

## Handling and Disposal of Agricultural Chemicals on A2 Farms in Chirumhanzu District

**Matunhu Viola\***

*Midlands State University, Gweru, Zimbabwe*

**\*Corresponding Author:** Matunhu Viola, Midlands State University, Gweru, Zimbabwe.

**Received:** January 09, 2020; **Published:** March 31, 2020

### Abstract

This study focus on the handling and disposal of agro-chemical on 21 A2 farms in Chirumhanzu District. In the study the term farmers and farm employees are used interchangeably. The study involved farm employees on A2 farms that use agro-chemicals to enhance farm productivity. Non probability sampling techniques were employed to select the participating farms. In-depth interviews and observation where the main data collection instruments. A total of 150 respondents participated in the study. The findings of this study were that there is poor management of agro-chemicals on the farms despite the fact that most of these chemicals are carcinogens. Farm employees need to be trained on personal and public health implications of poor management of agro-chemicals. Although, most of the employees on the farms are literate, they find it difficult to understand the jargon on labels.

**Keywords:** A2 Farmers; Agro-Chemicals; Public Health

### Introduction

In 2000 Government of Zimbabwe (GoZ) undertook a massive land redistribution programme under its black economic empowerment policy. The programme involved forced seizure of white-owned farms and sub-dividing them into smaller units<sup>1</sup>. However, most of the land beneficiaries were ill-resourced and ill-trained to use the land in an ecologically friendly manner. This paper, which is based on preventative public health care investigated handling and disposal of chemicals on A2 farms. The paper claims that failure on the part of public administrators to appropriately advice political leaders on implementation of the land reform could be counterproductive. Public health administrators should put in place systems and programs that assist farmers to safely acquire, use and dispose agrochemicals. Sustainable Development Goal 11 and the Zimbabwe United Nations Development Assistance Framework (ZUNDAF) 2016 - 2020 priority area 6 speak to safe and sustainable human settlements. The World Health Organization (WHO) estimate that there are three million cases of pesticide poisoning each year and up to 220 000 deaths primarily in developed countries (Gilbert 2011). This scary exposition makes it imperative that studies be carried out to establish the public health implications of use of toxic chemicals in the Chirumhanzu District. The study is timely as the country is reviewing its public health act [1]. The study is also timely as the Midlands Province, which houses the District, is rated as experiencing the highest number of deaths resulting from contamination by toxic chemicals [2]. The objective of the study is to find out how farmers in Chirumanhu District use and dispose agro-chemicals and also ascertain whether they appreciate the implication of these chemicals to the general public and the environment.

---

<sup>1</sup>The farms were subdivided into A1 and A2 farms. A1 farms were designed on welfarism and therefore a tool for alleviating poverty.

The study adopted the Ecological Public Health Model which posits that human health is dependent on how people coexist with the natural world. Meaning to say that the state of public health is a function of the interaction of human in their immediate environment. The model locates humans as one among many species existing within shared space. This space from the atmosphere (troposphere), to seabed (aquasphere) and subterranean crust (lithosphere) is malleable in the sense that human actions have some flexibility in how they live with or alter it. A key theme in this theory is interrelatedness, how people use and care for the natural world. How all species interact, and how their interactions have consequences almost always with feedback loops. It assumes that health is not a state of existence but a continual outcome of many processes e.g. agriculture and industrialization. According to the model, how health is improved or ill-health created is dependent upon how bodily mechanisms are integrated into their environment, natural and human, made and inherited. The model views ill health as a result of mismanaging relationships. The notion of mismatch has been proposed as one central explanation for ill-health. The ecological public health model might be posited as a new thinking, a response to the current twentieth- twenty -first century crisis of climate change, fossil fuel dependency and general environmental degradation. The general thinking about ecology and health is rooted in the evolutionary tradition of Darwin. In its health translation, ecological public health becomes a theory about human diseases patterns being shaped by humankind impact on the biosphere. It also becomes a recipe for redirecting modern living with one strand centering on promoting living simple lives while criticizing the anthropometric focus of modern living. Ecology is described as a science of the interrelatedness of all species in the environment. In public health this is translated as humans and their context.

### Public health systems in Zimbabwe

Zimbabwe's health delivery system is guided by the Zimbabwe Constitution which itself defines the structure, procedures, powers and duties of the Government in as far as health provision is concerned. The Constitution promises every citizen the right to an environment that is not harmful to their health or wellbeing [3]. The country's health delivery systems are decentralized, with health care provided at primary, secondary, tertiary and quaternary levels. However, the public health systems are centralized for policy and administrative guidance providing systems decision making, completing and determining funding allocations, coordinating response to national issues and approval of staff hires at district and provincial levels. From the 1990s to 2000, the health system was well funded, and did not require substantial funding from donor funding.

The National Health Strategy (NHS) 1997 - 2007 set the agenda for launching the health sector into the new millennium. The working document aimed at improving the health status of Zimbabwean staking cognizance that the population would not depend on health sector action alone but relay on multi-sectorial approach in managing health. The 1997 - 2007 NHS sought to pull together all national efforts which had potential to enhance health development into a promising new era. Whilst the situation analysis carried at that time showed a worrying decline in health status indicators, the optimism associated with the dawn of a new era provided hope and conviction for improvement. The identified weaknesses in the performance of the health system were thought to be temporary in the hope that the holding capacity of the economy to support a robust health system would improve. The challenges facing the health sector continued and in fact worsened during the second half of the implementation of the 1997 - 2007 NHS. Zimbabwe experienced severe economic challenges which peaked in the year 2008. The economic decline resulted in a sharp decrease in funding for social services. This directly contributed to an unprecedented deterioration of health infrastructure, loss of experienced health personnel, drug shortages and a drastic decline in the quality of health services available for the population.

In 2009, the MHCC began to be guided by the provision of the newly developed National Health Strategic plan for 2009 - 2013 "Equity and Quality Health- a People's Right". The document is a successor to the National Health Strategy (NHS) 1997 - 2007 "Working for Quality in Health". The main thrust of the 2009 - 2013 NHS are, firstly to provide a framework for immediate resuscitation of the health sector and secondly to put Zimbabwe back on track towards achieving the Millennium Development Goals. The strategy was based on information from several studies carried out and these include among others, study on access to health services, Vital Medicine and health Services Surveys, community working group on health surveys, existing national plans and programs as well as existing programs specific policy and strategic documents. The strategy took into consideration regional and international policies, strategies and commitments made

by the country such as the MDG and the Ouagadougou Declaration on primary health care and health systems in Africa as well as other international, continental and regional health protocols including the Africa Union Health Plan, the East and Southern Africa Health Community Agreements (ESAHCA) and the SADC Health Sector Protocol. This means that every citizen of Zimbabwe has the right to enjoy the highest attainable standard of physical and mental health. To show its commitment the GoZ instituted a legal framework for promoting health by deliberately putting in place proper legislative provisions to achieve the realization of these rights by instituting the Public Health Act and the Medical Services Act which regulated health services delivery systems in Zimbabwe.

The GoZ committed itself to fulfilling the right to health for Zimbabweans by being part to various regional and international treaties which guarantee the right to health. The right to health must be guaranteed just as right to freedom of expression and association are protected. This means that it is possible to challenge policies and laws that violate the right to health in court of laws and it is justifiable for newly resettled farmers to seek legal provisions that protect them against improper disposal of farm chemical. Both the Constitutional draft of 2000 and the Kariba Draft include the right to health in the national objectives of Zimbabwe. Protecting the right to health within a justiciable bill of right means it is enforceable and can actually claimed unlike rights stated as part of national objectives. Justiciable right means the rights are protected in a way that a court of law can enforce them and compel the government to meet its obligation.

The Health Strategic Plan was fully adopted by the beginning of 2010. A Patient's Charter which was originally developed in 1996, has since been revised. However, the Zimbabwe's National Health Strategic Plan 2006 - 2013 reports that Zimbabweans are dying from mostly preventable and treatable conditions. Public health's core function include, assessing population health needs, identifying health priorities, developing appropriate and relevant policies, implementing programs and effective monitoring and evaluation of services. The key notion of public health is that good health flows from the population level to the individual rather than the other way round. Public health is distinguished by its emphasis on understanding how lifestyles and living conditions determine health status. This includes recognition of the need to understand the socio-cultural context and how this can influence the choices and behaviours adopted by individuals, communities and families. Public health is an indicator of progress both for and of human society. The improper disposal of agricultural chemical can adversely affect the healthy living condition of society by making people vulnerable to diseases.

Research has shown that successful societies are those which embrace public health principles, but in the process of applying these principles, and investing in their implementation, these societies normally lose sight of the rationale of why the actions have been pursued. Success in preventing ill health quickly breeds collective amnesia. Thus, public health easily represent a rather sober case for investing in and accepting the need for measures which are designed to improve the lot of the public. The health of the public is the measure of societal progress. Public health is the health of societies and is the ultimate yardstick by which most people value existence for themselves. It would be interesting to find out whether the Zimbabwean Government is taking deliberate action to protect newly resettled farmer from the effect of farm chemical exposure. These arguments are essentially that the public health is overweening and self-aggrandizing. But they also expose how health interventions are moral and societal dilemmas.

### Methodology

In-depth interviews, questionnaires and observation were the main data collection tools. Primary data sources provided room for obtaining first-hand data from the respondents. Secondary data were collected through reviewing published and unpublished articles, pamphlets, journals, and textbooks. A fieldwork was conducted where the researcher negotiated 'entrance and acceptance' into the field through the District Administrator's (DA) office. Semi-structured questionnaire were administered to a set of purposively selected respondents. The major advantage of using a questionnaire is that it promotes objectivity and that it was less time consuming. Questionnaires allow the respondents the opportunity to openly express their beliefs, or feelings on the subject under inquiry [4]. The researcher ran self-administered questionnaire which yielded a hundred percent questionnaire return rate. A representative of the Faculty of Agriculture from one of the local universities, the District Lands and Agriculture officer, the District Lands and the Resettlement Officer, Provincial Medical Director, Provincial Health Inspector, the Churumhanzu District Health Inspector and the District Medical Officer were

my key informants. These were purposively selected. In this type of a research, there are no strict rules for sample size in qualitative and mixed methods research inquiry. Sample size depends on what one want to know, the purpose of the enquiry, what is at stake, what will be useful, what will have credibility and what can be done with available resources and time ([5]: 187). With the same fixed resources and limited time, a research may study a specific set of experiences for a large number of people (seeking breadth) or a more open range of experiences for a smaller number of people (seeking depth). The validity, meaningfulness and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational and analytical capabilities of the researcher than with the sample size. Freud established the field of psycho analysis based on fewer than 10 client cases ([5]: 185). A questionnaires was distributed to all the 150 selected respondents. A total of 15 key informants were purposively were interviewed.

**Results and Discussions**

**Bio-data of the respondents**

The age distribution on the diagram below shows a normal distribution; the advantage of this is that it brings about confidence in terms of respondents’ views on the use and disposal of chemicals in A2 farms in the District. The worry of this study is that the earlier in life people get involved in poor usage, handling and disposal of dangerous chemicals, the more their lives are likely to be cut short because of the negative action of the drugs in human anatomy. The educational attainment of most farm employees in the District is ‘O’ and ‘A’ levels. By implication, these respondents are literate, thus their capacity to be trained is high. The high literacy rate on the farms is not surprising. Zimbabwe has a literacy rate of 92 percent, one of the highest rates in Africa. However, the challenge is that agro-chemicals in use in the District are written in technical jargon, which is way above the comprehension of the respondents.

1. Ages in years	Males	Females	Totals	2. Highest Educational Attainment	Males	Females	Totals
Below 20	13 (11%)	6 (21%)	19 (13%)	Never been to school	1 (1%)	0	1 (1%)
20 to 30	18 (15%)	5 (18%)	23 (15%)	Grade 7 certificate	13(11%)	18 (64%)	31 (21%)
30 to 40	35 (29%)	9 (32%)	44 (29%)	Junior School certificate	47 (39%)	5 (18%)	52 (35%)
40 to 50	28 (23%)	2 (7%)	30 (20%)	‘O’ level certificate	51 (42%)	5 (18%)	56 (37%)
50 to 60	17(14%)	5 (18%)	22 (15%)	‘A’ level certificate	4 (3%)	0	4 (27%)
Over 60	11 (9%)	1 (4%)	12 (8%)	Other	6 (5%)	0	6 (43%)
Total	122	28	150 (100%)	Total	12 2	28	150 (100%)
3. Employment Status	Males	Females	Totals				
Farm supervisor	18 (15%)	3 (11%)	21(14%)				
General Hand	104 (85%)	25 (89%)	129 (86%)				
Total	12 2	28	150 (100%)				

*Table 1: Demographic profile of farm employees (n = 150).*

**Handling and disposal of agricultural chemicals by the A2 farmers**

The research established that those who handle and apply pesticides are potentially at risk of exposure and poisoning. Most of the employees either did not have protective clothing or did not have adequate protective clothing. The employees have an appreciation of what toxic chemicals can do to their health. The general feeling among the respondents is that milk can wash away all toxic chemicals in

a human body. One farm manager in concurrence with his subordinates said, “what is essential is for us to drink at least a glass of milk soon after exposing ourselves to these chemicals... milk has medicinal properties...” This is a misconception because milk can only boost a person’s immunity system, it does not wash away toxic chemicals in human tissues. The other challenge is that most farms do not have constant water supply by the farm. The farmers use empty chemical containers to search for water elsewhere. This tends to compromise the health of farm workers because they are supposed to thoroughly wash their protective clothing after use. Even those that are supposed to be discarded are supposed to be washed before discarding for example disposable gloves and head gear. Due to the fact that water sources are far away from the farm, farmers usually do not wash their cloths as expected.

Farm employees should be provided with protective clothing that is suitable for the type of application and the chemicals. In addition, applicators should be properly trained and supervised in the correct use of protective clothing; the minimum standards of handling and disposal of the chemicals are set by the MoHCC. The farmers are aware of the fact that adherence to the standards is monitored by Environmental Management Authority of Zimbabwe (EMA) and Environmental Health Officers (EHO).

Practice	Below minimum standards	Meeting minimum standards	Reaching beyond minimum standards
Storage of chemicals	142 (95%)	6 (4%)	2 (1%)
Adequate water supply on farm	137 (91%)	9 (6%)	4 (3%)
Use of adequate protective clothing	141 (94%)	9 (6%)	0
Use of appropriate equipment for mixing chemicals	820	15 (10)	0
Use of appropriate application equipment	119 (79%)	31(21%)	0
Availability of first aid equipment on farm	145 (97%)	5(3%)	0
Availability of valid first aid certificate	150 (100%)	0	0
Disposal of chemicals and containers	150 (100%)	0	0

**Table 2:** Summary of findings on use of agro-chemicals at the farms where n = 150.

At all the farms there were no proper facilities for the disposal of the chemicals and empty containers. None of the farmers were aware of the fact that chemicals disposal sites should be identified by public health officers to minimize contamination of underground water and the environment. The most popular ways of disposing chemicals and their empty containers at the farms are pit latrines and anti-hills. At some farms, empty containers are cleaned and reused. At all A2 farms, toxic agro-chemicals such as pesticides chemicals are not stored in accordance with government regulations. In 19 farms, chemicals were being stored either in bed rooms or in living rooms. In two farms, there were storerooms but they were not constructed in accordance with government regulations. In all the farms, employees are not going for routine medical checkups. One of the respondents said, “I am scared of going for medical checkups.... I am not on a medical insurance...”

**Training of farmers on health and environmental effects of chemicals they use**

One hindered and seven (107) respondents had no formal training on use and disposal of toxic agro-chemicals. The respondents could give a coherent description of the short term and long term effects of toxic chemicals on public and environmental health. When asked how they got to know what they know about use and disposal of toxic agro-chemicals, the farmers retorted that they learned the trade through trial and error. Only 43 respondents claim to have attended a single one-day training workshop in the past 4 years. One of the respondents said, “The workshop was conducted in 2010. No certificates were issued to the trainees after the workshop”. Most of those people who attended the training workshop rated the training as having being ineffective because of two major reasons: first, the language by the trainers was too technical and that the time allocated to the training workshop was too short.

Attributes	Trained			
	Never trained	True	Not true	Not sure
Training methods were very effective	107 (71%)	10 (7%)	33 (22%)	0
Training programme covered handling of agro-chemicals	107 (71%)	43 (29%)	0	0
Training period was long enough for us to understand	107 (71%)	0	40 (27%)	3(2%)
Training programme covered effects of agro-chemicals on the wellness of our environment	107 (71%)	43 (29%)	0	0
Training programme covered storage and disposal of chemicals	107 (71%)	43 (29%)	0	0
Training programme covered first aid	107 (71%)	43 (29%)	0	0
Public officials (EMA and MoHCC) are monitoring and evaluating on farm use and disposal of farm equipment	N/A	0	122 (81%)	38 (19%)

**Table 3:** Training of farmers on management of agro-chemicals.

The information on the table shows that the respondents are not properly capacitated to use and dispose agro-chemicals on the farms. Yet, capacity strengthening for sound management of public health should become a priority. The respondents from the MoHCC and EMA reported that aggregated data on human and environmental pesticide poisoning in the District are unavailable, implying that they have no system in place to collect and keep such data. This is an important aspect of agro-chemical management that all A2 farms should try to observe. The nurses in the District are not trained in management of clients who have been exposed to agro-chemicals used in the district. One of the medical officers in the District said, “Our nurses have qualifications in general nursing, none of them has a specific training in management of toxic material poisoning. This is a challenge for us because each time we have severe chemical exposures, we refer them to central hospitals in either Harare or Bulawayo.” Perhaps it is advisable that all nurses be trained to manage chemical poisoning cases.

#### Procurement of agricultural chemicals by the farmers

To understand the public administration implications of the use and disposal of agro-chemicals in the District, I needed to understand the factors that influence the farmers’ choice of agro-chemicals. There are several dangerous chemicals that are on the Zimbabwean market which are injurious to society [6]. The study established that several factors are considered by the farmers when purchasing agro-chemicals.

Factor	1 (least important)	2 (important)	3 (very important)	4 (Extremely important)
Toxicity level of the chemical	0	0	0	150 (100%)
Impact of chemical on the environment	118 (78,67%)	17 (11.33%)	3 (2%)	2 (1.33%)
Effect of chemical of human health	106 (70.67%)	132 (88%)	9 (6%)	3 (2%)
Cost of the chemical	0	0	0	150 (100%)
Source of the chemical	137 (91.33%)	13 (8.67%)	0	0
Manufacturer of the chemical	147 (98%)	2 (1.33%)	1(0.67%)	0

**Table 4:** Factors considered by farmers when purchasing agro-chemicals.

The two most important factors considered by the farmers in the District are toxicity and cost of the chemical. The least important factors being considered by the farmers when buying agro-chemicals include manufacturer of the chemical, source of the chemical (reg-

istered vendor or not registered vendor), effect of the chemical on both human health and environmental health. One the farm managers said, “during these difficult economic times what counts is nothing more than the cost of the chemical and its effect on pests. We are more concerned about increasing agriculture productivity.” The researcher also collected data on interpretation of colour codes by the farmers. Only 28 out of 150 respondents were able to interpret the colour codes correctly. Most of the respondents confused the meaning of ‘red’ and ‘purple’.

### Use and disposal of agricultural chemicals by the farmers

The farmers in the District are not adhering to standing rules and regulations that governing handling and disposal of chemicals on farms. The user should read the label on the package or container for any specific advice on waste disposal. The standard practice is that empty agrochemical containers should never be reused except possibly, if in good condition, to contain an identical product transferred from a deteriorated or leaking container. All other containers should always be cleaned thoroughly before disposal. They may be cleaned in accordance with the labeled instructions. In the absence of instructions, rinse the containers in water successively at least three times. Care should be taken to ensure that the water used for rinsing does not contaminate the environment. After cleaning, the containers should be punctured in several places or crushed to make them unusable and stored in a secure compound until their disposal is arranged. Packages of dry powders and granules must be shaken out thoroughly into a mixing vessel or the applicator tank. Containers may be buried on premises owned or occupied by the agrochemical user. The burial site must be chosen carefully so that there can be no risk of pollution to surface water or groundwater and the area used should be fenced or marked with warning signs and a record should be kept of the dates and the material buried. During my fieldwork in the Chirumhanzu District, I observed some empty containers of toxic agrochemicals thrown around the area. Some of the empty containers were used as storage for household goods like mealie meal, sugar, salt, water, and grain. Some of the empty containers were being sold openly in the nearest town (Mvuma) and Gweru- the provincial capital city. Those who were selling the containers and the buyers of these containers had no idea of the dangers of using the containers.

The malpractice in use and disposal of chemicals on the farms is not unique to Zimbabwe [6]. For this reason, World Health Assembly (2010) adopted two resolutions related to strategic approach to international chemical management including the management of pesticide. The two resolutions concerned improvement of health through safe and environmentally sound handling and disposal of hazardous chemicals in all member states. This could be achieved through a range of actions including adopting policies, enacting legislation and developing comprehensive plans, enhancing sense of social responsibility through awareness campaigns. In Zimbabwe, there are a number of policies that detail the requirement on the use and disposal of agro-chemicals and these include among others, the Public Health Act (PHA), Environmental Health Act (EHA), Animal Health Act (AHA) and Hazardous Substances Act (HSA). The A2 farmers in the District equally governed by these provisions but this research established that farmers in the District are not adhering to these acts and government is not doing enough to foster adherence to these acts by the farmers. What is clear is that our government has perfect policies on chemicals use and disposal, however, what is lacking is proper monitoring and evaluation of these policies.

Very few farmers in the district use personal protective equipment to reduce exposure to the pesticide. WHO guidelines give provisions on the type of personal protective equipment needed and these depend on the toxicity of the pesticide being used, the product formulation (e.g. liquid, wettable powder or granules), and activity (e.g. loading and mixing or spraying). Farmers are also encouraged to follow the requirements on the product label. Occupational Health and Safety Act (Section 6.97) indicates that the employer must provide the worker with suitable protective clothing and equipment if the worker mixes, loads or applies a pesticide, or cleans, maintains or handles equipment or materials contaminated with pesticide residues. Farmers should ensure that their employee use proper calibration all the time. This will prevent excessive exposure of plant to animals, plants and the general environment. Farmers should also ensure that correct nozzles are fitted to the sprayers. Use of inappropriate or ill-fitting spraying equipment led to excessive exposure to pesticides especially to those applying the chemical. Some farmers in the district under study were using branches to sprinkle pesticides on the cattle and most of them could not meet the minimum expected standards of protective clothing. This leaves the applicator at risk through skin

contact or inhalation of chemicals. Another challenge which farmers in the district met is the failure to correctly identify the pest. This lead to wrong diagnosis and wrong pesticides being applied by the farmers in the District. Continuous use of wrong pesticides lead to unnecessary exposure of the environment to agro-chemicals and probably resistance of pests and subsequently increase in the demand for stronger and more toxic chemicals to be used against the pests.

Lack of awareness by many people especially on the chronic effects of pesticides on human health has led to most people dealing with pesticides adopting a casual attitude towards the use of protective clothing. Some of the negative effects on human health may persist even after the termination of an acute poisoning incident ([7]: 133-199). Hence pesticide abuse which is rampant in the District is partly due to ignorance. Failure to observe the safe period between time of spraying and harvesting especially when milking cattle or consumption of meat after the cattle died within seven days after spraying. Many farm workers unknowingly eat or sell animal products which are contaminated by pesticide residue. This means that the extent of individual and environmental damage in Chirumhanzu farms could be extensive hence the need for more research within the District. Donors and private organization can be robbed in to provide the necessary resources needed for research to be conducted. Logically, the success of pest control programme depends, inter alia, on how well pesticide applicators carry out their job. This, in turn, requires practical training in the handling, preparation and proper application of vector control pesticides, as well as in safety precautions for the applicators' own protection and for protection of the public and the environment. Public administrators in the MoHCC should ensure that each farmer in the District have a training schedule for themselves and their employees. Trainings should be done on regular bases and each farmer should have evidence of training within reach for easy monitoring and evaluation. The administrators could provide certificates to each employees which shows where the training was done and when the training was done. This will assist those farm employees who may want to seek greener pastures in other farms. It will also be easy for the administrators to conduct refresher causes for the employees on the use of protective clothing. For purposes of sustainability, individual farmers could be requested to contribute in or kind towards funding the training programmes.

A multi- sectoral approach to educating the farmers is necessary. Private players, donor agencies, MoAMID and MoHCC are some of the key players in providing education to farmers in the District. Various approaches can be used in ensuring that health information researches the targeted farmers in the District. For example, pamphlets and flyers can be designed and distributed to the farmers. Various media for communication can also be exploited for example, ordinary messaging through cellular phone, WhatsApp messaging, radios and televisions. Billboards can also be erected within the area so that farmers and their employees are constantly reminded on the importance of proper use and disposal of agro-chemicals. The Occupational Health Act (OHA) of 1991 recommends that farmers or farm workers should thoroughly wash their protective clothing immediately after use to avoid self- contamination. Gloves and boots should be washed before removal and the inside should be thoroughly washed, rinsed and dried. Goggles and face masks must equally be washed and dried. Farmers in the District are not well versed with management of protective clothing. They need to be educated on the procurement, wearing, removal and storage of protective clothing as this is key in preventing self- contamination. Ill- fitting or worn- out protective clothing should be avoided. Proper storage is also key to avoid tearing or further contamination of protective clothing. Proper demonstration should be done to farmers and farm workers during training and films which showcase the use of protective clothing and the dangers of their mismanagement can also be shown to the farmers.

### Knowledge and expertise of the farmers on the effect of chemicals to the environment

The environmental impact of pesticides consists of the effects of pesticides on non- targeted species. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their targeted species because they are sprayed or spread across entire agricultural field [8]. Runoff can carry pesticides into the aquatic environment while wind can carry them to other fields, grazing areas, human settlements and undeveloped areas potentially affecting other species. Such undesirable effects have led many pesticides to be banned, while regulations have limited or reduced the use of others. Farmers in the District must be made aware of these environmental challenges so they take well informed precautional measures to minimize environmental damage through chemical leakage. Article 5.1.3 of the Code of

Conduct stipulates that governments should carry out health surveillance programmes for those who are occupationally exposed to pesticides and should both investigate and document all cases of pesticide poisoning. The need for this action is endorsed by WHO's (2010) study that concluded that the lack of data on agro-chemical poisoning is evident in the African and Eastern Mediterranean regions, where about four-fifths of countries indicated that they have no such data.

Improper disposal of agro-chemical containers have an adverse effect on the environment. For instance leakages and seepage of these chemicals into the soil may end up contaminating rivers and dams. Farmers then do fishing from these water bodies while their domestic animals drink water from the same sources. Contaminated fish, animals including vegetable are a danger to health if consumed. The study established that most empty pesticide containers are either being reused to store food items and water or they are sold prior to checking if there are no dangerous residue left inside. The fact that the district does not have an accurate data base of poisoning is worrisome. Article 5.1.5 of the Code of Conduct calls upon governments to establish national or regional poisoning information and control centers at strategic locations to provide immediate guidance on first aid and medical treatment of poisoning cases at all times. The pesticide label contains vital information about pesticide hazards. Some labels indicate how the containers can be disposed of. Literacy levels of farmers in the District is high, but it does not imply that all the farm workers can understand English or the technical jargon on the labels. It is therefore important that the manufacturers use the local languages for effective communication. Most farmers in the District use Shona and Ndebele as their language of communication and the research recommend the use of such languages on the pesticide labels. The functionalist theory of public management, in which this study is premised views education as critical in dealing with public issues. Lack of proper education on the use and handling of agricultural chemicals by farmers could be counterproductive. The general importance of health management education can be reflected in massive budgets that nations spend on health and by the large number of people it employs.

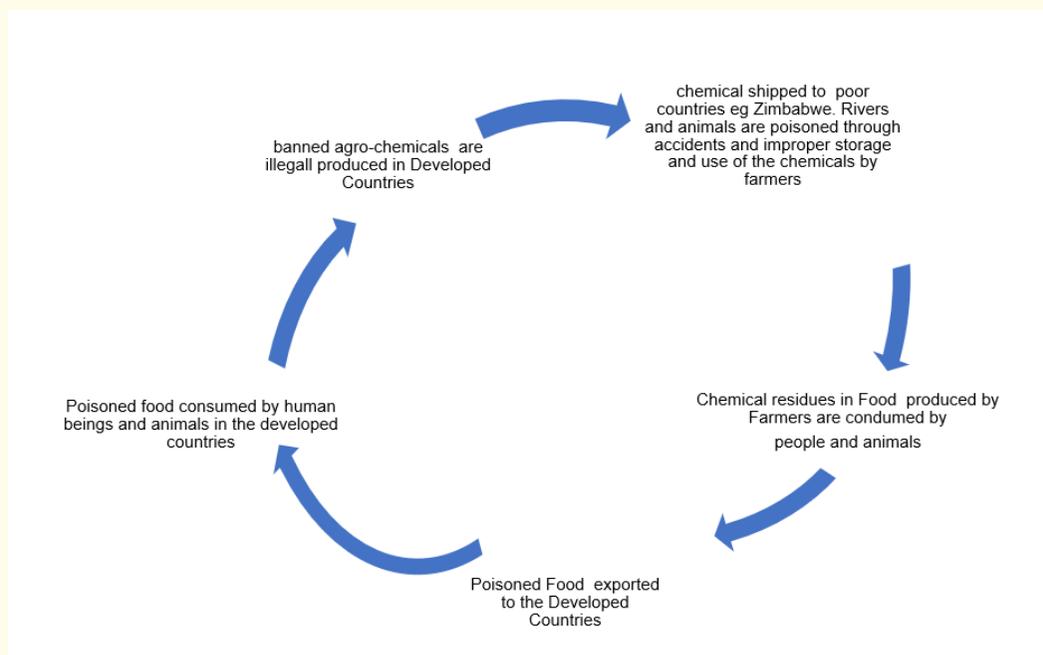
This paper ranked factors being prioritised by farmers when purchasing agro-chemicals. Top on the list of the factors were cost and toxicity. The fact that farmers are less concerned about the legality of the chemicals and whether or not the vendors are licensed to sell the chemicals could be supporting underground operations. The fact that some of the retail outlets and manufacturers are not registered could signify their failure to meet the minimum requirements in terms of quality and process of producing the chemicals. The above finding contradicts Muchena's assertion that Zimbabwe has a proud record of safe use of agro-chemicals because of excellent co-operation between the chemical manufacturers, retailers, consumers and legislative officials (Muchena 1991). These unregistered dealers might not cooperate with government in managing use and disposal of agro-chemicals in the District. Yet, Article 5.3.3 of the Code of Conduct states that government and the pesticide industry should cooperate in further reducing risks by establishing services to collect and safely dispose of used pesticide containers and small quantities of leftover pesticides.

### Storage, use, and disposal of the chemicals by the farmers

The study established that in all farms, toxic chemicals are not stored in accordance with government regulations. Government Regulations state that toxic chemicals should be stored away in storerooms. Such rooms should have concrete floors and the walls should be washable (Medicines Control Authority of Zimbabwe, 2010). Farmers should adhere to these regulations for the benefit of society. WHO Article 5.1.3 of the Code of Conduct for its Member States stipulates that governments should carry out health surveillance of those who are occupationally exposed to pesticides and investigate, as well as document, cases of poisoning. It is important for the public health officials to establish a mechanism for verifying and certifying the safety and quality standards of pesticide application equipment. This will assist in minimizing the rate of exposure and environmental pollution. Most of the equipment used by the farmers were either ill-fitting or leaking and those who were using them were not properly trained. In some farm, some workers were improvising the equipment using brooms or tree branches for spraying. This compromised the health of the workers and the environment due to excessive to exposure and lack of calibration which leads to inappropriate measurements being used. The WHO established specification guidelines for equipment for pesticide control (WHO, 2010a). The guidelines provide the minimum required standards and are intended to assist national authorities in selecting good quality equipment for pesticide control.

Safe storage of pesticides involves the control of all factors that may cause deterioration or potency of the stored products. Ideally, pesticides must be stored in their original containers, under lock and key away from food and where children have no access. Disposal of pesticide waste include everything from redundant out-dated formulations with high pesticide content to contaminated containers, left over spray solutions and rinse water. There are three recommended procedures for disposal of pesticide waste and these include, incineration, hydrolysis and burying or dumping in an approved landfill. Farmers should only mix the quantity of chemical that can be applied in one day [9]. The people on the farms come into direct contact with pesticides and other agricultural chemicals due to poor knowledge on pesticide safety as well as unsafe working conditions. There is need to quantify the health cost and impact of these chemicals on both households. Compulsory routine medical checkups are advisable in these areas. Costs and the lack of legislation that forces people to go for routine medical checkups are some of the reasons why people exposed to these chemicals are not taking routine medical checkups.

The fact that the people on these farms are not examined regularly, affects the reliability of exposure data in the district and by inference to the nation. It would work out better if farmers are forced to have routine checkups. Available records would lead to firm and decisive regulations on use and disposal of agro-chemicals. This is happening at a time when the country is in the process of phasing out the use of pesticides that are no longer accepted as safe health-wise and environmentally sound. These include ethylene di-bromide and methyl bromide. Used in soil fumigation in tobacco production. These are considered highly carcinogenic and mutagenic by the U.S Environmental Protection Agency. Some poisonous agro-chemicals are produced in the developed world and traded in poor regions of the world. While it is true that the effect of these chemicals on the environment could be more pronounced in poor parts of the world because of the lack of adequate information on use and disposal of the chemicals, the developed countries also stand to suffer similar consequences. One of the concern is the amount of residual pesticide that end up at the tables and the other concern is the amount of pesticides that drain into the water supply system. The figure 1 below is a cycle of food poisoning.



**Figure 1:** The circle of food poisoning.  
 Source: Researcher’s initiative.

More specifically, the food poisoning cycle can be illustrated as: the United States of America (USA) is a leading producer of pesticides.

There is a critical shortage of data on pesticides exposure in Chirumhanzu District, resulting in an inability to evaluate the true environmental and human health impact of agro-chemicals in the district. More so, little is known about the effects of long term exposure to pesticides in food. This difficulty in getting accurate information in this regard was also observed by Chimhowu, Feresu and Manjengwa [10] whose study concluded that many developing countries (districts) do not keep track of exposure data, and those that do often fail to report the data to central organizations like the United Nations. Most of the literature show that exposure data is outdated and available only through special interest groups or from international organizations that currently suffer from budget shortfalls. The most recent comprehensive exposure study was conducted by World Health Organization in 1988 and the findings were that globally over one million exposures are occurring annually. Although domestic and international efforts are moving toward full disclosure of the dangers and proper use of pesticides, no single set of rules can ensure the safe use of pesticides under every condition [11]. Instructions and restrictions apply to specific pesticides, formulations, application methods and commodities. In an effort to help resolve these this problem, government and industry alike should allow strict PIC procedures. Demanding good conduct on the part of industry in exchanging toxicological information between states, and having rules on trading, labeling, packaging, storage and disposal will have a beneficiary impact. The current trend in the pesticide industry involves more training time for agricultural workers and the greater company efforts to monitor pesticide use.

Current initiative to curb pesticide trade problem offer little assistance in resolving exposure problems without a firm commitment by the world's key chemical exporting countries. The voluntary nature of international soft law scheme render them virtually unenforceable in today's lucrative international chemical markets. More-over until the international market reflects a level economic playing field, powerful domestic lobbies will likely defeat USA. Initiatives on a legislative level. Incentives greater than money must exist before key chemical producing would submit to a convention mandating responsible trade. Perhaps proponents should stress the potential loss of life and the danger of domestic food safety, in hopes that ethical and moral motivations will prevail. Although systematic estimate of overall exposure could not be ascertained by this study, there is no doubt that farm workers, farm households, consumers and the environment are exposed to dangerous levels of pesticides. Direct observation of farmers handling, spraying and disposing of pesticides show that they are significantly exposed at work. There is a need for biological measurements of metallic and organo-chloride pesticide residue in people's bodies and of acetyl-cholinesterase enzyme depletion in people in the District. Better still, new studies should be carried out to expose the presence or persistent of bio-accumulative pesticide residues in foods, body tissues and breast milk in consumers far removed from the farms.

The study established that the farmers procure the chemicals from any source. The need to control this aspect is should be emphasised given the fact that there are weak provisions on anti-dumping of chemicals and strict rules of origin of some of the agro-chemicals being used by the farmers. The poor capacity for enforcing the regulatory environment allows the excessive and unsafe use of toxic agro-chemicals and results in pollutants in food, drinking-water and the environment, all of which pose a significant risk to human health. The availability of substandard, illegal and counterfeit agro-chemical products on the market is also of great concern; these products not only fail to deliver the expected efficacy and performance but also present a substantial risk to human health and the environment. This view point was also noted by SAPRIS (2000) when they asserted that the SADC Trade Protocol of 2000 was complicated by its weak provisions on anti-dumping and strict rules of origin on some agro-chemicals products. Resolution 63.26 of the 63<sup>rd</sup> World Health Assembly (WHA), on improvement of health through sound management of obsolete pesticides and other chemicals, urges Member States to establish or strengthen capacity for the regulation and sound management of toxic chemicals throughout their life-cycle as a means of avoiding the accumulation of obsolete chemicals [12]. These chemicals have both short term and long term effects on the users, the public and the environment. Management of agro-chemicals in the country in general and the District in particular should be a first priority for sustainable human development in Zimbabwe [13-15].

### Conclusions and Recommendations

Agro-chemicals are vital in sustaining Zimbabwe's agricultural sector in terms of food security, foreign exchange generation, employment and provision of raw material for the manufacturing sector. On the other hand misuse or continuous use can have adverse effects on human beings and the environment. This research established that most farmers in Chirumhanzu district are not aware of the GOZ Regulatory framework for safe disposal of pesticide containers or pesticide waste. Therefore, it is imperative that public health officials increase awareness programmes of the regulation provisions. This could be achieved through the print and electronic media or can be communicated through cell phones. The available opportunity for making this recommendation a success is that over 94 percent of people in Zimbabwe have a cell phone. Use of local language on labeling agro-chemical is very crucial. The fact that most farm workers in the District are literate does not mean that they are able to understand the technical jargon used on pamphlets. The pamphlets should inform farm workers and this means the pamphlets should contain simply language, which can be understood by any laymen. They should also contain the local language which could either be Shona or Ndebele. This will allow farmers to be adequately informed about the use and disposal of agro-chemicals. Those who sell agro-chemicals should be actively involved in educating farmers on management of agro-chemicals at the point of sale. A2 farmers associations in the District should be encouraged to form health committees whose mandate is to monitor the adherence by farmers to best practices in the use and disposal of agro-chemicals and other issues which affect their areas.

### Bibliography

1. Public Health Bill 2017.
2. Kavhu S and Rumhungwe M. "Contaminated tap water kills 320: water pollution likely to have long term effects". In The Sunday Mail (2014).
3. Government of Zimbabwe. Constitution of Zimbabwe Amendment (No.20) Act 2013. Harare: Fidelity Printers and Refiners (2013).
4. Adams GR and Schvaneveldt JD. "Understanding Research Methods". Longman: London (1991).
5. Patton MQ. "Qualitative Evaluation and Research Methods". (2<sup>nd</sup> Edition). Newbury Park, CA: Paul Chapman Publishing (1990).
6. Manjeru P. "Cotton Insect Management Practices by Smallholder Farmers in the Mid- Zambezi Valley: Safe and Effective Pesticide Use Practices and Their Extension Through Farmer Field School". Department of crop Science, Faculty of Agriculture, Harare: University of Zimbabwe (2004).
7. Ecobichon DA., *et al.* "Neuro-toxic effect of pesticides. The effects of pesticides on human body". Princeton Scientific Publication Company. Princeton (1990).
8. Papendick RI., *et al.* "Environmental consequences of modern production agriculture: How can alternative agriculture address these issues and concerns?" *American Journal of Alternative Agriculture* 1.1 (2007): 3-10.
9. Oudejans JH. "Agro-pesticides: properties and functions in integrated crop protection economic and social commission for Asia and Pacific". Bangkok: United Nations Publishers (1991).
10. Chimhowu A., *et al.* "Moving Forward in Zimbabwe: Reducing poverty and Promoting Growth, 2<sup>nd</sup> edition". Harare: Institute of Environmental Studies, University of Zimbabwe (2010).
11. Rayner G and Lang T. "Ecological Public Health: Reshaping the conditions for good health". New York: Routledge (2012).
12. WHO. "Healthy Cities in Action: 5 case studies for Africa, Asia, Middle East, and Latin America". Geneva: WHO (2000).
13. Gabriel T. "Pest Control, Pest Management and the Human Factor". *Tropical Pest Management* 35.3 (1991): 254-256.

14. Parliament of Zimbabwe Report. "Chirumhanzu- Zibagwe Profile". Parliament Research Department. Zimbabwe (2011).
15. The Constitution of Zimbabwe. "COPAC Final Draft for Referendum". Harare (2013): 345.

**Volume 4 Issue 4 April 2020**

**©All rights reserved by Matunhu Viola.**