AGROCHEMICAL SAFETY AND HEALTH INFORMATION USAGE AMONG FARMERS.

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ABSTRACT

The need to increase and improve the quantity and quality of farm produce has led to increase use of agrochemical by both small and large scale farmers. However, there are other corresponding cost brought about by an increase dependence on agrochemical among which include harmful effects on human health and environment. Illegal marketing of agrochemical, low illiteracy level and poor understanding of safety and health information are some of the greatest challenges in the use of agrochemical. Information is said to be ‘’Power’’ and as such the adherence to agrochemical safety and health information (product label) will no doubt help to reduce the incidence of agrochemical hazards as meeting the minimum necessities of occupational health standards is viewed as one of the most important components of sustainable agricultural development.

Keywords: Agrochemical, Safety and health information, Farmers

INTRODUCTION

The need to feed the ever increasing population in the world has been one of the major issues especially in the third world countries who are backwards in terms of modern agriculture. The United Nation Population Division (UNPD) (2007) has reported that the World has witnessed population growth over the last 100 years by nearly fourfold and it is projected to increase from 6.7 billion to 9.2 billion by the year 2050 consequently, the demand for cereal is expected to increase by almost 50 % by 2030 (Food and Agriculture Organization (FAO), 2007). The decrease in food production can be attributed to the effect of flooding, desert encroachment, climate change and increase in conflict which has paralyze food production and has dislocated millions of refuges. However, increase in food production cannot be achieved without the use of improved farm inputs like agrochemical (United Nations, (UN) 2015).

Maize has been regarded as one of the most important cereal in the world as a result of its high economic importance and numerous uses (for domestic consumption in addition to its industrial use by flour mills, breweries, confectioneries and animal feed manufacturers). In the world, it is ranked third after rice and wheat, also in Nigeria it is one of the most important cereal crops especially in the middle belt of Nigeria (Offiah, 2015). Ironically, maize as a result of the various domestic uses shows a domestic demand of 3.5 million metric tonnes which outstrips supply production of 2 million metric tonnes while maize area forecast for the year 2020 was 9229.74 thousand hectares with lower and upper limit of 7087.67 and 11371.81 thousand hactare, respectively (Badmus *et al.*, 2011). Forecast of maize production showed an increasing trend. As a result of its high demand, maize is gradually becoming less affordable for poor consumers, thus the need for its increase production can never be over emphasized and invariably, the use of agrochemical will also increase (Badmus *et al.*, 2011).

Agrochemical implies all chemical products which are manufactured or processed for use at work in agriculture and agro-allied industries to increase productivity and control pest and diseases (Omari, 2014). It encompasses fertilizers, pesticides (herbicides, insecticides, rodenticides, and fungicides), and plant regulators. In bid to control maize pests such as stem borers, armyworms, silkworm and weevils, weeds and maize diseases such as downy mildew, maize rust, leaf blight and leaf spot for improvement in productivity, maize farmers have over the years resorted to the use of agrochemical. Mc Acthur and Mc Cord (2014) reported that agrochemical increase crop yield which leads to economic growth. The use of agrochemical for crop production has been on the increase and an estimated 2.5 million tonnes of pesticides are applied to agricultural crops worldwide each year (Nnamonu and Onekutu, 2015). In Nigeria, an estimated amount of 125,000-

130,000 metric tonnes of pesticides is applied each year (Aderonke, *et al.* (2017) and Asokwa and Galvin, 2009).

However**,** FAO has caution farmers on the excessive application of agrochemical as these can increase the risk of having residue in crops and farm environment. Zia, *et al.* (2010) in Ajmer, *et al*. (2017)) reported that residue of cereals showed that wheat contained the highest concentration of tested agrochemical than maize and rice while maize contained a much higher concentration of agrochemical than rice. According to World Health Organization, each year, about 3,000,000 cases of pesticide poisoning and 220, 000 deaths are reported in developing countries (Lah, 2011). Furthermore, about 2.2 million people, mainly belonging to developing countries are at increased risk of exposure to pesticides (Hicks, 2013). Children may also be exposed to agrochemical through forms of hazardous child labour involving fieldwork, spraying agrochemical or washing their parents' contaminated work clothes.

Safety refers to the state of being protected from agrochemical related hazards. Safety and health practices and/or information on agrochemical therefore seeks to identify a product and describes how, where and when it should be used. It is then complimented with details of potential hazards, good practices, safety precautions, first aid instructions and advice to health personnel (International Labour Organization, (ILO), 1991). Before using any agrochemical it is always recommended that the user read, understand and comply with the safety and health practices/information.

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Muhammad *et al*. (2011), reported that the use of pesticides as crop protection technology began in 1952 in Pakistan and the Government support increased rapidly over the last two decades reaching 1, 175, 13 metric tonnes in year 2005-06 which was only 12530 metric tons in 1985.

Types of Agrochemical

Jerry and Hans (2007) reported that herbicides are the most commonly used type of agrochemical since weeds are the major problem that reduce yield in many crops. Muhammad, *et al*. (2011) reported that most of the agrochemical used are insecticides. Adeola, (2012) on the other hand reported that pesticides and fertilizers are the agrochemical commonly been used by vegetable farmers in Ogbomoso, Nigeria. While, Khalid *et al.* (2013) reported that 87.7 percent of the farms apply fertilizer to their crop, about 77.1 percent used one or more type of pesticides while 60.1percent of them use insecticide. Julius *et al. (*2012) and Adesiyan, (2015) in a work titled Economic Analysis of Maize Production in Osun State indicated that fertilizer, herbicides and pesticides where the agrochemical used by maize farmers in the study area. Banjo *et al.* (2010) in their work titled Farmers' Knowledge and Perception towards Herbicides and Pesticides Usage in Fadama Area of Okun-Owa, Ogun State of Nigeria reported that pesticides and herbicides where the agrochemical used by the farmers. Morealso, Iyaba (2013) reported that herbicides was the major agrochemical been used by horticultural farmers in the study area.

Agnes *et al*. (1993) opined that all the interviewed farmers reported to have use one form of agrochemical or the other for their crops growth and protection. The main groups of agrochemical used according to the author included insecticides, fungicides, herbicides and fertilizers (inorganic and organic manure). Opaluwa *et al*. (2014) and Mohammed *et al.* (2013a) in their separate work reported that herbicides, pesticides and fertilizer were agrochemical been used by the farmers in their separate study area. Salau *et al*. (2011) also reported that the major agrochemical used were attracine karate and Paraquate which are all insecticides.

Sources of Information on Available Agrochemical

Mahantesh *et al*. (2009) reported that about 36.5 percent of respondents were solely dependent on pesticide dealers, followed by public extension system agents / personnel (27 percent) as well as information from fellow farmer/friends (13 percent). Gitahi, (2014) reported that about 40 percent of the respondents got information on agrochemical from other friends, 20 percent from open market while 15 percent and 5.3 percent from agricultural extension officers and researchers respectively. Furthermore, radio represented about 7 perecent while other minor sources include television, newspapers and internet. Farmers' previous experience and commercial agrochemical sales forms the major source of information on agrochemical among the farmer (60 percent). The author further stressed that farmers got information on agrochemical mainly from among themselves and commercial agrochemical sales is of concern as there is no guarantee on the quality of agrochemical or information passed.

Awareness on Agrochemical Safety and Health Practices/Information among Farmers

Gobusamng *et al*. (2012) reported that all of the farmers interviewed (100 percent) said that they read and followed the directions on the pesticide containers. In Brazil, Waichman *et al*. (2007) reported that 72 percents of the farmers did not read pesticide safety and health information while in Turkey all farmers that were interviewed said that they read safety and health information (Isin and Yildirim, 2007). Mustapha *et al*. (2017) reported that Kuwaiti farmers' level of understanding of agrochemical safety practices is insufficient as over 70 percent of them did not read or follow pesticide safety and health information. Taj-al-Din *et al*. (1999) in their work titled Agricultural pollution and the environment in the Kingdom of Saudi Arabia mentioned that 55 percent of farmers complied with the information available on the packaging labels. About 62 percent of the farmers in the study area tends to get information on how to apply agrochemical through friends

while relatively few of them read the safety and health information to know the key elements of the agrochemical and anti-poison instruction. The authors stressed that agrochemical packaging must contain all the relevant instruction on the use, its application procures and its hazard level. Information on how to apply, the quantities, periods of prohibition and all the necessary precautions to be observed, during and after use must be written on the labels. Gobusamng *et al*. (2012) reported that 73 percent of mature and experienced farm workers mentioned that they read safety and health information rapped to the pesticide containers before using them. Clyde *et al.* (2012) recommended that before handling, compounding, packing or applying any pesticides, uses should read the product safety and health instructions carefully. Reading and adhering to instruction among farmers usually help to reduce hazards associated with the use of agrochemical.

Methods use to Disseminate Safety and Health Practices/Information

Methods used to relay agrochemical safety and health information changes with change in farmers socio-economic characteristics. Educational resources usually save as an important guide in encouraging farmers and their families to compile with safety instruction and practice which will help change their attitude when handing agrochemical **(**Shari *et al*., 2017). Over the years, researchers had come to find out that various farmer characteristics are in line with preferred information sources. A study on the preferred information sources of cotton farmers who use agrochemical revealed that majority of the farmers rely on extension resources and they tend to be younger, have big farms, higher incomes, and rent larger proportions of land as compared to other groups (Velandia *et al*., 2010). Jensen *et al.* (2009) opined that highly educated and younger farmers were more likely to use a wide range of information outlet while female farmers prefer interactive, hands-on and educational resources in different formats (Barbercheck *et al*., 2009).

Ngathou *et al.* (2006) reported that farmers' characteristics also are related with their perceptions of a particular information outlet. Additionally, when addressing hazards and farm injury prevention, it is necessary to use communication resources that stimulate people to take action (Shari, *et al*. 2017). Due to the earlier stated reasons, it is always important for those that manufacture, design, package and deliver to put into consideration the farmers perception and socio-economic characteristics agrochemical when carrying out their various activities (Seiz and Downey, 2001). Shari *et al*. (2017) reported that internet, social media, and e-mail messaging are the most preferred sources of information for farmers that are less than 35 years of age as compared to the older farmers. Farmers with ages greater than 56 years prefer local papers as a source of farm safety and health practices/information while farmers with age less than 35 years attend kids' safety events and school programs more than older farmers. The authors also reported that younger and middle aged farmers prefer using informational websites significantly more than older farmers.

Furthermore, farmers who received 76–100 percent of their incomes from farming were more likely not to use information from the educational materials as oppose to farmers who received 26–75 percent of their incomes from farming. Materials that encompassed general or simple languages were mostly preferred over those that have technical terms. Photographs or a combination of photos, drawings, and cartoons were preferred visual images. Materials signifying lifelike, easy-to-use approaches and materials directed at youths and children were favorite over materials listing applicable protective equipment. Images showing familiar farming practices and useful prevention strategies inspire use of resources. Content that is too technical, information farmers have received previously, unpleasant images and unpleasant language discourage use of resources. One-page fact sheets were mostly chosen, although two-page fact sheets were also

acceptable. On the other hand, one- to two-page articles and publications were preferred while videos lasting less than 5 or 10 min were mostly preferred (Shari *et al.,*2017).

Caffaro *et al*. (2017), Caffero *et al.* (2015), Tebeaux *et al.* (2010a) and Tebeaux *et al.* (2010b) reported that respondents' often love preference for non-technical farm safety and health materials. Furthermore, many resources on agricultural safety are mixed-up and overwritten, and as such these material are not read, this was considered as an essential point for safety and health specialists to consider as they produce educational materials. The authors also recommended that literacy levels and educationally appropriate communication schemes should be considered when creating materials for a range of uses.

Training on Use/Handling of Agrochemical

Franklin *et al*. (2017) reported that there have been cases where farmers over apply agrochemical than the recommended quantities or repeatedly application per season as a result of the fact that a good number of the farmers in the country cannot read, lack basic and formal training on agrochemical handling and recommended personal protective equipment. Chemicals that have been washed from sprayed farms usually contaminate food crops and even spread to affect water bodies. The problem usually becomes more serious when farmers wash their knapsack sprayer and clothes in water bodies during and after spraying.

Muhammad *et al*. (2011) reported that only 8 percent of the farmers received basic training on appropriate techniques of handling pesticides, while 89 percent said that they neither had any access to nor did they know who provides this training. Gobusamng *et al*. (2012) opined that most farmers especially with basic training on the use of pesticides are usually concerned about having direct contact with pesticides which might seriously affect their health in the present and that of their children in the future.

Tadesse *et al*. (2008) reported that various training modules concerning agrochemical were provided out of which 33.9 percent indicated that they were trained on pesticide issues. Among farmers who received training, 26.3 percent indicated that they were trained on how to handle pesticides, 12.1 percent were trained on proper handling, 7.1 percent were trained on fertilizer application, 7.1percent were trained on disposal, 12.3 percent were trained on application skill and 10.7 percent were trained on harmful effects of agrochemical on the environmental. Gitahi (2014), reported that training of farmers on proper handling of agrochemical handling was low with only 17 percent having been trained on pest control, 3 percent each for agrochemical hazards on environment and human health, 0.2 percent on fertilizer use knowledge and 69 percent having had no training. Kesner *et al.* (2015) in their surveys revealed that there seems to be a lack of awareness among farmers who received training on agrochemical use about the harmful effect of the products on human health.

Effects of Agrochemical on Plant Output

The immediate outcome of pesticides use is referred to as its effects. Adoption of improve farming method and farm inputs such as agrochemical by farmers is basically to meet the need of the consumers, government and currently food processors and vendors. By so doing, they have been able to make many adjustments in the way they cultivate their crops, including the heavy use of agrochemical. Increase yield, crop protection, and elongation of shelf life of farm produce, ensure all year round availability of food at a cheaper price to ensure food security are the main reason why farmers use agrochemical. Greater crop production lies on systematic utilization of farm inputs especially commercial agrochemical (Shetty *et al.,* 2011). Today's skill-based agricultural

practices have had a bigger effect on increased food production across the world. Generally, the economic effects of increased production have been tremendous. Jerry and Hans (2007) reported that controlling agricultural pests (including diseases and weeds) and vectors of plant disease, controlling human and livestock disease vectors and disease causing organisms and preventing or controlling organisms that harm other human activities and structures are the three most important benefits of using agrochemical. The authors also reported that prolonging the viable life of the stored produce, preventing it from insect infestation which will in turn prevent huge post-harvest losses from pests and diseases can be achieved with the use of pesticides. Almaszabeen *et al.* (2018) reported that 62 percent of the farmers in the study area agreed that agrochemical are the solution for pest infestation and also increases levels of crop yield. Furthermore, Damalas *et al.* (2011) surveyed a total of 310 tobacco farmers and reported that large majority of the farmers (96 percent) viewed pesticides as an assurance for high yields and high product quality. Morealso, Akeem and Sofoluwe (2012) reported that herbicides play an important role in weed control in maize crop and thus positively affecting yield and yield components of maize.

Entry route of Agrochemical into Human Body

Wolfe (1973) and Iyagbe (2013) indicated that over 97 percent of agrochemical to which the body is subjected to during possible exposure situations is deposited on the skin. According to Akobundu (1987), 46 percent of all agrochemical been spray by farmers are deposited on the ankle. Requena, (2009) and Kesner *et al*. (2015) on the other hand reported that dosage, the time and duration of spraying, the route of entry into the body, the chemical composition and genetic properties are the major factors that determine the levels of hazards associated with the use of agrochemical. Clyde *et al*. (2012) reported that agrochemical can get into the body through three major ways;

- Through the mouth (orally),

- By breathing into lungs (inhalation) and most common.
- By absorption through the skin or eyes (dermally)

Toxicology Information Brief (1993) reported that a compound, such as chloroform, which dissolves promptly and can be found in drinking water are ways that people can unknowingly consume agrochemical. At the point when this water is utilized for drinking, ingestion becomes the course of exposure. When it is utilized for showering, introduction may happen because of inward breath of the steam or fog and from coordinate contact through the skin. Similarly, agrochemical can easily get into the human system through many ways or through more than one route if precautions are not taken. An agrochemical which is sprinkled can be breathed in, have direct contact with the skin when mixing or application and be ingested through nourishment if hands are not properly washed before eating. The entry route of agrochemical into human body are discussed categorically below.

Through the mouth (orally)

Lack of proper personal hygiene (washing of hands) can cause impurity on the lips and mouth or accidental swallowing of agrochemical. Also, it is dangerous to blow blocked sprayer nozzles in an attempt to clean it (ILO, 1991). Chemicals that mistakenly get into the mouth and are gulped don't generally harm the gastrointestinal tract itself except if they are chafing or destructive (ILO, 1991). Synthetics that are soluble during digestion usually remain in the body with the help of gastrointestinal track coating material while those that are insoluble in liquids during digestion are excreted out. Those that remain in the body are eventually transported by the blood to various internal organs where they can eventually cause harm (Toxicology and exposure guidelines

(2003)). Shetty *et al.* (2011) also opined that consumers may be affected by relatively low amounts of agrochemical residues in drinking water and through food products (long-term effects) or acutely through high doses caused by misuse, wrong application or overdose at the farm level.

Inhalation (By breathing into lungs)

Agrochemical that are in form gases, fine spray droplets, dust, fumes and smoke are often been breathed into the lungs while gases mixed with the air tend to remain suspended in the air for some time after release this is because these particles are so small or well dispersed that they cannot be seen International Labour Organization, (ILO), (1991). Spraying agrochemical without adequate precautions is noted to be a common cause of poisoning by inhalation.

Toxicology Information Brief (1993) reported that inhalation is the major route of entry of agrochemical that are in form of vapors, gases, mists or particulates. Once inhaled, agrochemical are either exhaled or deposited in the respiratory tract. If deposited, damage can occur through direct contact with tissue or the chemical may diffuse into the blood through the lung-blood interface. Upon contact with tissue in the upper respiratory tract or lungs, agrochemical may cause serious health impairment ranging from simple irritation to severe tissue destruction. Substances absorbed into the blood are circulated and distributed to organs that have an attraction for that particular chemical. Health effects can then occur in the organs, which are sensitive to the toxicant.

Skin absorption (or eye)

Agrochemical absorbing through the skin is one of the most common poisoning routes. Pesticides usually kill pest by penetrating the insect's skin or surfaces of plants considered to be weeds. Therefore, these substances can easily penetrate the intact human skin, if allowed to do so. Some

formulations that are toxic and contain penetrative solvent like petroleum products, xylene or kerosene are usually are hazardous to human. These substance can penetrate through the farmers cloth unnoticed (ILO,1991).

Toxicology and exposure guidelines (2003) reported that hazards of agrochemical as a result of skin contact (dermal) can sometimes be moderately harmless while cases like redness or gentle dermatitis are more extreme impacts that tends to cause harm to humans when agrochemical come in contact with the. Numerous synthetic substances can unknowingly penetrates into the skin and be ingested into the blood system. Once ingested, they may cause harm to some vital organs inside organs. The eyes are sensitive to synthetic compounds as even a little introduction can make extreme impacts on the eyes or the substance can be ingested through the eyes and be transported to different parts of the body causing destructive impacts.

Injection

Injection which is another way agrochemical gets into the body occurs when a substances enter the body when the skin is penetrated or punctured by contaminated objects. Impacts would then be able to happen as the substance is coursed in the blood and saved in the objective organs.

Perceived Health Hazards Associated with the use of Agrochemical

As a result of about 2 million tonnes of waste (industrial wastes, chemicals, human waste and agricultural wastes such as fertilizers, pesticides and pesticide residues) that are been dumped into water bodies each day, several water bodies have been rendered unfit for both primary and/or secondary usage (United Nations Educational, Scientific and Cultural Organization (UNESCO) (2003)). Almaszabeen *et al*. (2018) reported that about 9.16 percent of cocoa farmers strongly agreed and 81.16 percent agreed that the pesticide use cause effects on human health. Also, Mustapha *et al*. (2017) reported that a significant number (82 percent) of Kuwaiti farmers reported

at least one symptom of acute poisoning immediately after applying or handling agrochemical, while 18 percent of respondents did not attribute any health problem encountered to agrochemical exposure. The most frequently reported symptoms were headaches (82 percent), skin irritation (58 percent), nausea (49 percent), itchy eyes (79 percent), dizziness (41percent), fatigue (50 percent), and coughing (22 percent). Other symptoms reported by respondents were poor vision, stomach ache, excessive sweating, shortness of breath and vomiting. When respondents were asked what action they took following an incident of poisoning, about 75 percent reported taking no action as the incident was minor or required only self-medication (chewing of cola nut). Only 5 percent of respondents reported a serious poisoning incident that required medical attention in a hospital.

Truong *et al*. (1999) in their work reported that eye weakness, experiencing body weakness, tiredness, headache and dizziness are some of the health challenges respondents experience as a result of inappropriate use of agrochemical. Adeola **(**2012) reported that farmers 'perception of agrochemical' include effects on the environment, harming beneficial insects, decrease biodiversity, contribute to air pollution, pollute streams, rivers and wells on non-target animals like birds and earthworms which ultimately affects the balance of ecosystem. Destroying some useful micro-organisms such as butterflies, bees etc that serves as agent of pollination can also leads to the extinction of some animals from the ecosystem cycle.

Agrochemical are considered a vital component of modern farming, playing a major role in maintaining high agricultural productivity. However, concerns about human health and environmental effects of agrochemical has become a thing of concern and has been on the increase over the past years (Van der Werf, 1996). They pollute water bodies thus making it unsafe for human use e.g. drinking, washing of farm produce, etc. The negative impact on human health and the environment by the use of agrochemical has not been known, especially, by farmers. The

excessive use of agrochemical more than the recommended quantity by farmers was as a result of advertisement from chemical sale agents. Many of the agrochemical used are persistent soil contaminants, which can stay for decades in the soil without decaying and in the long run affect soil conservation (Van der Werf 1996). Death as a result of agrochemical related poisoning are often caused by using agrochemical packages or containers after they are emptied of contents. Low literacy level, poor reading culture of agrochemical labels and sometimes lack of understanding of the agrochemical label are some of the reason why people still use empty container of agrochemical to store food and water.

Agrochemical that are applied to crops can volatilize and may be blown by winds into nearby areas, potentially posing a threat to wildlife (Sequoia and Kings, 2007). More importantly, the remains of these agrochemical are washed into streams which might serve as a source of drinking water for human and animals thus resulting to one ailment or the other depending on the concentration. Shetty *et al.* (2011) observed that most of the respondents are aware of agrochemical related symptoms and possible routes of their absorption. Awareness about the use of personal protective devices is common among farmers but there seems to be a weakness in translating the knowledge into practice. The use of agrochemical without wearing personal protective equipment creates substantial health impacts in all parts of the World. Agrochemical effects can be divided broadly into two categories:

• Acute effects, which appear immediately or very soon after exposure and

• Chronic effects, which may manifest themselves many years later and whose origins are often difficult to trace.

Gitahi, (2014) reported that 69 percent of the respondents had some ailment they attributed to agrochemical, of which 96.6 percent mentioned eye irritation, 48 percent skin irritation, and 10.7 percent had experienced stomach upset while 89.7 percent had experienced an irritation on more than

one part of the body due to inappropriate handling of agrochemical.

Shetty *et al.* (2011) reported that headache, irritability, dizziness, loss of appetite, nausea, muscle twitching, convulsion, loss of consciousness, chest pain, asthma, cough, running nose, vomiting, excessive sweating, diarrhea, burning on urination, abdominal pain, irritation of eye, temporarily and permanent loss of vision, weakness of arms, hands and legs, stiffeners of the waist, fatigue, and possible death as some of the hazards of agrochemical usage. Other include carcinogenic effects, neurobehavioral effect, reproductive deficits and diabetes.

Safety Measure Employed in the use/ Handling of Agrochemical

Iyagba (2013) reported that 58 percent of the farmers use Personal Protective Equipment (PPE), 51 percent talk during application, 39 percent throw away left over spray mixture into the water bodies, 36 percent wash and sell the containers, seventy percent wash their sprayers in running water, 73 percent took their bath after application while 23 percent experienced low crop injury due to over dose of agrochemical. Mustapha *et al*. (2017) reported that 58 percent of Kuwaiti farmers' did not use any Personal Protective Equipment (PPE) when handling agrochemical. The author also reported that although farmers' knowledge of agrochemical hazards was high, the safety measures employed by them were poor. Complete intervention measures to reduce the health and environmental risks of agrochemical, including agrochemical safety training programs for farmers, stringent enforcement of agrochemical laws and promoting integrated pest management and non-synthetic methods of pest control is needed among the farmers.

Agrochemical popularity has led to its extensive use and as such, there are serious concerns about health risks arising from the exposure of farmers when mixing and applying agrochemical or working in treated fields and from residues on food and in drinking water for the general population. Mishandling of pesticides usually as part of the operator error due to willful

negligence, lack of information or lack of training can pose serious health risk for farmers who are the major agrochemical users and are regularly exposed to pesticides in many ways (Reeves and Schafer 2003). Farmer's health challenges as a result of agrochemical use has a strong linkage with the method of application and handling procedure. (Damalas *et al*., 2011). The place and time of application to some extent influences the type of health symptom that manifests. The exposure of workers increases in the case of not paying attention to the instructions on how to use the agrochemical and particularly when they ignore basic safety guidelines on the use of personal protective equipment and fundamental sanitation practices such as washing hands after agrochemical handling or before eating (Damalas *et al*., 2011).

In general, the way in which agrochemical are applied has a strong bearing on the extent of agrochemical hazard on farmers. For example, leaks from joints in the application equipment may often cause farmers to come into direct skin contact with large amounts of agrochemical. Similarly, blocked or unsuitable nozzles of the spraying equipment affect the quality of application and increase the degree of exposure**.** Damalas *et al.* (2011) further stressed that agrochemical absorption through the respiratory tract is largely supported by changes in wind speed and direction during spraying. Also application on extremely hot and dry days promotes agrochemical drift and increases exposure while, spraying in poorly ventilated spaces, such as greenhouses, expose farmers to inhalation and absorption by skin of high concentrations of agrochemical. Spraying from the air can create a risk for farmers who are not involved in the operation, the population at large, food products left in the open and the environment as a whole. All the listed situations, which are common during agrochemical application, may result in direct and prolonged exposure of farmers to pesticides and may affect their health.

According to Asogwa and Dongo (2009), lack of adhering to safety precautions during

agrochemical application cause's contaminations and poisoning in the field. Unfortunately, investments in protective clothing, masks or gloves only pay back in terms of health and well-being, not in financial terms. Most farmers are ignorant of the hazardous effects of agrochemical and are very unlikely to buy protective clothing, especially in cases where they are scarce. In Nigeria generally, farmers do not wear any protective materials at all, no matter what agrochemical is being applied (Meijden, 1998). Other precautionary measures are scarcely observed by these farmers as they are found eating, smoking or drinking in-between spraying activities. The left over agrochemical and empty containers are not properly disposed as the containers are sometimes washed and used for domestic purposes. Mustapha *et al*. (2017) reported that protective measures during and after agrochemical application are important to reduce exposure to them. The author further reported that 58 percent of the farmers did not use any PPE when mixing or spraying pesticides. When respondents were asked to indicate the main reasons for not using PPE, lack of availability when needed (35 percent) and PPE being uncomfortable in the local hot and humid climate (90 percent), too expensive (65 percent) and slowing you down (29 percent) were the most reasons cited. Respondents (6 percent) also cited not experiencing any health problems from using pesticides as reason for not using PPE. Among respondents who reported using PPE, less that 5 percent wore all the recommended six key PPE items (coveralls, protective boots, glasses/goggles, gloves, respirator, and hat) as recommended by ILO (1991). The PPE most often used were protective gloves (61 percent), hats (42 percent), and glasses/goggles (48 percent). A significant number of respondents reported not wearing respirators (70 percent), coveralls (68 percent), or protective boots (54 percent) at all.

Adeola **(**2012), reported that knowledge of agrochemical misuse was regarded as failure to wear Personal Protective Equipment (PPE). Franklin *et al.* (2017) observed that maize farmer do not

use PPE during agrochemical application while one third of the maize farmers in the study area use agrochemical containers for buying of oil and drinking of water in the farm while others wash the spraying machine and containers in water bodies like rivers and streams. Okoffo *et al.* (2016), reported that farmers in Brong-Ahafo region of Ghana put on full Personal Protective Equipment (PPE) during agrochemical application.

Muhammad *et al*. (2011b) reported that another fact describing unsafe practices by farmers is the re-entry time in the field after application, 72 percent and 75 percent (poor and non-poor respectively) re-enter the sprayed field within 24 hours after agrochemical application. This shows that farmer's re-entry time in the area is very short which raise serious concerns because many of pesticides used by the farmers consist of organophosphate and pyrethroid mixture and they have essentially acute effects.

Also, Tadesse *et al*. (2008) reported that 55.2 percent store their pesticides in a separate place specified for pesticide storage but 31.3 percent store their pesticides anywhere in the house and 5.7 percent stored their pesticides in the kitchen. Regarding empty pesticide containers, 49.3 percent indicated that they use it for water and/or food storage, 33.2 percent indicated that they bury it in the soil and 7.1 percent indicated that they sell it. Furthermore, about outdated pesticides at the farmers' hand, 38.4 percent indicated that they continue using it, 24.4 percent indicated that they dispose it in the soil and only 17.1 percent indicated that they ask advice from a development agent. In line with expiry date of pesticides, only 24.9 percent consider the availability of it on the original container. Iyagba (2013) reported that as much as the horticultural farmers are adopting the use of herbicides, the usage should go along with health and safety education. Adeola (2012) reported that farmers were aware of using banned pesticides as misuse and also had knowledge of agrochemical misuse as failure to wear PPE. The author recommended that extension systems must

be strengthened to increase farmers' knowledge and understanding of the effects of agrochemical on the environment.

Conclusion

Although agrochemical has alot of benefit in terms of increasing output and protecting crop, but the benefit are far been outweighed by several health and environmental challenges due to their indiscriminate use. Literatures have shown that farmers even when literate do not usually read and follow manufactures instruction that are on the label hence the high incidence of agrochemical poisoning Morealso, accumulation of agrochemical residues in food grains and vegetables is as a result of their excessive use. However, the impact of agrochemical can hazards on human /environment and residues on crop can be minimized by adhering to manufactures instruction and observing personal hygiene.

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