreaks, adverse health effects due to exposure during use and environmental contamination. Farmer's exposure to pesticides has been associated with bad health effects, with the higher percentage occurring in LMIC.

Farmers and farm workers, and especially those who are directly involved with the handling of pesticides, are posed with a high risk of exposure to pesticides through contact with pesticide residues on treated crops, unsafe handling, storage and disposal practices, poor maintenance of spraying equipment, and the lack of protective equipment or failure to use it properly (Litchfield, 2005). WHO, (2011) and UNEP estimates that one to five million incidences of pesticide poisoning occurs among agricultural workers.

Each year, about 20 000 fatalities occur due to poisoning. Some of the risk factors for poisoning cases included lack of PPE and use of defective PPE. Poisoning incidences among farmers were reported to happen when spraying and on mixing pesticides. Also when stored in bulk, agrochemicals can cause significant environmental risks especially when spills occur accidentally. (Litchfield, 2005).

In a study carried out by Maumbe& Swinton (2003) on the Hidden Cost of Pesticide use, results showed that cotton farmers in Gokwe District spent an average 45% to 80% of their realized income on pesticide-related direct and indirect acute health effects. The practice of agriculture especially in Southern Africa is dominated by small scale farmers and their families. They operate in the informal sector where they are not registered and in most cases are not known by regulating authorities. This lack of formalization among the small scale farmers makes their regulation close to impossible.

Surveys conducted in the tropical regions concluded that a greater percentage of accidental and non-suicidal cases of agrochemical poisoning occur due to poor knowledge and risky practices in the storage, handling as well as spraying of pesticides. However there is great concern on the actual magnitude of the problem as it may be underestimated due to poor reporting and diagnosis.

Zimbabwe is one of the largest growers of tobacco in Africa and it is ranked fourth in the world. About 3 million of the population depended on tobacco for their livelihood (TIMB, 2018). However most studies that have been done in Zimbabwe have mainly focused on the health effects associated with exposure to agrochemicals. The researcher

could not find comprehensive literature that looked at knowledge on storage, use and disposal practices that result in exposure. Therefore this study seeks to assess the storage, use, safety/hygiene and disposal practices that result in farmers being exposed to the agrochemicals focusing on small scale tobacco growers in Zvimba District.

### 1.2 Background to the study

Globally up to 50% of crops are lost annually due to effects of pests and diseases. In Nepal, loss due to poor postharvest storage and pre-harvest loss accounts up to 25% annually. Agrochemicals proved to be beneficial if used sustainably as they can increase food quality, quantity and shelf life. Improper use of agrochemicals can have detrimental effects to human health and other living organisms due their high level toxicity.

Zimbabwe is among the top four global producers of the tobacco leaf which makes it the second foreign currency earner from mining. Tobacco farming has grown to become a lucrative means of livelihood for the small scale resettled farmers in Zimbabwe. Tobacco production is of significant in the Zimbabwean economy (TIMB, 2018). It employs a vast majority of subjects in its production chain. On a small scale production, tobacco is grown by families. It is important that tobacco requires a great amount of pesticides to prevent it from effects of pests and diseases. Although tobacco has proven to be economically significant, concern has been raised over the intensive use of agrochemicals that are involved in the early stages of the production chain. Several studies have associated exposure to those chemicals to high levels of acetylcholinestarase activity among those exposed to the chemicals (Mugauzi, Mabaera, Rusakaniko,Chadambuka & Gombe, 2011).

Up to100 various agrochemicals are listed for use in the production of tobacco, whereby the active chemicals of each agrochemical is either organic or inorganic. Inorganic chemicals generally contain elements such as sulphur, potassium, copper, whereas organophosphates constitutes a group of pesticides that is commonly used in agriculture. Pesticides used at tobacco fields have been shown to increase the chances of developing DNA damage, as was observed in cell lines of animal models, and human studies (Ukpebor, Llabjani, Martin, Halsall, 2011).

With Zimbabwe aiming to achieve the Upper Middle Income Economy by 2030, agriculture has been cited as one of the major contributors towards attaining of the Vision 2030. This means tobacco production is most likely to be scaled up to increase foreign currency revenue. If the risks posed by these activities are not mitigated, the economic gains will most likely be eroded by the health impacts associated with pesticide exposure during its production.

**1.3 Statement of the problem**

Agro-chemical poisoning accounts for about 34% of all poisoning cases in Zimbabwe. These were mainly recorded in resettlement areas which are mainly dominated by new farmers. Statistics from two clinics in Zvimba District, Mashonaland West province showed an increase in suspected cases related to pesticide poisoning both accidental and deliberate poisoning from for the past five years. The records show that the agrochemical related poisoning cases usually peak during the rainy season. The following table shows the statistics.

**Table 1: Summary of suspected agrochemical poisoning: Source Ministry of Health and Child Care Quartely Report, Mashonaland West, 2019.**

| Year | 2017 | | 2018 | | 2019 | |
|---|---|---|---|---|---|---|
| | Deliberate poisoning | Accidental poisoning | Deliberate | Accidental | Deliberate | Accidental |
| Number of pesticide suspected poisoning | 8 | 13 | 5 | 17 | 9 | 19 |

## 1.4 Broad Objective

The objective of this study is to assess knowledge and practices of small- scale tobacco growers in Zvimba District on Agrochemical use for the period 2017 to 2020.

### 1.4.1 Specific objectives

The study will seek to:

- Describe the agrochemicals that are used by the small scale tobacco growers in Zvimba District for the period 2017 to 2020
- Assess the storage, use and disposal practices of agrochemicals by small scale tobacco growers in Zvimba district for the period 2017-2020.
- Assess the knowledge on agrochemical use by small scale tobacco growers in Zvimba District for the period 2017-2020.
- Evaluate the safety and hygiene protocols practiced by the tobacco growers when handling agrochemicals.
- Identify barriers to the adoption of occupational safety precaution measures among small scale tobacco growers in Zvimba District for the period 2017-2020.

- Determine factors that are associated with knowledge, safety and handling of agrochemicals.

### 1.5 Research Questions

- What are the chemical properties and associated health risks of agrochemicals that are commonly used in tobacco farming?
- What are the farmer's practices on storage, application and disposal of agrochemicals?
- What is the farmer's level of knowledge on use of agrochemicals?
- What hygiene and safety protocols do the farmers follow when using the agrochemicals?
- What are the factors that hinder implementation of good occupational safety practices among the small scale tobacco growers?
- What are the factors that are associated with knowledge, safety and handling of agrochemicals?

### 1.6 Significance of study

Agrochemicals are important component of food production as they both increase the quality and quantity of agricultural produce. The increase in yield will ensure that the population is food secure thus alleviating hunger and possibilities of malnutrition. Evidence has shown that the benefits of pesticides are realised at a significant cost to society. However research has shown that improper use and handling of these agrochemicals have had devastating health impacts on both humans and animals thus making their use a public health concern.

In Zimbabwe, Occupational Safety and Health issues are mainly covered under the Factories and Works Act, however it is worth noting that besides the diverse occupational risks and dangers in the farming/ agriculture, this industry not covered by the Act which is mainly implemented by NSSA. This will then make it difficult for the regulatory body to monitor and ensure safety measure is followed. This lack of guidance and monitoring from the experts results in lack of knowledge on safety guidelines. Therefore this study should be conducted in order to identify the gaps in the following areas,

- It will help to identify gaps in knowledge concerning agrochemical handling and use among small scale farmers
- Will help in highlighting the training needs in agrochemical use among farmers.
- Help identify ways in which occupational safety challenges can be addressed in this sector just like any other sector in Zimbabwe.
- Help to guide in policy formulation that will encompass farmers

**1.7 Delimitations of the study**

The study only enrolled farmers who are registered tobacco growers with the Tobacco Industry and Marketing Board. Small scale farmers who grew tobacco but not registered with TIMB were excluded from the study. Due to the budget and time constraints, this study was only carried out in one district which is Zvimba District in Mashonaland West Province.

## CHAPTER 2: REVIEW OF RELATED LITERATURE

### 2.1 Introduction

Agricultural chemicals that are in use in modern day farming for example synthetic fertilizers and pesticides help farmers improve productivity. This results plays in structural development and reduction in poverty especially in LMIC. Evidence shows a strong, causal relationship between agrochemical use and crop yields and increase in crop yields. (McArthur & McCord, 2014). However indiscriminate use of agrochemicals may cause a great risk to the environment and human health hence decreasing the net benefit in productivity. Agrochemical misuse was reported to be rampant especially in LMIC which encompasses the most affected zone for agrochemical poisoning. The manner in which spraying is done, duration of spraying, doses used, equipment used are some of the human factors able to cause harm to humans health. (McArthur & McCord, 2014)

Tobacco-related agrochemical use is well documented in LMIC, however details on their use, health effects and environmental impacts are not well recorded. Tobacco is a monocrop which makes it susceptible to a variety of pests and diseases prompting intensive use and application of large quantities of chemicals. These include insecticides, fumigants, herbicides, fungicides and growth regulators. These agrochemicals are applied to tobacco plants in various growth stages. In Low to Medium Income Countries, growth regulators are normally applied with handheld bottles or knapsack sprayers often in the absence of adequate PPE. In addition to pesticides and growth

regulators, tobacco plants also require intensive use of chemical fertilizers for example the Nitrogen rich fertilisers. (Arcury & Quandt, 2006)

## 2.2 Theoretical Framework

A theoretical framework constitutes of concepts and their definitions. They are mainly derived from related literature and other theory that already exist for the study. The theoretical framework helps to further illustrate concepts and theories deemed to be relevant to the subject of interest. A theoretical framework helps to support the study by specifying the key variables influencing a phenomenon of interest. It also highlights the need to examine how those key variables might differ and under what circumstances. (Kivunja, 2018)

**Table 2: Theoretical Framework**

| **AGROCHEMICAL POISONING** | | |
|---|---|---|
| **Accidental Poisoning** | **Deliberate Poisoning** | **Fowl play** |
| • Poor handling when mixing<br>• Poor storage<br>• Lack of training<br>• Residual poisoning in sprayed fields<br>• Unsafe disposal<br>• Lack of PPE<br>• Easy access in case of young children<br>• Accidental ingestion of residue<br>• Contamination with food | • Easy access to chemicals<br>• Poor storage resulting in easy access<br>• Suicidal intentions<br>• Murder intentions<br>• | • Homicide intentions<br>• Intention to cause harm |

## 2.3 Tobacco farming in Zimbabwe

Zimbabwe falls among the World's top three producers of the "golden leaf" as the tobacco plant is often referred to. Almost 90% of the tobacco grown in Zimbabwe is grown under the contact scheme. This contract system is where the tobacco company contracts farmers to grow on their behalf. They provide the farmers with all the required inputs that include fertilizers, seed, pesticides and money for labour. This makes access to agrochemicals easy to almost all the farmers that get into the contract scheme. The small scale farmers grow tobacco from pieces of land which varies from half of a hectare up to four hectares on average. The main source of labour for the small scale farmers comes from the family members that are the wife, children and other extended family members.

TIMB reportedthat tobacco is grown in the following provinces that are Manicaland (14 percent), Mashonaland West (38 percent), Mashonaland East (13 percent)Mashonaland Central (35 percent. Flue-cured tobacco is the common type of tobacco that is grown in Zimbabwe. The flue cured tobacco is removed is treated by use of heat in in curing barns. It takes about six months from the seedbed up to the curing stage. After being sold to tobacco companies, the crop undergoes minimal processing pending international export. A small percentage is retained mainly for cigarette manufacture (TIMB, 2018).

## 2.4 Regulation of Agrochemicals

Uncontrolled agrochemical application and abuse can result in accumulation of chemical residues in the environment which may become persistent thus resulting in

environmental pollution negative impact on human health. Legislation is also another tool that can be used to regulate the use, selling, storage and disposal of agrochemicals. In the United States of America (USA), agrochemical safety and regulation is a responsibility of the EPA which regulates agrochemical registration. The US Department of Agriculture, the FDA and the Occupational Safety and Health Administration which ensures pesticide safety for workers involved with pesticides.

In Australia, pesticides are regulated through the shared responsibility of the Commonwealth, State and its territories through the national registration scheme of the Australian Pesticides and Veterinary Medicines Authority and Food Standards Australia. However, the use of the pesticides is controlled, regulated and monitored by states and territories individually (Islam *et al,* 2017). In these developed counties where resources are abundant, legislation has to some extent achieved its targets on regulation of agrochemicals.

Low to medium income countries in Africa has also adopted pesticide Maximum Allowable Concentrations (MRLs) from the Codex limits. Majority of countries have enacted their agrochemical laws and regulatory authorities. However, despite the presence of regulations, several setbacks like lack of funds and resources for enforcement of the regulations present a barrier towards full implementation of the legislations. Some African countries still do not have a registry system for agrochemicals which results in use of banned extremely toxic pesticides.

In Tanzania, agrochemical registration, use, effectiveness and protection of public health and safety are regulated by the Tropical Pesticides Research Institute Act, while residues

in food are monitored by the Tanzania Food and Drug Authority under the *Food,* in South Africa, agrochemicals are regulated under Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, which is governed by the Department of Agriculture, Forestry and Fisheries (Islam *et al*, 2017). Similar to other countries, Zimbabwe enacted statutory instruments under the Environmental Management Act (EMA Act CAP 20;27 ) that regulate agrochemical importation and sell. The Hazardous Substances, Pesticides and Toxic Substances Regulations, SI 268 of 2018 is the statutory instrument that sets standards and regulations on pesticide labelling, packaging, repackaging and sale of hazardous substances or articles in Zimbabwe. It also sets conditions that employers have to consider in the handling of hazardous substances at the workplace. It also states that agrochemicals that are used in Zimbabwe must be registered under the Hazardous Substances statutory instrument of the EMA ACT. Also all traders need to apply for a permit to sell the agrochemicals from EMA. However monitoring regulation on the access and use of agrochemicals has been a significant challenge.

Giles (2014) in his survey of pesticide use in LMIC found out that even when legislation is enacted, it is often difficult to enforce given existing structures and budgets. Due to these reasons, non-occupational poisonings continues to account for one of the major public-health problem in the LMIC. According to the World Health Organization (WHO), low capacity towards enforcement of agrochemical related regulations result in excessive and unsafe use of pesticides, resulting in food and water contamination. On a global scale, indiscriminate use of agrochemicals in agriculture has shown to contribute

to insecticide resistance in insects of vector borne diseases like Malaria. Availability of substandard and counterfeit agrochemical products on the market is a major source of concern especially in LMIC.

Agrochemicals in Zimbabwe are sold in a paper, plastic, glass and steel containers ranging from bottles to drums and it is legal requirement for each chemical to be clearly labelled. The label on every container clearly states the toxicity, precautionary measures, first aid, signs of poising and disposal method However, a study by Maumbe& Swinton (2003) in Gokwe Zimbabwe highlighted that they are now counterfeit agrochemicals that are not registered as some have been banned or do not meet the legal requirements that are on the market. These often come at a cheaper price compared to the actual chemical hence they become more lucrative to the peasant farmers. However the study also showed that some of these chemicals do not have clear labels of management which pose a risk to the farmer.

According to the World Health Organization (2011), about 3 million acute cases of agrochemical poisoning occur every year. Most of these cases occur in developing countries where less of theses agrochemicals are in use. The reason being lack of stringent laws and training on pesticide management. The report also stated that more than 25% of all LMIC have no legislation that regulate agrochemical use while about 80% do not have the resources to enforce the laws that are in existence. This was also shown in a study that was conducted in Vietnam, the survey found out that about 2800 of retailers operated without a permit beside it being illegal. Over 5000 of the retailers were found selling about 2,5 tonnes of banned agrochemicals and of 10 tonnes of

smuggled counterfeit agrochemicals. Although Vietnam has legal instruments in place to regulate the importation and sell of the agrochemicals, they also face a challenge of limited resources on the implementation and monitoring of the regulations(World Health Organisation, 2011).

A study in Ghana found out knowledge on pesticide use was very low among the small scale vegetable growers. This was mainly linked to failure to read and comprehend the safety instructions on the agrochemical container. Farmers who reported not reading labels on agrochemicals prior to use highlighted language barrier as a factor contributing to that. Up to 70% of farmers reported buying pesticides in foreign languages that they do not comprehend. This clearly shows lack of enforcement on the regulations as the regulations clearly indicate that labelling and instructions must also be in vernacular languages understood by local people. Ghana also has regulations which govern the sell, use and disposal of these agrochemicals but failure to enforce result in low compliance.

### 2.4.1Knowledge of Farmers Regarding Pesticide Use

Knowledge on where to purchase agrochemicals, how to store them, application and disposal are crucial in ensuring sustainable use of the agrochemicals. Knowledge also empowers the farmers to follow safe procedures thereby minimizing risks associated with mishandling of the agrochemical. However several studies have highlighted a gap in knowledge regarding agrochemical use among small scale farmers.

Sonchieu, Fointana, Edouard, & Brownlinda (2013) in a study in Cameroon found that seventy percent (70%) of pesticide empty containers were discarded thrown in the environment after use, (12%) were not aware on the residual effects post application. On

routes of entry, 42% managed to identify the mouth as one possible route of agrochemical entry into the human body. This study highlighted poor knowledge on the use and handling of pesticides among the investigated population. This study showed the link between pesticide misuse and mishandling to lack of knowledge. This low level of knowledge could be linked to low literacy levels but this was different case in another similar study that was done in the Philippines.

This study showed that knowledge on handling was also low even in communities that are educated. This result was then linked to attitude of farmers. Some did not even take time to read the instructions carefully and those that had been using these chemicals for a long time (more than 10years) thought that they have enough knowledge and did not bother to go through all the information before use. 72% percent highlighted that they read the labels partially and did not bother reading much on safety precautions.

A study conducted in Ghana on the attitudes and perceptions of farmers regarding pesticide use revealed that almost 95% of the farmers were not aware on both human and environmental repercussions of agrochemical use. Farmers had no knowledge on the safety procedures and mechanisms. The farmers indicated that they mainly acquire knowledge from Extension Officers (AEA) (4.9%), instruction from agrochemical label (1.6%), NGOs representatives (1.6%), agrochemical dealers (54%) and other sources such as friends and neighbours made up to 38%. Use of instructions on agrochemical labels as a source of knowledge on safe pesticide use was unsatisfactory as majority of farmers (91.5%) did not read the labels. Farmer illiteracy accounted for the majority of farmers not reading agrochemical labels. Only (8.5%) that highlighted that they do read

agrochemical labels had achieved some higher qualification or were tertiary graduates. Of the 77% that do not read labels, they revealed that some of the pesticides that they buy do not even have labels or instructions. (Millar, Kaunza, Puordeme, 2020)

Besides low level of literacy among farmers, lack of proper training on handling of pesticides as a factor contributing to low knowledge among farmers has been documented. In a study carried out in Ghana, results showed that some chemicals had pictorial explanation that captured safe use practices, possible dangers and safe handling. However, most of the farmers (53%) stated that they were unable to adequately understand the correct meaning of the pictographs. This clearly indicates a gap that could be filled in if proper training is conducted.

**2.5 Toxicity of Agrochemicals**

The toxicity of a pesticide is its capacity or ability to cause injury, illness or death. The extent of injury caused by any agrochemical substance is directly dependant to the exposed dose. An agrochemical which is highly toxic is most likely to causes adverse symptoms of poisoning with fewer doses given. Also an agrochemical with a low toxicity levels generally calls for a huge dose to produce minimal symptoms. The period of exposure that is the frequency of use of agrochemicals also determines the level of injury or toxicity. Some agrochemicals will be toxic after one big dose (i.e acute toxicity) whilst others can be dangerous after minimal doses or repeated doses (i.e chronic toxicity). The toxicity of chemicals is often put into three major categories which are listed below. (Nesheim , Fishel , & Mossler, 2014)

**Table 3: Classes of toxicity, Adapted from Nesheim et al, 2014.**

| Type | Definition |
|---|---|
| Acute toxicity | It occurs from a single exposure (single short-term exposure). |
| Subchronic toxicity | This occurs as a result of recurring exposure over a lengthy period of time that is weeks or months |
| Chronic toxicity | This occurs from recurring incidents of exposure for a number of months or even years (repeated long-term exposure that can last for the entire lifetime. |

### 2.5.1Acute Toxicity

Acute toxicity of an agrochemical refers to the effects resulting from a single dose or a recurring exposure over a very short time. Incidents like pesticide spills during applying or mixing can result in acute poisoning. Acute toxicity is measured using Lethal Doses and lethal concentrations. The Lethal Dose 50 is the value that is often used. This value (LD50) refers to the amount of agrochemical (lethal dose) which can kill up to 50% of the test organisms that had been exposed. This could be oral or dermal exposure. The smaller the LD50 implies the more toxicity of the pesticide. (Ministry of Food Agriculture and Fisheries, 2022)

The LC50 refers to extent of toxicity of an agrochemical where test organisms breathe air fused with agrochemical vapours, dust, and spray mist. The LC50 refers to the concentration of an agrochemical which can kill 50% of a population of test

organismsand it is often determined for a specific period of exposure (e.g. inhalation for 6 hours). The length of exposure is of important as shorter exposure periods generally need higher concentrations to produce toxic effects (Ministry of Food Agriculture and Fisheries, 2022).

### 2.5.2Chronic Toxicity

Chronic toxicity is a term used to describe the long term effects of prolonged or recurring lower levels of exposure to a toxic substance. This can occur for example when a pesticide applicator frequently spills the pesticide on him/herself during spraying. However, the long term effects of prolonged exposure do not show any signs immediately after first exposure but it may require several years to present symptoms. Some agrochemicals which have a tendency to accumulate in tissues (bioaccumulation), or which break down very slowly when they are in body tissues usually causes the greatest long term exposure hazard. A person who is repeatedly exposed to lower doses of such agrochemicals may develop symptoms of poisoning after a long time from the date of the onset of exposure.

### 2.5.3 Health effects of agrochemicals

Exposure to pesticides has been reported as one of the major occupational hazard in farming communities. Pesticides are made of different chemical formulations that can also cause harm to human health. Agrochemicals enter the human body during application, diluting, re-entering of sprayed fields and when cleaning up operations. There are mainly three routes of entry of agrochemicals in the human body which are:

- The skin (dermal)- the chemicals can be absorbed via the skin and can cause immediate irritation like burns and irritation
- Through the lungs (inhalation) – when spraying, agrochemicals can form capours that can be inhaled by those using them.
- By mouth (ingestion) – accidental ingestion or through poor personal hygiene practices like hand washing after application can lead to ingestion of agrochemicals.

The severity of the exposure effects also vary with the type of pesticide, route of exposure, dose and duration or frequency of exposure. Harmful effects of pesticide exposure have shown to be one of the leading causes of mortality in the world. Agrochemicals can cause enzyme inhibition inhibit of the enzyme aetylcholinestarase causing excess accumulation of cholinesterase at the nerve synapses. This will lead to overstimulation of the nervous system leading to development of acute negative health effects that includes confusion, tremor, paralysis, convulsion, coma, gastro-intestinal distress and death can also result. In some cases continuous exposure to pesticides can lead to developmental challenges especially in children (Sonchieu *et al*, 2013).

In a study conducted in the Philippines to assess the economic versus the medical impact of pesticides on farmers, results showed that farmers who used pesticides for a long period presented symptoms of prolonged exposure to harmful agrochemicals. Analysis of economic data showed that the extent of chronic health effects and health costs were directly linked to agrochemical exposure. When health effects were explicitly accounted

for, the net benefits of insecticide use were negative (Pingali, Marquez, Palis, & Rala, 2019*)*.

An assessment of the health implications of agrochemical use in Sub-Saharan Africa showed that agrochemical use was related to higher health care expenditures. The study concluded that agrochemical use was associated with higher costs on health care as a result of morbidity in Uganda and Tanzania(Sonchieu *et al*, 2013).. Households which used agrochemicals were 5-10% more likely to have skipped work due to sickness in the previous 1-3 as compared to households that did not use agrochemicals in their fields. This finding was very consistent across all the three countries where this data was obtained which are Nigeria, Uganda and Ethiopia.

Households that used agrochemicals in Tanzania also reported more consultations to a healthcare worker. This study also highlighted gender matters in relation to pesticide use. Although the study did not find any differences in tasks (exposure) based on gender, however the results showed an association between male gender and negative health impacts associated with pesticide use. This difference was explained using the health behaviour model which stated that females are more health conscious and are most likely to follow safety procedures compared to their male counterparts. Also other factors like tobacco smoking during handling of chemicals further exposed men to the pesticides more compared to women (Megan, Sheehan, Barrett, & Goldvale, 2019).

In Zimbabwe, a study to look at the Health impacts of pesticides amongst farm workers in Kwekwe Commercial farm found out that farm workers were at a very high risk of developing occupational diseases as result of exposure to agrochemicals due to

inadequate knowledge, safety systems and training. The study also found out that the prevalence of acetylcholiestarase inhibition due to agrochemical exposure and poisoning amongst the farm workers was 24.1%. Farm workers were subjected to unacceptably very high levels of agrochemicals (i.e. the levels that result in abnormal cholinesterase activity AchEM75%). These results were in consistent with previous studies conducted in Zimbabwe before the land resettlement program (Nhachi & Kasilo, 1996).

Those findings highlighted that the safety and health health activities in the commercial farms in Zimbabwe were not effective. In a similar study carried out in Ethiopia, results showed that storage, handling, personal hygiene, PPE use by farm workers fell far below the expected standard.

**2.8 Use of Personal Protective Equipment (PPE)**

Use of agrochemicals is frequently accompanied by undesirable effects such as poisoning and chronic health effects for farmers and farm workers during the storage, mixing and application of pesticide products as well as cleaning of pesticide clothing or spraying equipment. Most of the common health effects associated with agrochemical exposure in agriculture have been well documented. Several studies have highlighted headaches, skin and eye problems, salivation, nausea, diarrhoea, respiratory depression, burning sensation, weakness, cough, seizures, and loss of consciousness as some health challenges posed by exposure to agrochemicals. Similarly several chronic effects for example hormone disruption, brain damage, cancer and birth defects were reported among different groups of farmers.

Appropriate exposure reduction measures must be adopted in order to minimize exposure to a level which is as minimal as possible. However studies have shown that correct and consistent use of personal protective equipment can minimize exposure to these agrochemicals (Arcury *et al*, 1999). A large body of knowledge on the appropriate and safe use of agrochemicals has shown that use of personal protective equipment which include, including face mask, gloves, hat, goggles, protective clothing, boots and respirator when working with pesticide is an effective risk-mitigation measure to prevent or reduce pesticide exposure' health problems .

The World Health Organization WHO lists the following items as components of correct PPE for use when handling agrochemicals in agriculture: head protection, face protection, respiratory protection, and protection of the eyes, gloves, protective overalls and protective footwear like gumboots. However regardless of the hazard posed by use of agrochemicals in agriculture, personal protective equipment is rarely used by the farmers. (Arcury *et al*, 1999)

A study in the Gaza strip revealed that despite the awareness of protective equipment advantages, a smaller fraction of the farmers reported consistent and correct use of gloves, goggles, overalls and boots when using pesticide (Yassin & Mourad, 2002). Many studies have investigated the motivators and barriers to use of PPE among different groups of farmers, farm workers and agrochemical operators. Lack of adequate knowledge on the importance of using personal protective wear and on its importance in reducing risk of pesticide exposure was cited as a major hindrance towards correct and consistent use of PPE. Discomfort, and the unavailability of PPE when needed, was also

another barrier to use of PPE by farmers and farm workers. Results from other studies revealed that the majority of farmers were unaware of the type of PPE that should be used when working with agrochemicals.

A study carried out in Zimbabwe on the assessment of health effects posed by exposure due to use of agrochemicals in Midlands Province, results showed that the farm workers were not adequately supplied with the recommended PPE and in instances they were given, it was not enough or inappropriate. Use of face masks a significant risk factor associated with cholinesterase activity among the farm workers. Although some of the farm workers were supplied with face masks, they did not use them as they perceive them as a hindrance to smooth air flow (Mugauzi, *et al* 2011).

In a study to seek understanding and knowledge on factors motivating farmers to use personal protective equipment, Sapbmrer & Thammachai (2020) came up with the following graphical illustration of factors influencing use of PPE.

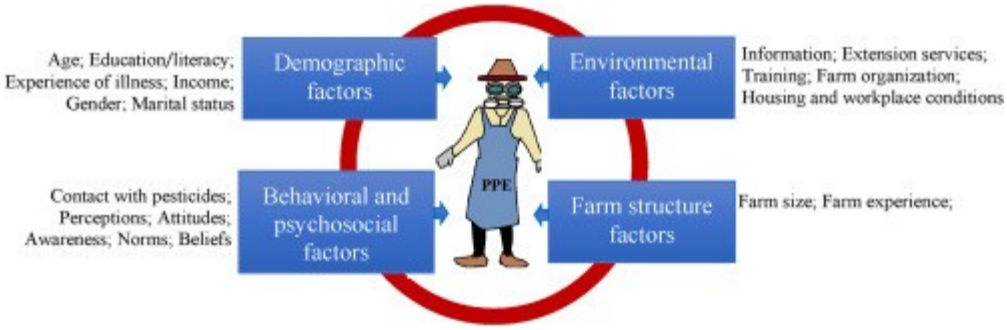


**Figure 1: Graphical abstract on factors influencing use of PPE. Adopted from Sapbmrer *et al*, 2020**

In their review, they also concluded that globally, most basic PPE worn among pesticide handlers was shirts with long sleeves (66%), full trousers (71%), head cover (47%). The lowest basic PPE worn was an apron 8%, goggles 24.3%, gloves 40.5%, boots 21%.

Florencia, Palis, Flor,Warburton & Hossain,( 2006) found out the following perceptions among farmers:

- Agrochemicals are not toxic
- Farmers suffer from ill effects, but they associate these ill effects to other causes rather than agrochemicals.
- Agrochemicals are only toxic under certain conditions.
- Agrochemicals are only toxic to a certain group of people like those who are old and weak.
- Farmers perceive that they have enough precautionary measures in place.
- Agrochemicals are toxic and practicing safety measures will not help

( Adopted from Florencia *et al*, 2006)

The Health Belief Model (Hochbaum & Rosenstock, 1952) predict health-related behaviour in terms of certain belief and perception patterns. It states that people are

likely to take precautionary measures if they perceive the threat of a health risk to be real, or if they feel they are personally likely to be affected**.** This was found to be true in this study by Florencia *et al* (2006) were the above listed perceptions influenced the adoption of a health promoting behaviour that is the use of personal protective equipment.

**2.6Agrochemical application practices**

Agrochemical application includes the treatment of seed by various chemicals such as fungicides, use of chemical methods for weed control, and the spraying of different pest control chemicals in the crop field. Devices and equipment used for these tasks vary as depending on a number of factors such as the size of the farm and the amount of pesticide needed per unit area. (Giles, 2014) Equipment such as boom sprayers which are tractor drawn are used on large scale commercial farms, small scale farmers normally use knapsack sprayers with a spray nozzle for their fields. The type of equipment used for spraying and mixing of the agrochemicals is very important as it can open routes for exposure to the operator. In small scale farming the type of equipment used is mainly determined by the economic status of the farmer that is affordability.

A study carried out in Nepal which assessed the methods used for application of agrochemicals, results showed that most of the farmers used broom (8%), power sprayer (8%), knapsack sprayer (48%) and hand sprayer (35%). The application using a broom showed risky practices that farmers conduct during application with the possibility of huge droplets spilling on them. Also the same broom will be used for domestic purposes such as sweeping of floors inside their homes (Abdollahzadeh *et al,* 2017).

Environmental factors such as wind, rainfall and temperature also play a key role during application of agrochemical. During agrochemical application, the direction of application and movement is deemed to be of great concern as it can lead to direct contact with the agrochemical when spraying. Rainfall during spraying should also be considered as it can lead to washing away of the chemical causing poisoning of the immediate environment. So farmers need to take note of these environmental factors to prevent exposing themselves to the chemicals as well as causing poisoning to nearby environments. However a study carried out in Nepal by Sandesh, Bipana, Rinicha, Bharati, & Alesha (2021) revealed that 71% of the respondents took note of the direction of wind while spraying and 39% of the farmers stated they move against the direction of the wind while spraying. The chi-square test for association showed that application practices were dependent on whether one had received training or not.

**2.7 Storage and Disposal practices of agrochemicals**

Proper storage of pesticides is important in order to protect people, animals, and the pesticide itself. Correct storage is also important in preventing vandalism, theft, or the possible misuse of pesticides. Pesticides should be stored in their original containers which are manufactured to preserve the physical and chemical properties of the agrochemical. Agrochemical containers should be stored containing the manufactures original labelling which includes disposal directions, names of active ingredients, application and mixing directions and first aid information. The original storage container should always have its original cap or seal in place to avoid accidental poisoning of children and pets.

Pesticides must be kept in lockable units or storage room where access is tightly regulated. There must also be free circulation of air and no direct light must be allowed. Some chemical compounds are made of compounds that are sensitive to either heat or ultra violet light. Exposure to these harsh weather environments can result in degradation of the original contents into substances which may be very toxic.

A study carried out in Bangladesh showed that storage practices were largely inadequate, where 94.5% of farmers reported storing pesticides in residential rooms under the bed, on the roof, in the kitchen, in the toilet, and in animal shelters with other items (Sandesh *et al*, 2021). Bass et al (2014) in his study found out that for storage of pesticide, 55.5% of respondents stored within the house, 10% did not consider the place for storage, 10.3% stored in a separate inventory, and 24.2% stored in the respective store made for storing chemicals and fertilizers. However storing of agrochemicals in houses can be risky as chemicals can volatilize and travel through air and storing of the chemicals in the home can make the inhabitants vulnerable to poising through inhalation and food contamination. However this is of concern given that inhalation is one of the principal routes that chemicals enter the body. Proper agrochemical waste disposal is a critical component of responsible pesticide use. Improper disposal often results in contamination of groundwater, soil and surface water. Agrochemical waste include empty containers, mixed residue, pure left over chemical, water used for cleaning and other materials used for example for mixing. Improper discarding of these residues has proven to be detrimental to both human health and the environment (Imoro & Larbi, 2019). Ozkan & Heimlich, (2008) highlighted that residue that leaks from discarded

unrinsed containers can caused a significant level of environmental contamination. They stated that about three ounces of pesticide residue is normally left out from a 5 litre gallon of chemical after normal use.

If not much attention is paid to disposal of these pesticide containers, all the residues will find its way into the environment. These chemicals can be washed into rivers, dams and wells through runoff thus contaminating drinking water sources for humans and animals. A study conducted on management of empty pesticide container found out that 94% of agrochemical empty containers were disposed of in sensitive places. In developed countries like Australia and France, they follow up collecting empty pesticide containers. In 2003, they managed to collect managed to collect 40% and 25% respectively of the total number of empty containers that were generated in the year 2003. However this is a completely different scenario when it comes to developing countries where they are no systems to do a follow up collecting empty pesticide containers for proper disposal. Rather reports of reuse of these containers have been reported in several countries in the low to medium income countries. (Huici & Skvgaard, 2007). Huici *et al* (2007) also found out that 10% of the empty pesticide containers were being used to store food and water.

In some provinces of Ethiopia, 77% of the farmers repurposed the agrochemical containers for various household uses. The study also found a significant association between literacy and reuse of pesticides empty bottles. Lack of knowledge on the real danger that they subject themselves to by reuse of these empty containers is minimal.

Sandesh *et al*, 2014 recommended adoption of a robust management plan to that will ensure immediate decontamination after the use. Education by means of training workshop on the danger or careless disposal of agrochemical empty containers was also.

**2.8 Personal hygiene in agrochemical use**

Personal hygiene helps to maintain a clean body by making sure that anything harmful does not remain on the body long enough to be absorbed through the skin. Personal hygiene plays an important role in ensuring safety after handling of agrochemicals. It is crucial to prevent ingestion or inhalation of even minute quantities of agrochemicals. Basic hygiene practices when using agrochemicals requires one to thoroughly wash exposed body parts of the body after every work session.

Clothing used for spraying of agrochemicals must be immediately removed and washed after every single use (ILO, 2016).Personal hygiene measures like changing clothes, showering, washing hands and washing work clothes separately from the rest of the family laundry immediately after work have been also highlighted as effective and important in prevention of secondary poisoning after agrochemical application. However these practices are rarely applied consistently and in many instances they are frequently neglected leading to poisoning.

A number of studies have concluded detecting significant levels of agrochemical residues on farm workers' clothes, boots and on other equipment that had been used. This suggested a possible avenue for household contamination due to these poor hygiene measures. Farmers and farm workers who adhered to proper personal hygiene measures, particularly after spraying were shown to have higher levels of knowledge. However,

there was no significant association with practices involving use of personal protective clothing. (Ngowi, Mbise,& Ijani, 2007)

## 2.9 Chapter Summary

This chapter reviewed the theoretical and empirical literature that related to the topic. The chapter started by describing the theoretical framework on factors that had been found to be associated with agrochemical poisoning among small scale tobacco farmers. Literature from various sources which provided an overview on the subject matter was analyzed. The following chapter presents an outline of the study methodology.

# CHAPTER 3: METHODOLOGY

## 3.1 Introduction

This chapter presents the methodology on how data was gathered going in order to answer the set objectives and research questions. It presents the step by step guide from the selection of the study area, sampling procedure and how the sample size was calculated. All the methods that were used to collect data were also explained. This chapter also details how the collected data was going to be managed and analyzed and presented.

## 3.2 Research design

An Analytical Cross-sectional Study was found to be most appropriate for this study. This was so because it allows determining if an exposure has an association with an outcome (i.e., disease or condition of interest).

### 3.3 Study Area and population

**Figure 2: Map of Zvimba District, Zimbabwe**


Zvimba District falls under agro-ecological zone two which makes it favourable for farming activities. Major crops that are grown include tobacco, maize and cotton. This district was found to be appropriate for this study because of a significant report in incidence of poisoning as well as having a very high number of registered tobacco growers.

### 3.4 Sampling

A total of three wards were randomly selected. Participants were selected using the Tobacco Industry and Marketing Board grower registers and also various contracting companies register. Three wards were conveniently selected. The wards with the highest number of registered growers were picked into the study. Each ward was then treated as a cluster. The researcher used Systematic random sampling where to choose participants within each cluster. Systematic random sampling refers to a probability sampling method where the researcher selects subjects from a target population by choosing a random starting point and selects sample members after a fixed 'sampling interval'. Sampling interval was calculated by dividing the population size (that is the number of registered farmers per ward) by the desired sample size per ward which was almost 30.

### 3.5 Sample Size

The sample size for this study was calculated using the Dobson formula with 5% margin of error and 95% confidence interval. The minimum calculated sample size was 91.

### 3.6Data Collection tools

#### 3.6.1 Questionnaires

Data was collected using structured questionnaires. Questionnaires were used to collect data based on the following parameters: knowledge, attitude and practices on the following factors: spraying parameters, storage and disposal, health issues, toxicity of pesticides, first aids, level of education and pesticides marketing. Data was captured manually. The data was then was then entered to Excel for cleaning and management. For analysis, the data was then imported to STATA 16 for Windows.

### 3.7 Pretesting of instruments

Pretesting of the data collection instruments was done a week prior to the actual data collection. This was done to assess the appropriateness and validation of the data collection tool. It was also carried out to ensure that those involved with data collection get to familiarize with the tool in order to avoid any hiccups that may occur due to lack of familiarity with the data collection tool during the actual study.

### 3.8 Data Collection Procedure

The researcher was accompanied by the Agritex officer and two field officers from two contracting companies. The team moved as a team from one farmer to the other in the three wards doing one ward at a time. After introducing ourselves and our study, the participant was asked if he/she had understood well the scope of the study before giving written consent. After giving consent, the team proceeded to administer the questionnaire by means of a face to face interview. Each participant was allocated a code which was in form of a unique number. During the data collection, all COVID-19 protocols such as wearing of face masks and hand sanitization were observed.

### 3.9 Statistical Analysis and organization of data

Firstly, data collection was performed on paper questionnaires before being transferred to Microsoft excel (2016) for its management. During data cleaning, all variables were assessed for consistencies and inadequacy of responses. All missing variables were referred to the paper questionnaires. However, if found missing, the researcher assumed

data was missing at random and performed complete case analysis. All data analysis was be performed using STATA 16 for Windows.

Continuous variables like participant age were first assessed for normality using histograms and the Shapiro Wilk test and presented as means (standard deviation). Nonetheless, if skewed, quantitative variables were presented as medians (interquartile range). Also, all categorical variables like marital status was presented as frequencies and percentages.

To further determine the effect of socio-demographic and past experiences on the knowledge of agrochemicals and handling, we first scored ten questions depending on participant responses. The questions were on: (1) symptoms of poisoning (2) action taken after a suspected poisoning (3) ability to read the pesticide label (4) knowledge of pesticide handling (5) information to look at the label (6) how to interpret the pesticide dosage from the label (7) wearing of personal protective equipment (PPE) (8) how to treat personal clothes after using pesticides (9) knowledge of pesticides storage (10) cleaning of one-self after using pesticides.

We further classified the total scores to represent poor (<5) knowledge of agrochemicals, handling and safety. Univariate logistic regression was performed to determine socio-demographic, agro-experience factors associated with poor knowledge, reporting odds ratios and the 95% confidence interval. All factors with $p<0.25$ were considered in a multivariate model reporting adjusted odds ratios and their respective 95% confidence interval.

### 3.10 Ethical Considerations

Ethical approval to conduct this study was sought from Africa University Research Ethics Committee (AUREC). After granted permission from AUREC, authority was also sought to conduct this study from the following

- Village Heads
- Ward Councilors
- Agritex Officers
- TIMB District Officer

#### 3.10.1 Informed Consent

Written informed consent was sought from the participants before proceeding with the study. The researcher will read out the contents of the consent to the participant. The participants were given the chance to ask any questions and seek clarity on issues of concern. After giving all the details, the researcher will ask for permission to either proceed or terminate the interview. Once the participant agrees to continue, the researcher gave the participant an informed consent form to sign.After signing, the researcher will proceeded to administer the questionnaire. Participation in the study will be strictly on a voluntary basis

### 3.11 Chapter Summary

This chapter gave an outline and justification of methods that were followed to get to the results. An Analytical Cross Sectional design was found appropriate for the study. Sample size was calculated using Dobson's formula. It detailed the data collection

procedure and analytical methods that were followed. The next chapter presents the findings from this study.

## CHAPTER 4: Data Analysis and Presentation

### 4.1 Introduction

After being filtered coded and themed the data was ready for presentation. Chapter four of the research is intended to give answers on the research questions and illustrate the achievement of the objectives of the research. The findings on the initial research contacted on the study of Agrochemical poisoning among small scale tobacco growers in Zvimba District, Mashonaland West, Zimbabwe were presented below inform of tables, charts and graphs among other methods. The diagrammatical presentation of the findings was accompanied with a narration on the findings to give a clearer understanding on the results.

The previous chapter explained the methodology used for data analysis. For quantitative data the STATA version 16 software and Microsoft Excel were used to code and analyse the quantitative data extracted from the research. Theming pf qualitative data was done with the aim of providing a clearer understanding of the findings. As earlier of posited, methods such as charts, graphs and tables where used to present quantitative data gathered from the research questionnaires. Pseudonyms names were used to protect the identity of the respondents during the qualitative data presentations.

### 4.2 Study Response Rate

The research was conducted in Zvimba Rural District, Zimbabwe targeting 91 respondents all within Zvimba District. The targeted population were those farmers growing Tobacco. Out of the 91 targeted respondent 84 turned out for the study as shown on the pie chart (Fig 4.1) below, hence the response rate was 92 % as shown on

the pie. This however represents a high degree of effort from the respondents. In this case the 92 % response rate made the research reliable. Only 8 % of the targeted population did not turn up.

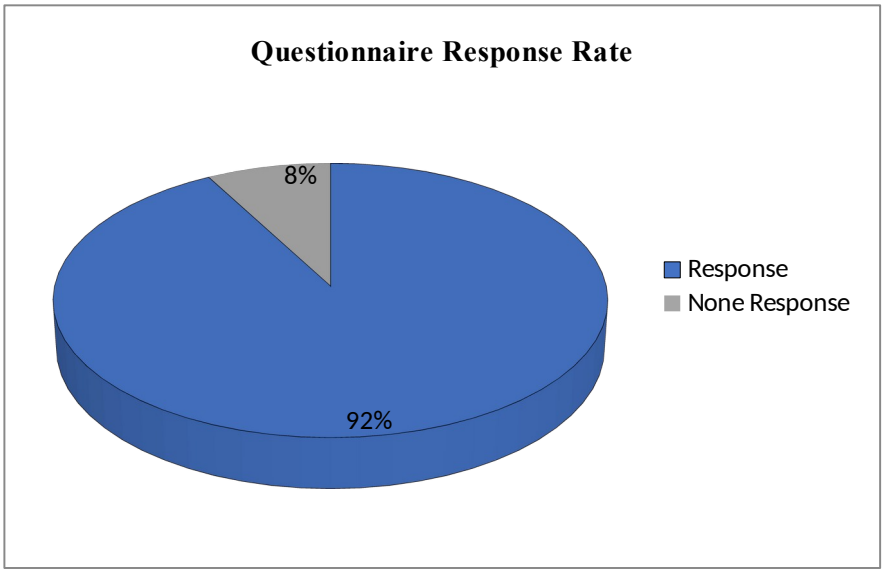


**Figure 3: Study Response Rate**

### 4.3 Respondents Demographic characteristics

The respondent's demography is a very significant part of the study it provide the researcher with a better understanding of the respondents profile thus their age, marital status, level of education as well as their experience with the use of agrochemicals. Bryman, (2012) indicated that the respondents profile provide the researcher with very significant information for the reliability of the survey.

**Table 4: Respondents Demography Information.**

| Category | Frequency | Percentage | Valid % | Cumulative % |
|---|---|---|---|---|
| **Gender** | | | | |
| Males | 72 | 85.7 | 86 | 86 |
| Females | 12 | 14.3 | 14 | 100 |
| Age | mean=37 | | | |
| Marital Status | | | | |
| Single | 13 | 15.4 | 15 | 15 |
| Married | 46 | 54.7 | 55 | 70 |
| Divorced | 11 | 13.0 | 13 | 83 |
| Co-Habiting | 5 | 5.9 | 6 | 89 |
| Widowed | 9 | 10.7 | 11 | 100 |
| **Age** | | | | |
| 20-29 | 17 | 20.2 | 20 | 20 |
| 30-39 | 34 | 40.6 | 41 | 61 |
| 40-49 | 22 | 26.1 | 26 | 87 |
| 50-59 | 7 | 8.3 | 8 | 95 |
| 60+ | 4 | 4.7 | 5 | 100 |
| **Highest Level of Education Attained** | | | | |
| None | 0 | 0 | 0 | 0 |
| Primary | 7 | 8.3 | 8 | 8 |
| O'Level | 59 | 70.2 | 70 | 78 |
| A'Level | 13 | 15.5 | 16 | 94 |
| Tertiary | 5 | 5.9 | 6 | 100 |
| **How Big is the area that you grow tobacco?** | | | | |
| -1 acre | 9 | 10.7 | 11 | 11 |
| 2 acres | 20 | 23.8 | 24 | 35 |
| 1 hector | 24 | 28.5 | 29 | 64 |
| 1 hector Plus | 31 | 36.4 | 36 | 100 |

As indicated on the upper most part of table 4.1 above the majority of the respondents were males covering 86 % of the total respondents thus females covered only 14% of the respondents. This suggest that the agricultural industry particularly in the tobacco farming sector is mostly dominated by males. Atkinson and Flint (2001) indicated that farming is a masculine economic active that is mostly dominated by males as it involves hard labour.

The second section of the table illustrate on the marital status of the respondents. As presented, the majority of the respondents were married covering 55% of the respondents. 15% of the respondents where single while 13% where divorced. 10 % of the respondents were widowed with the least percentage covering 6 % of the respondents were co-habiting. The marital status of the respondents was vital for the study as it suggested the number of respondent who could share farm duties.

On the third section of the table are results on the respondents' age. The table shows that 40% covering the greater part of the respondents were between 30-39 years of age while 26% were between 40-49 years. Between2 0-29, 50-59 and 60+ were covering 17%, 8% and 5% respectively. This clearly shows that tobacco farming in Zvimba Rural District council is mostly done by the economically active ag which as stated by Chiwandamira (2000) that in Zimbabwe the most economically active age is between 30 and 50 years of age.

The table also provided on the level of education attained by the respondents, in this case the majority of the respondents reached Ordinary Level and this group of respondents covered 70%. 16% of the respondents had an Advanced Level certificate while 6 % had reached higher education. None of the respondents indicated that they had never been to school while 8% had dropped school at primary level. This indicates that tobacco farming in Zvimba District is done by people who are literate thus they are able to read and interpret agro chemical labels, simples and instructions.

On the last part of the table 4.1 are results pertinent to the hector age used by each individual respondent. The researcher found out that the greater number of respondents were practicing tobacco farming on a hector plus size of land. As shown on the table 29% and 36% where farming tobacco on a hector and a hector plus size of land respectively. 24% of the respondents where using 2 acres while 11% used 1 acre.

### 4.4 Agrochemicals used by toxicity

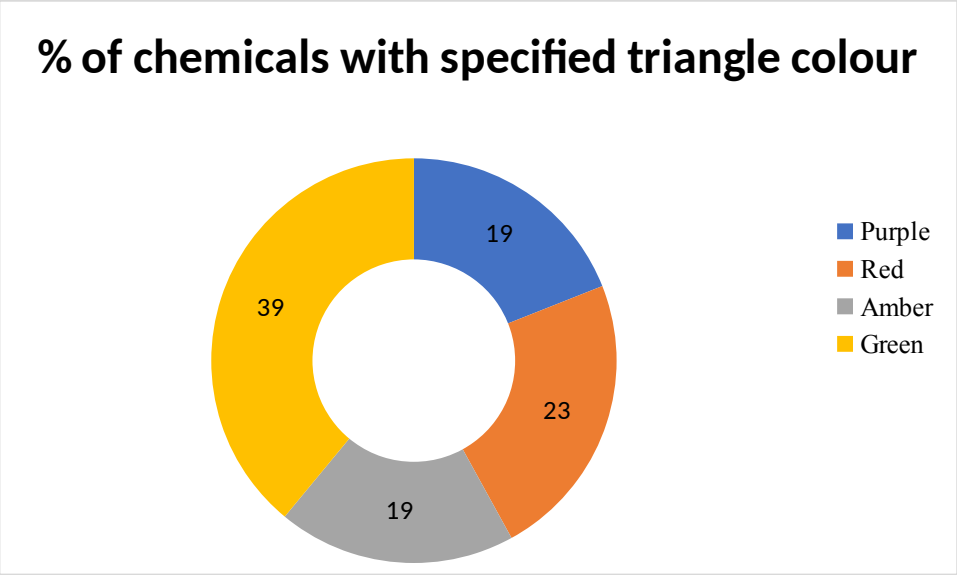


**Figure 4 Agrochemicals Used by toxicity**

The figure 4 shows the toxicity of various chemicals that the tobacco farmers reported using. 39% of the agrochemicals used had green triangle meaning low toxicity, 19% used the ones with caution that is Amber/Yellow triangles. However 19% and 23% of the list of chemicals that the farmers used had purple and red triangles respectively. This shows that the farmers are exposed toxic chemicals during tobacco production.

### 4.5 Agrochemical Application Practices

**Table 5: Agrochemical application practices by farmers.**

| | Total (n=84) | Males (n=72) | Female(n=12) |
|---|---|---|---|
| Spraying/application equipment used | | | |
| Knapsack sprayer | 69(82) | 62(86) | 7(58) |
| Spray bottle with nozzle | 5(6) | 3(4) | 2(17) |
| Sweeping broom | 10(12) | 7(7) | 3(25) |
| Period taken before re-entering field after chemical spraying | | | |
| Immediately after spraying | 47(60) | 43(60) | 4(33) |
| Wait for some time | 25(25) | 16(22) | 5(42) |
| The following day | 16(19) | 13(18) | 3(25) |
| Environmental factors that you consider before and during application | | | |
| Wind speed and wind direction | 39(46) | | |
| Rainfall | 77(92) | | |
| Temperature | 54 (64) | | |

On agrochemical application practices, majority of farmers 69(82) reported that they use knapsack sprayers for applying pesticides on their crops whereas 12% highlighted that they still use sweeping brooms to apply chemicals. 60% of the respondents agreed that they immediately re-enter the fields after spraying to continue doing other work like weeding and pruning. On environmental factors that influence application of agrochemicals, the majority (77%) stated that they mainly consider rainfall as it has potential to wipe away all the chemical before it works. 54% of the respondents also figured out temperature as another environmental factor that they take into account. The least (39%) of the respondents cited wind speed and direction.

### 4.6 Section B: Knowledge of Agrochemicals.

This section cover the results extracted from the respondents pertinent to their knowledge on Agrochemicals. When asked for how long they have been growing tobacco the respondents gave a wide range of answers though the majority were ranging between 5 and 15 years. Some indicated that they have been growing tobacco for a year only. Thus suggesting that, most farmers started focusing of tobacco farming a few years after the land reform program.

When asked on the number of people who work on their fields on full time basis per tobacco season. No of the respondents stated a number that is above 5. All 84 for 3 who stated that they need more that 70 worker including permanent workers, respondents stated 5and below. This indicated that tobacco farming in Zvimba is done at a small scale. However, the 3.5% indicate that they are a few big commercial farms where tobacco farming is done at a large scale.

**Table 6: Labour forms and experience working with agrochemicals by sex**

| | Total (n=84) | Males (n=72) | Females (n=12) |
|---|---|---|---|
| Type of labour, n (%) | | | |
| Own | 42(50.0) | 32(44.4) | 10(83.3) |
| Paid | 24(28.6) | 24(33.3) | 0 |
| Casual | 11(13.1) | 10(13.9) | 1(8.3) |
| Mixed forms | 7(8.3) | 6(8.3) | 1(8.3) |
| Use of pesticides, n (%) | | | |
| Yes | 84(100) | 72(100) | 12(100) |
| No | 0 | 0 | 0 |
| Usage frequency of pesticides | | | |
| Always | 61(72.6) | 52(72.2) | 9(75) |
| Sometimes | 23(27.4) | 20(27.8) | 3(25.0) |
| Rarely | 0 | 0 | 0 |
| Sources of pesticides | | | |
| Contract schemes | 46(54.8) | 40(55.6) | 6(50) |
| Retailer | 14(16.7) | 12(16.7) | 2(16.7) |
| Government | 13(15.5) | 10(13.9) | 3(25.0) |
| Relatives | 8(9.5) | 8(11.1) | 0 |
| Informal vender | 3(3.6) | 2(2.8) | 1(8.3) |
| Source of pesticide recommendation | | | |
| Self | 31(36.9) | 27(37.5) | 4(33.3) |
| Other farmers | 29(34.5) | 26(36.1) | 3(25.0) |
| Retailer | 18(21.4) | 14(19.4) | 4(33.3) |
| Agriculture officer | 6(7.1) | 5(6.9) | 1(8.3) |

Table 6 presents labour forms and experiences from the participants. Firstly, we report out on the type of labour used by small scale tobacco growers in Zvimba District. The majority of the respondents indicated that they use their own labour thus covering 50% of the respondents as shown. On the other hand, 29 % of the respondents indicated that

they use paid labour during the farming season while 13% used casual workers. Only 8% of the respondents indicated that they use all the mentioned types of labour. The distribution of the type of labour used was different with more women likely to report own labour (n=10; 83.3%) as compared to men (n=42; 50%). 100% of the respondents indicated that they use pesticide to control pests and improve leaf quality.

Moreover, the research asked the respondents on how often they use chemicals to control pesticides. The greater number of the respondents (72.6%) indicated that they always use pesticides, while 27.4%% indicated that they sometimes use pesticides. The frequency of usage was similar in both male and female farmers. Respondents highlighted that 54.8% get pesticides from contract schemes while just fewer than 17% receive theirs from retail outlets. Likewise, a further 13 (15.5%) and 8 (9.5%) of the participants obtained their pesticides from the government and relatives respectively, while only 3 received their pesticides from informal vendors.

Most of the respondents (n=31; 36.9%) indicated that they were self-motivated through research to buy specific pesticides. This was followed by other farmers (n=29; 34.5%) and retailers (n=18; 21.4%). However, the agricultural officers only recommended to 7.1% of the participants and this similar in both men and women. Nonetheless, more women visited retailers (33%) to get recommendations as compared to men (19%).

## 4.7 Training and handling of pesticides

### Table 7: Training and handling of pesticides

| | Total (n=84) | Males (n=72) | Females (n=12) |
|---|---|---|---|
| Received any training in the last 2 years | | | |
| Yes | 23(27.4) | 16(22.2) | 7(58.3) |
| No | 61(72.6) | 56(77.8) | 5(41.7) |
| Training providers | | | |
| Agriculture officers | 59(70.2) | 56(77.8) | 3(25.0) |
| NGO | 13(15.5) | 5(6.9) | 8(66.7) |
| Private | 12(14.3) | 11(15.3) | 1(8.3) |
| Frequency of training | | | |
| Every season | 31(36.9) | 29(40.3) | 2(16.7) |
| Once in two years | 26(31.0) | 23(31.9) | 3(25.0) |
| Once in three years | 15(17.9) | 12(16.7) | 3(25.0) |
| Every four to five years | 12(14.3) | 8(11.1) | 4(33.3) |
| Knowledge of pesticide poisoning | | | |
| Yes | 63(75.0) | 56(77.8) | 7(58.3) |
| No | 21(25.0) | 16(22.2) | 5(41.7) |
| Knowledge of action to take after poisoning | | | |
| Yes | 59(70.2) | 51(70.8) | 8(66.7) |
| No | 25(29.8) | 21(29.2) | 4(33.3) |
| Action to take after poisoning | | | |
| Rush to hospital | 42(50.0) | 36(50.0) | 6(50.0) |
| Drink milk | 16(19.1) | 14(19.4) | 2(16.7) |
| Recover at home | 9(10.7) | 8(11.1) | 1(8.3) |
| Provide first aid | 17(20.2) | 14(19.4) | 3(25.0) |
| Read pesticide | | | |
| Yes | 79(94.1) | 70(97.2) | 9(75.0) |
| No | 5(5.9) | 2(2.8) | 3(25.0) |
| Frequency of reading a pesticide | | | |
| Once on first day of using/buying | 56(66.7) | 47(66.2) | 9(69.2) |
| Every time I use the pesticide | 28(33.3) | 24(33.8) | 4(30.8) |
| Accurate identification of all colors found of the pesticide label | | | |
| Yes | 62(73.8) | 57(79.2) | 5(41.7) |
| No | 22(26.2) | 15(20.8) | 7(58.3) |
| Reasons for not reading the label | | | |
| Language barrier | 13(16) | 11(15.3) | 2(16.7) |
| No need to read each time | 51(61) | 45(62.5) | 6(50.0) |
| Poor understanding | 20(23.8) | 16(22.2) | 4(33.3) |

The results presented above in table 4.3 illustrate that the greater number of tobacco farmers have not received training on the use of pesticides in the previous 2 years. Specifically, 72% (n=61) of the respondents indicated that they have not received training on use of pesticides while 13% responded positively and this was more identified in males (n=68; 94.4%) as compared to females (n=5; 41.7%). Notably, the majority of respondents mentioned that training in the past two-years was provided by agriculture officers (n=59; 70.2%).Also, 15.5% and 14.3% of all trainings were provided by NGOs and private companies respectively. More women were trained by NGOs, whilst agricultural officers were preferred by more men.

Overall, three quarters of the participants reported that they have knowledge of pesticide poisoning though relatively fewer women (n=7; 58.3) were confident as compared to men (n=56; 77.8%). However, when asked about the action to take after a possible poisoning, five percent less were sure of the action (n=59; 70.2%). More specifically, half of the farmers highlighted they would rush to the hospital, while 20% each mentioned providing first aid and drinking milk. Of note, almost 10% of the participants indicated they would take the patient home until recovered. With regards to the ability to read agrochemical labels, 94.1 % of the respondents were positive on the notion and this was more reported among men (n=70; 94.2) compared to women (n=9; 75%). As illustrated, most of the respondents (n=56; 66.7%) indicated that they read the label once on the first day of using the pesticide while 33.3% indicated that they read every time they use a pesticide. This was comparable between male female participants. Furthermore, 73.8% (n=62) of the respondents were able to accurately identify colours

found on the triangle of the pesticide container. In comparison, less women (n=5; 41.7%) were able to pick and explain the meaning of colours as compared to men (n=5; 41.7). Specifically, the majority of the participants mentioned that there is no need to read the instructions each time (n=51; 61%), while language barrier and poor technical understanding affected 16% and 23.8% respectively.

### 4.8 Section C: Safety, storage and disposal practices

**Table 8: Safety, storage and disposal practices**

| | Total (n=84) | Males (n=72) | Females (n=12) |
|---|---|---|---|
| **Source of PPE** | | | |
| Contractors | 74(88.1) | 66(91.7) | 8(66.7) |
| Retailers | 10(11.9) | 6(8.3) | 4(33.3) |
| **Re-use of PPE** | | | |
| Yes | 71(84.5) | 62(86.1) | 9(75.0) |
| No | 13(15.5) | 10(13.9) | 3(25.0) |
| **Frequency of PPE re-use times** | | | |
| Once | 14(16.7) | 6(8.3) | 4(33.3) |
| At least twice | 70(83.3) | 66(91.7) | 8(66.7) |
| **Availability of dedicated PPE** | | | |
| Yes | 12(14.2) | 11(15.3) | 3(25.0) |
| No | 72(85.7) | 61(84.7) | 9(75.0) |
| **Change clothes immediately after spraying** | | | |
| Yes | | | |
| No | 8(9.5) | 2(2.8) | 6(50) |
| | 76(90.5) | 70(97.2) | 6(50) |
| **Hygienic practices after spraying** | | | |
| Wash hands | 74(88.1) | 66(91.7) | 8(66.7) |
| Take a bath | 7(8.3) | 4(5.6) | 3(25.0) |
| Wash the face | 3(3.6) | 2(2.8) | 1(8.3) |
| **Availability of lockable storerooms for chemicals** | | | |
| Yes | 78(92.7) | 67(95.7) | 9(75.0) |
| No | 6(7.3) | 3(4.3) | 3(25.0) |
| **Dispose left over chemicals** | | | |
| Yes | 66(78.6) | 61(84.7) | 5(41.7) |
| No | 18(21.4) | 11(15.3) | 7(58.3) |
| **Place of chemical disposition** | | | |
| Blair toilet | 31(47.0) | 28(45.9) | 3(60.0) |
| Open pits | 15(22.7) | 14(23.0) | 1(20.0) |
| Covered pits | 20(30.3) | 19(31.2) | 1(20.0) |

As shown on the table the majority of the respondents (n=74; 88.1%) indicated that they buy their protective cloth from contractors while 12% (n=10) of the respondents indicated that they buy theirs from retailers. More women participants (n=4; 33.3%)

accessed their PPEs from retailers as compared to men (n=6; 8.3%). Furthermore, the majority of the participants (n=71; 84.5%) highlighted they re-use their PPE.

Most participants n70(83.3) indicated re-using PPE at least twice once while a considerable number (n=14; 16.7%) indicated the frequency of PPE re-use was at least twice. 12% of the respondents agreed that they have PPE dedicated for spraying only. However, only 9.5% of the respondents admitted to changing of clothes immediately after spraying or mixing agrochemicals. Notably more women highlighted that after spraying, they take a bath (n=3; 25%) compared to men (n=4; 5.6%).

With respect to storage facilities, 92.7% of the respondents indicated they have available lockable rooms to store agrochemicals, while 78.6% mentioned that they dispose their chemicals. However, women were less likely to dispose (n=7; 58.3%) left-over chemicals compared to men (n=11; 15.3%). Overall chemical disposition was done in Blair toilets (n=31; 47%), covered pits (n=20; 30.3%) and open pits (n=15; 22.7%).Nonetheless, how the chemicals were disposed was also similar in both male and female participants.

### 4.8 Use of PPE by farmers

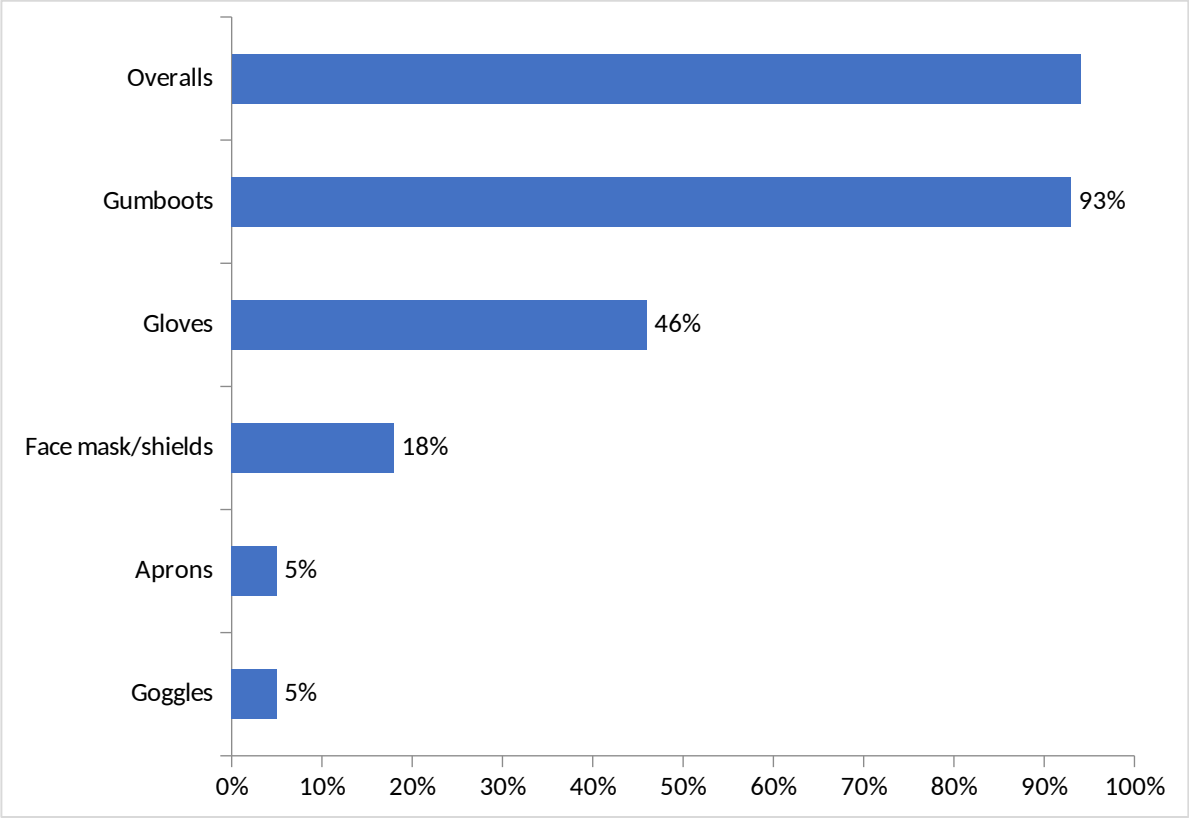


**Figure 5: Types of PPE used by farmers.**

The above figure shows the usage of protective clothing among tobacco farmers in Zvimba. In summary, 92.5% of the total respondents indicated that they wear gumboots while 94.3 % preferred overalls. Furthermore, 4.9 % of the respondents mentioned using aprons when using agro-chemicals. Likewise, 46.4 % and 18.2% of the respondents highlighted use of gloves and masks respectively. However, only 5.02% of the respondents ticked googles.

## 4.9 Hygiene and safety practices by farmers after handling and spraying agrochemicals

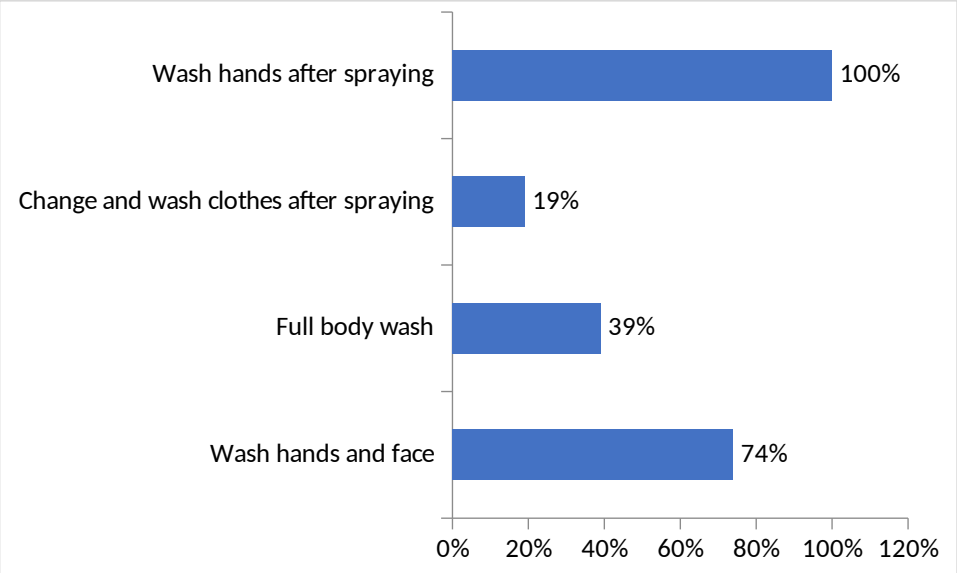

**Figure 6: Hygiene and safety practices by farmers after handling agrochemicals**

Poor hygiene is another factor that can result in unintentional poisoning. All the respondents agreed that they immediately wash their hands after mixing or applying the agrochemicals. 74% stated that they wash their hands and face after applying agrochemicals in order to get rid of chemical residue on their hands and face. 39% said that they take a full body wash after applying chemicals. The least, 19% highlighted that they change the attire that had been worn during application and wash it.

### 4.10 Barriers to use of PPE

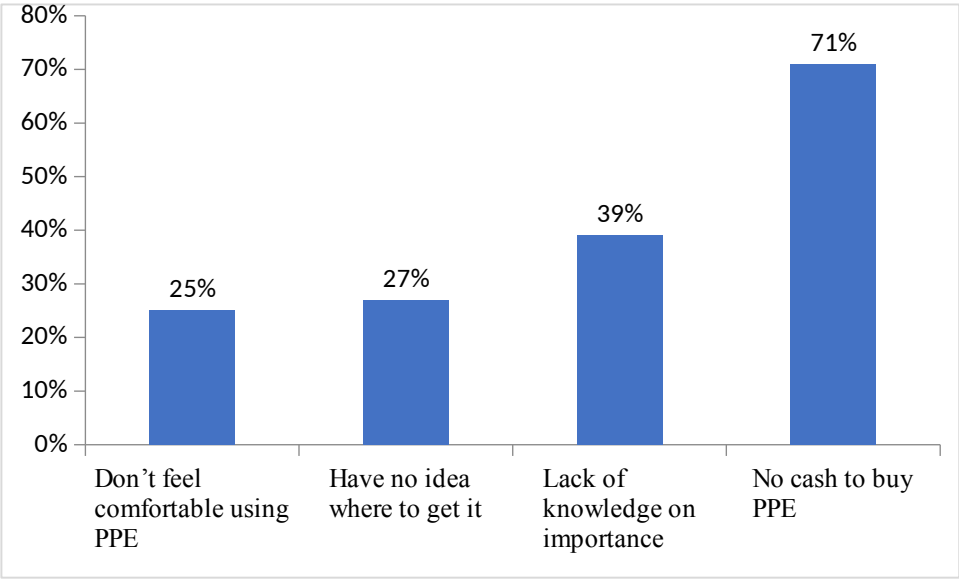


Figure 6: Barriers to use of PPE

**Table 9: Univariate analysis for demographic other factors associated with knowledge of agrochemicals, safety and handling**

| | Total (n=84) | Knowledge of agrochemicals, safety and handling | | | |
|---|---|---|---|---|---|
| | | Poor-score (n=54) | Positive score (n=30) | Odds ratio [95% CI] | p-value |
| **Demographics** | | | | | |
| **Sex** | | | | | |
| Male | 72(85.7) | 47(87.0) | 25(83.3) | Ref | |
| Female | 12(14.3) | 7(13.0) | 5(16.7) | 1.3[0.91, 1.73] | 0.134 |
| **Age** | | | | | |
| 20-29 | 17(20.2) | 11(20.4) | 6(20) | Ref | |
| 30-39 | 34(40.5) | 25(46.3) | 9(30) | 0.[0.51, 1.03] | 0.235 |
| 40-49 | 22(26.2) | 11(20.4) | 11(36.7) | 0.54[0.42, 0.72] | 0.039 |
| 50-59 | 7(8.3) | 4(7.4) | 3(10) | 1.38[0.88, 1.53] | 0.078 |
| 60+ | 4(4.8) | 3(5.6) | 1(3.3) | 0.61[0.11, 5.78] | 0.459 |
| **Marital status** | | | | | |
| Single | 13(24.1) | 9(16.7) | 4(13.3) | Ref | |
| Married/co-habiting | 51(60.7) | 34(63.0) | 17(56.7) | 1.125[0.91, 1.62] | 0.073 |
| Divorced/Widowed | 20(23.8) | 11(20.4) | 9(30) | 1.84[1.17, 2.41] | 0.021 |
| **Highest level of education** | | | | | |
| Primary | 7(8.3) | 4(7.4) | 3(10) | Ref | |
| O level | 59(70.2) | 39(72.2) | 20(66.7) | 0.68[0.43, 0.94] | 0.011 |
| A level | 13(15.5) | 7(13.0) | 6(20) | 1.14[0.12, 1.31] | 0.067 |
| Tertiary | 5(6.0) | 4(7.4) | 1(3.3) | 0.33[0.01, 0.87] | <0.001 |
| **Average monthly income** | | | | | |
| ≤150 | 43(51.2) | 29(53.7) | 14(46.7) | Ref | |
| 151-300 | 17(20.2) | 12(22.2) | 5(16.7) | 0.86[0.02, 0.97] | 0.031 |
| 301-450 | 10(11.9) | 5(9.3) | 5(16.7) | 2.07[0.97, 3.19] | 0.324 |
| >450 | 14(16.7) | 8(14.8) | 6(20) | 1.55[0.87, 1.96] | 0.561 |
| **Alcohol use** | 37(44.0) | 27(50) | 10(33.3) | 2.0[1.54, 3.12] | 0.045 |
| **Smoking** | 17(20.2) | 11(20.3) | 6(20.0) | 1.02[0.73, 1.67] | 0.092 |
| **Agricultural related factors** | | | | | |
| Size of agricultural area | | | | | |
| 1 acre | 9(10.7) | 6(11.1) | 3(10) | Ref | |
| 2 acres | 20(23.8) | 16(29.6) | 4(13.3) | 0.16[0.02, 1.14] | 0.981 |
| 1 hector | 24(28.6) | 18(33.3) | 6(20.0) | 0.67[0.34, 1.12] | 0.671 |
| >1 hector | 31(36.9) | 24(44.4) | 17(56.7) | 1 | - |
| **Usage of pesticide** | 72(85.7) | 44(77.8) | 28(93.3) | 0.31[0.07, 0.66] | <0.001 |
| Number of years using pesticides | | | | | |
| ≥10 years | 45(53.6) | 34(63.0) | 11(36.7) | Ref | |
| <10 years | 39(46.4) | 20(37.0) | 19(63.3) | 2.94[1.71, 3.41] | 0.022 |
| Trained in the last two years | 12(14.3) | 7(13.0) | 5(16.7) | 0.74[0.11, 1.19] | 0.122 |

### 4.11 Univariate analysis

We evaluated the factors associated with knowledge, safety and handling of agrochemicals using univariate logistic regression. Of note, participants aged 40-49 years were 46% likely to have a positive score (≥5) with regards to knowledge, safety and handling of agrochemicals as compared to the youngest age group (20-29 years). Also, participants who were divorced/widowed were OR=1.8 [95% CI: 1.17, 2.41] times more likely to score poorly as compared to who were single. However, attaining a higher education status was protective of scoring a low mark with respect with knowledge, safety and handling of agrochemicals. Specifically, respondents with O level or tertiary education were 32% and 67% less likely to have poor knowledge as compared to those who only attained primary education respectively.

Likewise, participants who have a higher income were protected from low scores of knowledge, safety and handling of agrochemicals. Notably, having an average monthly income between 150-300 dollars was 14% (OR=0.9; 95% CI: 0.02, 0.97) less likely to have low marks as compared to those who earned at most 150 dollars. Participants who reported use of alcohol were twice likely to score poorly with an estimated OR=2.0(95% CI: 1.54, 3.12).

We also evaluated if current use of pesticides was associated with knowledge, safety and handling of agrochemicals. We report, participants who indicated current usage of pesticides were almost 70% less likely to have low knowledge with regards to agrochemicals, with an OR=0.3(95% CI: 0.07, 0.66) than those who were not using

pesticides. Nonetheless, those who highlighted usage of agrochemicals for less than 10 years were 2.9(95% CI: 1.71, 3.41) times more likely to report low score on knowledge, safety and handling of agrochemicals more than those who had higher number of years.

### 4.12 Multivariate analysis

**Table 10: Multivariate analysis for demographic and other factors associated with knowledge of agrochemicals, safety and handling**

| | Total (n=84) | Knowledge of agrochemicals, safety and handling | | | |
|---|---|---|---|---|---|
| | | Poor-score (n=54) | Positivescore (n=30) | Adjusted odds ratio [95% CI] | p-value |
| **Demographics** | | | | | |
| Age | | | | | |
| 20-29 | 17(20.2) | 11(20.4) | 6(20) | Ref | |
| 30-39 | 34(40.5) | 25(46.3) | 9(30) | 0.53[0.43, 1.73] | 0.379 |
| 40-49 | 22(26.2) | 11(20.4) | 11(36.7) | 0.84[0.62, 1.21] | 0.072 |
| 50-59 | 7(8.3) | 4(7.4) | 3(10) | 1.38[0.88, 1.53] | 0.078 |
| 60+ | 4(4.8) | 3(5.6) | 1(3.3) | 0.31[0.19, 6.71] | 0.593 |
| Marital status | | | | | |
| Single | 13(24.1) | 9(16.7) | 4(13.3) | Ref | |
| Married/co-habiting | 51(60.7) | 34(63.0) | 17(56.7) | 1.73[0.22, 5.26] | 0.175 |
| Divorced/Widowed | 20(23.8) | 11(20.4) | 9(30) | 1.24[0.57, 2.49] | 0.077 |
| Highest level of education | | | | | |
| Primary | 7(8.3) | 4(7.4) | 3(10) | Ref | |
| O level | 59(70.2) | 39(72.2) | 20(66.7) | 0.76[0.33, 0.82] | 0.017 |
| A level | 13(15.5) | 7(13.0) | 6(20) | 0.52[0.23, 0.91] | 0.041 |
| Tertiary | 5(6.0) | 4(7.4) | 1(3.3) | 0.37[0.09, 1.21] | 0.059 |
| Average monthly income | | | | | |
| ≤150 | 43(51.2) | 29(53.7) | 14(46.7) | Ref | |
| 151-300 | 17(20.2) | 12(22.2) | 5(16.7) | 0.76[0.41, 1.31] | 0.076 |
| 301-450 | 10(11.9) | 5(9.3) | 5(16.7) | 1.17[0.87, 2.64] | 0.324 |
| >450 | 14(16.7) | 8(14.8) | 6(20) | 1.35[0.76, 2.16] | 0.671 |
| Alcohol use | 37(44.0) | 27(50) | 10(33.3) | 1.62[0.84, 5.02] | 0.093 |
| **Agricultural related factors** | | | | | |
| Usage of pesticide | 72(85.7) | 44(77.8) | 28(93.3) | 0.63[0.18, 0.82] | <0.001 |
| Number of years using pesticides | | | | | |
| ≥10 years | 45(53.6) | 34(63.0) | 11(36.7) | Ref | |
| <10 years | 39(46.4) | 20(37.0) | 19(63.3) | 1.98[0.94, 2.51] | 0.142 |
| Trained in the last two years | 12(14.3) | 7(13.0) | 5(16.7) | 0.54[0.11, 0.91] | 0.034 |

The multivariate analysis shows that, after adjusting for potential confounders and prioritized factors, participants were likely to get higher score with respect to knowledge, safety and handling of agrochemicals with a higher education level attained.

More specifically, participants who had attained an O level and A level were adjustably 24% (OR=0.8, 95% CI: 0.33, 0.82) and 48% (OR= 0.5, 95% CI: 0.23, 0.91) less likely to have poor knowledge, safety and handling of agrochemicals as compared to those who finished in primary school. Still more, participants who reported current usage of pesticides were likely to know more about safety and handling with an adjusted OR of 0.6(95% CI: 0.18, 0.82).

Likewise, receiving training in the last two years was associated with positive knowledge, safety and handling of agrochemicals with an adjusted OR of 0.5(95% CI: 0.11, 0.91). However, we also report borderline adjusted associations with increased income (151-300 dollars) and age (40-49 and 50-59 years) protective of low knowledge, safety and handling of agrochemicals. Likewise, other adjusted borderline statistical evidence were also identified in participants with alcohol use with an adjusted OR=1.6(95% CI: 0.84, 5.02; p-value=0.093).

### 4.13 Chapter Summary

This chapter presented the results that came out of this study. Results on socio-demographics, application practices, use of PPE, knowledge and training on use of agrochemicals were presented. Bar graphs, charts and tables were used to present data. A univariate and multivariate logistic regression was done to find factors that were associated with knowledge and practices on agrochemicals. The following chapter presents the discussion, conclusion and recommendations of the key findings from this study.

## CHAPTER 5: Discussion, Conclusion and Recommendations

### 5.1 Introduction

Findings presented in the past chapter were discussed in this chapter.

### 5.2 Demographics

The highest number of the respondents in this particular study were found to be male. This shows that the agriculture industry particularly the tobacco sector is a male dominated field. Also the study enrolled registered tobacco growers. According to a research published by the TIMB (2020), small scale tobacco growers mainly work as a family with the rest of the family members providing labour and usually the head of the household which is usually the men will be the registered member. Women are mainly found to be registered growers in cases where they are single or widowed. Also tobacco farming is a labour intensive industry and that could also explain why the sector is dominated by men.

### 5.3 Chemicals used by farmers

An analysis of the toxicity of the agrochemicals used by tobacco farmers was also carried out**.** Results showed that farmers use agrochemicals that are highly toxic. This implies that strict hygiene and personal protective measures must be put in place. This includes use of adequate personal protective gear. However this was not the case in this study where results indicated poor use of personal protective wear as well as the general practice of hygiene. This could open a possibility for poisoning.

### 5.4 Knowledge on agrochemical use

The study showed high usage of agrochemicals among the small scale tobacco growers with all the respondents highlighting that they use agrochemicals. With regard to knowledge of use, older participants aged 40-49 years were more likely to have more knowledge with regard to safety and handling of agrochemicals as compared to the younger age group that was aged between 20-29 years. This was likely due to the fact that they have been growing the crop for a longer time and have learnt the best practices through experience. On the other hand, the 20-29 year age group have less experience in both growing and handling the agrochemicals hence they were more likely to have a lower score.

Respondents with higher educational qualifications were less likely to have poor knowledge as compared to those who had primary education only. Farmer education can play a significant role in promoting safe pesticide use and in reducing pesticide overuse (Khan, Hafiz, & Christos, 2015). Farmers with high level of education are most likely to read and comprehend the instructions and user manuals that come with the agrochemicals as compared to those with lower qualifications.

Higher income earners were also less associated with low scores of knowledge on agrochemical use. Also higher income earners were associated with higher education qualifications. This could mean that the higher income educated farmers would have an advantage of being able to follow manuals and instructions when growing their crops hence they are more likely to produce quality crop that fetches higher prices on the

market compared to their fellow low income earners. However these findings contradict to what was observed in a study on farmers behaviour in pesticide use carried out Bangladesh. It concluded that higher income earners were farmers that had no educational background.

Farmer experience or number of years growing tobacco also was associated with level of knowledge on agrochemical use. Farmers with ten years or less of experience were 2.94 times more likely to score low on knowledge, safety and handling of agrochemicals as compared to those with at least 10 years of experience. More years of experienced often indicate accumulation of knowledge with regard to agrochemical use. Having more years using agrochemicals might mean that the farmers have over the years gained knowledge practically as they use the chemicals every season.

**5.5 Training and first aid**

Agrochemical handling remains unsatisfactory as indicated in this study due to lack of appropriate training on the safe use and handling handling of agrochemicals. Abang, Kouame, Hanna, & Fotso, (2013) found similar information in tropical region of Cameroon. They attributed this inadequacy to shortage orunavailability of extension training and services to the farmers. Occupational exposure to pesticides in agricultural applications can lead to acute and long-term health effects to farmers. It is therefore important to ensure that farmers are well trained in handling of agrochemicals. However the results from this study also showed low levels of training among the interviewed participants. Studies have proven that most trained farmers showed higher levels of knowledge of agrochemical use, higher levels of beliefs in agrochemical hazard control

as well as exhibiting safety behaviour as compared to non-trained farmers. This study also found similar results where after adjusting for confounders, those farmers who had received some form of training were most likely to have a higher score on knowledge of handling of agrochemicals. Pesticide education programs like training by extension workers, community engagements and workshops can be helpful in advancing farmers' knowledge on how to improve pesticide management practices.

Although the farmers showed to have some knowledge on agrochemical poisoning, only 50% of the respondents knew the correct action to take when one gets poisoned. This clearly shows that they are still gaps in knowledge with regard to health and safety regarding agrochemical use. This is knowledge that can only be acquired through training. Sonchieu *et al* (2013) remarked that first aid after intoxication practices are generally poor among farmers. The victims are locally managed by other fellows and they are not always transferred to the hospital. Sonchieu *et al* (2013) also found out that the farmers still use traditional unproven methods to manage victims. Use of charcoal, liquid milk and palm oil to manage intoxicated victims was reported and in most cases the victims will succumb before they even reach the nearest health care facility for proper treatment.

**5.6 Use of Personal Protective Equipment and personal hygiene**

Most farmers acknowledged using some form of personal protective equipment. Majority only had gumboots and overalls that they use when working in the fields. However use of other important personal protective equipment such as gloves, respirators/face masks, helmets and aprons was very limited. The major reason for not

having adequate personal protective equipment was due to its unavailability in the study area (34.8%) whereas some expressed ignorance on the importance of having a complete set of personal protective wear whilst spraying. 12. 2 % reported having other personal protective equipment such as helmets and respirators but they indicated they are not comfortable wearing them all day as they work in the fields. According to Blanco & Lacasaña (2011), farmers may not use safety measures if they have an economical burden or a time restraint to performing the work. They also cited environmental factors like heat and high humidity that makes some personal protective equipment uncomfortable. This was similar to what was observed in the study were farmers regarded buying PPE as a luxury due to economical constraints. Low use of PPE can suggest a considerable scope for contamination whilst using agrochemicals.

Personal hygiene practices are important when it comes to handling of agrochemicals. Results from this study showed poor hygiene practices with the majority only considering hand washing only especially after spraying or re-entering a sprayed field. This result is also backed by a study carried out by Koirala *et al* (2016) in which they investigated the impact of poor personal hygiene of farmers on the life of family members. EFSA (2014)shows that the practice of poor hygiene by farmers will lead to numerous health problems such as respiratory, circulatory and genital problems in the family and the community. This indirect exposure is not to be neglected since the study carried out by Atabila *et al* (2013), shows a major health risk.

Other studies conducted in Ethiopia have also shown that personal hygiene and the proper use of personal protective equipment by farm workers was below a standard and in the Philippines poor personal hygiene coupled with experiencing spills on farm workers bodies were risk factors to acute agrochemical poisoning among farmers and their family members.(Lu,2005)

**5.7 Storage and Disposal of agrochemicals**

Results from the study showed that farmers still use agrochemicals which have red and purple labels meaning that they are highly toxic. This high toxicity level puts the health of the farmers at risk as any mistake in handling can lead to acute and chronic poisoning. Storage and disposal of agrochemicals are of importance both to humans and the environment. If they are not stored properly, they might end up being accessed by children resulting in accidental poisoning. Storage of these chemicals in poor conditions induce degradation of the active ingredients and resulting in an increase of impurities and degradation by-products such as ETU (Ethylene Thio-Urea) which could be more poisonous than the original compound.

The practice of managing emptied containers in this study was poor since proper instructions on use, storage and disposal of waste containers were not adhered to. Although Majority of respondents (92%) indicated that they have secure places where they store agrochemicals, much care was not given regarding disposal of residual agrochemical and empty containers with 23% of respondents citing that they just throw in any pit. Diomedi & Nauges (2016) also reported that the majority of the respondents prefer to burn and bury the pesticides and packaging materials.Throwing, burning of

empty containers in the environment, repurposing can be considered as contamination pathways that can lead to poisoning. No friendly environmental waste management system recommends such practices. Indiscriminate disposal of empty containers and chemical residue will lead to the ecosystems' destruction.

However proper disposal of agrochemicals is necessary as poor disposal practices can cause a harmful effect on animals, humans, plants and livestock. The improper disposal of agrochemicals also leads to microbial population destruction and also the cause of chemical flooding (accumulation of pesticides) in crops grown in the close area hence making them not suitable for consumption.

**5.8 Study Conclusions/Summary**

Pesticide handling practices in the study was far beyond the expected standard. Demographic factors such as highest level of education attained and age were significantly associated with the level of knowledge regarding agrochemical use and practices. Experience and training were other factors that had an effect on the level of knowledge. PPE use was low amongst the interviewed participants. This means more attention need to be given to awareness creation on both handling, use and on safety measures. Extension services should be increased so that people are likely to have more awareness which will lead to safe handling of agrochemicals thus ensuring sustainability in the tobacco farming industry. This study revealed that farmers cropping in this zone had average to low knowledge of pesticides use. The management of used containers was not environmentally friendly which may constitute a source of contamination.

### 5.9 Implications to practice

About 42% of the agrochemicals that the farmers listed to be using, 42% are in the very poisonous to extremely poisonous category. This was very important as it showed the level of risk that the farmers are exposed to. On spraying practices, only 69% used the appropriate application tool. So it indicates that the remaining 39% still use methods that are risky and unsafe to spray these toxic pesticides that exposing them thus increasing the risk of exposure leading to poisoning.

Only 26% of the respondents had received training in the last two years on handling and application. This lack of training reduces knowledge of safe practices. This can lead to incorrect use that may endanger the lives of the users. Less than 20% of the respondents used appropriate and adequate PPE when mixing or spraying. Failure to use appropriate PPE that covers the head, face, hands, whole body and feet has been found to a significant risk factor to accidental poisoning through inhalation and dermal contact. Hygiene practices were found to be unsatisfactory.

### 5.10 Recommendations

For the sustainable use of agrochemicals in the tobacco industry, the following recommendations were suggested:

- Since almost 90% of the tobacco that is being grown is now under contract farming, contractors should be urged to first do trainings before handing over agrochemicals to farmers and also as part of the package they should also give adequate PPE to the contracted farmers.

- Farmers and agrochemical traders should be given training by agricultural extension services department (both formal and informal) for safe pesticide handling and adoption of PPE to undermine occupational health exposure.
- Regulations which makes it mandatory for all agrochemicals to have user instructions also in vernacular languages to avoid language barriers must be enforced by regularly monitoring for compliance in retail distributors.
- Use of biochemical and bio pesticides which are easily degraded and not persistent should be encouraged rather than the use of synthetic chemicals.
- The relevant ministries should consider investing in research on use of Integrated Pest Management methods which are environmentally friendly.
- Persistent organic pollutants and illegal pesticides that have been banned should be heavily monitored so that these chemicals are not smuggled into the country where they will end up being used by our farmers again.

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## APPENDICES

**APPENDIX 1:** Informed Consent

**English Informed Consent Form**

**Project Title: Agrochemical poisoning among small scale tobacco growers in Zvimba District, Mashonaland West, Zimbabwe, 2021**

**Investigator:** Natasha Muziringa

Phone Number: 0775815645

**Participant Study number:……**

**Province** :_____

**District** :_____

**Ward** :_____

**Village** :_____

**School** :_____

**What you should know about this research study:**

- We give you this consent so that you may read about the purpose, risks, and benefits of this research study.

- The main goal of research studies is to gain knowledge that may help future patients.
- We cannot promise that this research will benefit you. Just like regular care, this research can have side effects that can be serious or minor.
- You have the right to refuse to take part, or agree to take part now and change your mind later.
- Whatever you decide, it will not affect your regular care. Please review this consent form carefully. Ask any questions before you make a decision.
- Your choice to participate is voluntary.

**PURPOSE**

You are being asked to participate in the investigation of Agrochemical poisoning among small scale tobacco growers in Zvimba District, Mashonaland West, Zimbabwe, 2021. The main aim of the study is to assess the extent of agrochemical poisoning and agrochemical use and management practices by small holder tobacco farmers in Zvimba district. You were selected to take part in the study as you met the selection criteria of being a tobacco grower registered with the TIMB.

**PROCEDURES AND DURATION**

If you decide to participate in the study, the research team will administer a set of questions that you are supposed to answer as accurately as you can.

**RISKS AND DISCOMFORTS**

Since there will only be questions that are going to asked verbally, there are no anticipated risks or discomfort that participation in this study will cause.

**BENEFITS AND /OR COMPENSATION**

There is no form of payment that is guaranteed for taking part in this study. However information that is gathered from this study will help the responsible ministry as well as TIMB to come up with ways they can ensure sustainable use of agrochemicals to prevent injury or poisoning

**PREVENTION OF COVID-19 TRANSMISSION DURING THE STUDY**

To protect the participants and the research team from COVID-19 transmission, all study procedures will be performed in an open space or well-ventilated area. Everyone will be wearing face masks in line with the national guidelines for COVID-19 in Zimbabwe. Everyone will be encouraged to hand wash or hand sanitize as frequently as required during the data collection process. The research team will not have direct contact with participants and a 2m distance will be maintained among individuals during the data collection process.

**CONFIDENTIALITY**

If you indicate your willingness to participate in this study by signing this document, your results will not be disclosed to anyone who is not part of research team except Participant confidentiality will be maintained throughout the study. All participants in this study will be assigned a unique identification number by the research team. The unique identification number will appear on all questionnaires.

**VOLUNTARY PARTICIPATION**

Participation in this study is voluntary and you will not receive payment. If you decide not to participate in this study, you are free to withdraw your consent and discontinue participation at any time without penalty.

**AUTHORIZATION**

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE IN THIS STUDY. YOUR SIGNATURE INDICATES THAT YOU HAVE READ AND UNDERSTOOD THE INFORMATION PROVIDED ABOVE, HAVE HAD YOUR QUESTIONS ANSWERED, AND AGREED TO PARTICIPATE.

_____ _____

Name of Participant *(please print)* Date& time

_____ _____

Signature of Participant Date & time

_____ _____

Signature of Researcher Date & time

*In the event that someone is not able to read or write, an individual chosen by the participant should sign below:*

**I have witnessed the accurate reading of the consent form to the participant and the individual has had the opportunity to ask questions. I confirm that the individual has given the consent freely.**

_____

Name of Witness (please print)

_____

Signature of Witness

_____

Date & Time

_____

Relationship to the Participant

_____ _____

Signature of Research staff Date & Time

YOU WILL BE OFFERED A COPY OF THIS CONSENT FORM TO KEEP.

Appendix 2: Shona Consent

**Musoro Wetsvakurudzo: Agrochemical poisoning among small scale tobacco growers in Zvimba District, Mashonaland West, Zimbabwe, 2021**

**Mukuru Wetsvakurudzo:** Natasha Muziringa

Nhamba Dzenhare: 0775815645

**Nhamba yemutsvakurudzo**_____

**Nzvimbo :**_____

**Dunhu :**_____

**Wadhi :**_____

**Bhuku :**_____

**Chikoro :**_____

**Zvamunofanira kuziva pamusoro petsvakurudzo ino:**

- Tinokupai fomu rino retendedzo kuitira kuti muverenge pamusoro pechinangwa, njodzi uye zvakanaka zvetsvakurudzo ino.
- Donzvo guru retsvakurudzo nderekuwana ruzivo rwunogona kubatsira varwere vemunguva yemberi.
- Hatikwanise kuvimbisai kuti tsvakurudzo ino ine zvakanaka zvaichakuwanisai. Serubatsiro rwenguva nenguva, tsvakurudzo ino inogona kuva nezvaingakanganisa nenzira huru kana duku.

- Mune kodzero yekuramba kuita chikamu, kana kubvuma kupinda mutsvakururdzo panguva ino mozoshandura pfungwa dzenyu pamberi. Ingave sarudzo ipi zvayo yamungaite, haizokanganise rubatsiro rwamagara muchipiwa.
- Tapota nyatsoverengai fomu rino retendedzo zvakanaka. Bvunza chero ipi mibvunzo musati maita sarudzo. Sarudzo yokuti mupinde mutsvakurudzo ino hamumanikidzwe.

**CHINANGWA**

Murikukumbirwa kuti mupinde muongororo yekuona mashandisirwe ari kuitwa mishonga yemuzvitoro inoshandiswa pakurima uye ruzivo pamusoro pemishonga iyi.Ongororo iyi ichange ichiitwa pavarimi vefodya sezvo ndivo vakaonekwa sebato revarimi rinoshandisa mishonga iyi zvakanyanya. Masarudzwa semumwe wevanogona kupinda mutsvakurudzo ino nokuti muri wezera rechikuru (kubva pa 18 zvichienda mberi) uye muri murimi wefodya kana kuti munogara pamusha mumwechete nemurimi wefodya. Zvichabuda muongororo iyi zvichabatsira hurumende , makambani anogadzira nekutengesa mishonga uye varimisa kuti vagare pasi vabude nenzira dzinotapuza njodzi burikidza nekushandisa mishonga yekurimisa.

**MAITIRWO UYE NGUVA INOTORWA**

Kana mukasarudza kupinda mutsvakurudzo, chikwata chevatsvakurudzi chichakukubvunzai mibvunzo vachinyora mhinduro dzenyu pasi. Munotarisirwa kupindura mibvunzo zvisina kutya uye muchivaudza chokwadi chamunoziva.

**NJODZI NEKUSAGADZIKANA**

Kupindura mibvunzo yamuchange muchibvunzwa hakuna njodzi kwamuri.

**ZVAMUNGAWANA KANA MURIPO**

Kana mukapinda mutsvakurudzo iyi hapana muripo wamuchapiwa.

**KUDZIVIRIRA KUTAPURIRANWA KWE COVID-19 PANGUVA YETSVAKURUDZO**

Kudzivirira kutapuriranwa kwe COVID-19 kune vapinda mutsvakurudzo nevatsvakuridzi, zviitiko zvese zvetsvakurudzo zvichaitirwa panze kana munzvimbo isina kupatikidzika inofamba mhepo. Munhu wese achenge akapfeka face masks maringe nemutemo we COVID-19 wenyika yeZimbabwe. Munhu wese achange achikuridzirwa kugeza maoko kana kumasanitiza (hand sanitize) pese pakafanira munguva yetsvakurudzo. Vatsvakurudzi vachange vasingabatani nevatsvakurudzwi uye vanhu vanenge vakataramuka nhanho mbiri (2m) kubva kune mumwe panguva yetsvakurudzo.

**KUCHENGETEDZWA KWEMASHOKO NEZVICHAITWA MUTSVAKURUDZO**

Kana mukataridza chido chenyu kupinda mutsvakurudzo iyi kubudikidza nekusaina chinyorwa chino, zvichaonekwa mushure metsvakurudzo hapana achazviudzwa kunze. Kana muchinge mangobvuma kupinda mutsvakurudzo iyi, muchapihwa nhamba yenyu mega yakasiyana nedzevamwe ichashandiswa pamapepa emubvunzo. Nhamba iyi ichashandiswa senzira yekukuzivai nekuti hapashandiswi zita renyu. Ruzivo rwupi zvarwo rwuchawanikwa mutsvakurudzo ino rwakanangana nemi, rwuchachengetedzwa uye rwuchazobuditswa chete kana matipa mvumo yenyu.

**KUPINDA MUTSVAKURUDZO PASINA KUMANIKIDZWA**

Munopinda mutsvakurudzo ino nekuti munoda uye hamupihwe mubhadharo. Kana mukafunga kuti hamuchadi kupinda mutsvakurudzo iyi, sarudzo yenyu haikanganisi hukama hwenyu nevarimisi. Kana mukanzwa kuti hamuchada kuenderera mberi muri muongoror, makasununguka kubuda pane chero ipi zvayo nguva uye hapana muripo kana chirango chamunopiwa.

**KUZVIPIRA KUPINDURA MIBVUNZO**

Musati masaina fomu rino, makasununguka kubvunza mibvunzo yese ine chekuita netsvakurudzo ino kana pane zvamunoda kujekeserwa. Makasununguka kutora nguva yenyu muchiverenga uye kufunga nezvetsvakurudzo ino.

**TENDEDZO**

Muri kuita sarudzo yekuti munobvuma here kana kuti hamubvume kupinda mutsvakurudzo ino. Siginicha yenyu inotaridza kuti maverenga mukanzwisisa zviri pamusoro, mibvunzo yese yamabvunza yapindurwa uye mabvuma kupinda mutsvakurudzo

Zuva raunosaina fomu rino uchizvinyoresa kuva mutsvakurudzo ino, kureva kuti, zuva ranhasi, RINOFANIRA kuva zuva riripakati pemazuva akanyorwa pachitambi chetendedzo chiri papeji imwe neimwe. Mazuva aya anoratidza kuti fomu rino nderechokwadi paunozvinyoresa muchidzidzo chino asi haaratidze nguva yaungatora uchiita chikamu muchidzidzo chino. Peji imwe neimwe yeFomu rino Retendedzo Yaunopa Uine Ruzivo Rwuzere inodhindwa kuratidza kuti fomu nderechokwadi sekutenderwa kwazvo neveMRCZ.

_____ _____

Zita rewapinda mutsvakurudzo *(*Tapota nyora nemavara makuru*)* Zuva nenguva

_____ _____

Siginecha yewapinda mutsvakurudzo Zuva nenguva

_____ _____

Siginecha yemumwe wevatsvakurudzi Zuva nenguva

*Zvichinge zvaitika kuti mumwe munhu haagoni kuverenga kana kunyora, munhu anenge asarudzwa neuyo ari kuita chikamu ndiye anofanira kusaina pazasi:* Ndaona

kuverengwa nemazvo kwefomu retendedzo kune uyo arikuita chikamu, uye munhu averengerwa uyu ave nemukana wekubvunza mibvunzo. Ndinopupura kuti munhu uyu abvuma zvisina kumanikidzwa.

_____ UYE

mutsvakurudzo

Zita remufakazi

(tapota nyora nemavara makuru)

_____

Zuva nenguva

_____

Siginecha yemufakazi

_____

Ukama neuyo apinda mutsvakurudzo

_____ _____

Siginecha yemumwe wevatsvakurudzi Zuva nenguva

MUCHAPIWA KOPI YEFOMU RINO REBVUMIRANO KUTI MUCHENGETE

.

Appendix 3: AUREC Clearance Letter.

**AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)**

*P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 website: www.africau.edu*

Ref: AU2300/21 2 January, 2022

Natasha Muziringa
C/O CHANS
Africa University
Box 1320
**Mutare**

RE: **AGROCHEMICAL POISONING AMONG SMALL SCALE TOBACCO GROWERS IN ZVIMBA DISTRICT, MASHONALAND WEST, ZIMBABWE, 2021 PROPOSAL**

Thank you for the above titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

b) Data collection instruments

c) Informed consent guide

- **APPROVAL NUMBER** AUREC 2300/22

This number should be used on all correspondences, consent forms, and appropriate documents.

- **AUREC MEETING DATE** NA
- **APPROVAL DATE** January 2, 2022
- **EXPIRATION DATE** January 2, 2023
- **TYPE OF MEETING** Expedited

After the expiration date this research may only continue upon renewal. For purposes of renewal, a progress report on a standard AUREC form should be submitted a month before expiration date.

- **SERIOUS ADVERSE EVENTS** All serious problems having to do with subject safety must be reported to AUREC within 3 working days on standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

**Yours Faithfully**

**MARY CHINZOU – ASSISTANT RESEARCH OFFICER: FOR CHAIRPERSON**
**AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE**

**Appendix 4:** Questionnaire

Study Title: **Agrochemical poisoning among small scale tobacco growers in Zvimba District, Mashonaland West, Zimbabwe, 2021**

# Farmers Questionnaire

**Participant Study number:……**

**Province** :_____

**District** :_____

**Ward** :_____

**Village** :_____

## SECTION A: DEMOGRAPHIC INFORMATION

1. Gender. a) Male b) Female
2. Age/ DOB……
3. Marital status. a) Single b)Married/Cohabiting c) Divorced/Separated d) Widowed
4. Highest level of education attained. a) Never been to school b). Primary c) O-level d)

   A-level e) Tertiary

5. How big is the area that you grow tobacco.
   a) Less than 1 acre
   b) 2 acres
   c) 1 hactare
   d) More than 1 hactare

## SECTION B: KNOWLEDGE OF AGROCHEMICALS

**6. For how long have you been growing tobacco?** .....years

**7. How many people work on your field on full time basis per tobacco season**? .....

**8. What type of labour do you employ?**

a) Own unpaid labour

b) Paid labour

c) Casual/Temporary paid labour

d) All above

**9. Besides Tobacco, can you list other crops that you grow.**

……

……

**10. Do you use pesticides for farming? 1. Yes 2. No**

**11. How often do you use the pesticides for farming?**

a) Always

b) Sometimes

c) Rarely

**12. What are the major sources of pesticides you use for farming? (Multiple response)**

a) Contract Schemes

b) Pesticide retailor/distributor

c) Government (Command/ Presidential)

d) NGO

e) Friends/ relatives/ neighbours

f) Informal pesticide vendor

**13. Who recommends the pesticide you use for farming? (Multiple response)**

a) Self (through experience)

b) Other farmers

c) Foreman (if it is a commercial farm)

d) Plant health officers

e) Extension officers

f) Pesticide retailers/ distributor

g) Informal Pesticide vendors

h) Other (Specify)……

**14. For how long have you been using pesticides for farming?**

…….

**15. On average, how much land do you usually spray? .....**

**16. How many times do you spray per month?**

..... ...

**17. How many people normally apply pesticides from this household/farm?**

……

**18. Have you received any training on the use of pesticides for farming in the last 2 years?**

1. Yes 2. No

**19. Who trained you on the use of pesticides for farming in the last 2 years? (Multiple**

**response)**

a) Government extension officer

b) Private company

c) Pesticide retailer/ distributor

d) Agricultural shows/field shows/demonstrations

e) NGO

f) Farmer Association

g) Friend/neighbor/ relative

i) Media (radio, T.V, social media, newspaper

j) Other (specify) ……..

**20. What were you trained on? (Multiple response)**

a) Correctly identifying pests

b) Selection of pesticides

c) Preparing the dose for mixing and application

d) Use of pesticide application equipment

e) Personal protective equipment (gloves, mask, clothes)

f) Understanding pesticide label and material safety data sheets

g) Dangers of pesticides for human health and the environment

h) Disposal of empty/expired pesticides containers

i) Integrated Pest Management

**21. How often do you receive training.**

a) every season

b) once every two years

c) once in three years

d) every three to 5 years

**23. Can you identify any symptoms of pesticide poisoning**?

a) Skin irritation

b) Skin rashes

c) Eye irritation

d) Sneezing

e) Nausea

f) Vomiting and diarrhoe

g) Dizziness

h) Difficulty breathing

i) Stomach cramps

23. Can you state any routes of entry for pesticide poisoning

……

……

……

**24. What action do you take when you suspect pesticide poisoning?**

a) rush to the hospital

b) give them milk

c) take them home and wait for their recovery

d) give first aid as written on the chemical

## SECTION C: AGROCHEMICA USE AND PRACTICES

**25. Do you read a pesticide label before use?**

a) Yes b) No

**26. How often do you read a pesticide label?**

a) Only the first time I am using the pesticide

b) Every time I use the pesticide

c) When I am buying

**27. Which information will you be looking for when you read the pesticide label? (Multiple**

**response)**

a) Trade name

b) Mixing and application/ usage rates and instructions

c) Risk to human health

d) First Aid information

e) Harm to environment

f) Pre-harvest interval

g) Re-entry interval

h) Interval between sprays

i) Expiry date

j) Storage

k) Type of crop to be protected

l) Target Pest to be controlled

m) Crop stage

n) Disposal method

p) Other (specify)
……

**28. Identify colors found on the triangle on pesticide containers**

a) Yellow

b) Red

c) Amber

d) Green

e) Black

f) Purple

) No idea

h) Other (specify)…….

**29. Which colour on the pesticide triangle means:**

a) Caution: a) Red b) Purple c)Blue d)Green e)Yellow

b) Extremely poisonous: a) Red b) Purple c)Blue d)Green e)Yellow

c) Dangerous poison: a) Red b) Purple c)Blue d)Green e)Yellow

d) Poisonous: a) Red b) Purple c)Blue d)Green e)Yellow

**30. How would you know that a pesticide has expired? (Multiple response)**

a) Check the expiry date on my own

b) Observe the changes in the formulation/colour

c) A relative/friend will let me know

d) Results after application

**31. Can you state any reasons why you do not read lables**

**a**) Language barrier

b) Prior use so there is no need for keeping on reading each time l buy

c) No label

c) Don't understand the technical terms

**32. How then do you decide on the dosage for each pesticide? (Multiple response)**

a) Experience

b) Use information from extension staff

c) Use information from other farmers

d) Use information from a pesticide vendor

e) Someone else reads the label for me

## SECTION D: SAFETY, STORAGE AND DISPOSAL PRACTICES

**33. What type of PPE do you use when applying pesticides. (tick)**

| **PPE item** | **Yes/no** |
|---|---|
| Gumboots | |
| Overalls | |
| Aprons | |
| Face shield/ masks | |
| Gloves | |
| Goggles | |

**34. Where do you get your PPE from?**

a) Tobbaco Contractors
b) Buy from shops

**35. Give reasons why one needs to put on PPE**

a) so that our clothes don't get dirty

b) as a routine

c) for prevention of exposure to chemicals

**36. How often do you reuse your PPE before washing or disposal**

a) once

b) twice

c) three times

d) more than three times

**37. Do you have clothes/ PPE that is dedicated for spraying only?**

a) Yes

b) No

**38. Do you change clothes immediately after spraying?**

**a) Yes**

**b) No**

**39. After spraying or mixing chemicals, do you do any of the following?**

a) Washing hands

b) Taking a bath

c) Wash your face

d) None of the above

**40. Who washes the overalls and boots after you fininsh your spraying session?**

a) myself

b) wife

c) child

d) helper

c) relative

**41. After spraying, how long do you wait in order to get back in the sprayed field?**

a) immediately

b) less than 12 hours

c) more than 12 hours

d) after one day

e) other specify……..

**42. Do you have any lockable room or cabinet that you store your chemicals?**

Yes……. No

**43. If you do not have, then where do you store it?**

Specify……

**44. Do you discard left over chemicals?**

a) Yes

b) No

**45. If Yes, where do you throw** it?

a) river

b) pits

c) Blair latrines

d) dig a hole and pour the cover it

**46. What do you do with pesticide containers?**

a) Just throw away

b) Burn

c) Burrying

d) throw in a water body

e) re-use for other purpose

This marks the end of my interview. Thank you for your time.