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Full Length Paper

Economic Impact Of Pesticides Application On Farms To Improve Agricultural Output: A Critical Review

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Abstract

The paper lucidly reviewed the concept of pesticides, historical perspective of pesticides and its classification of pesticides. However, it also critically examined the economic benefits of using pesticides on crop farms and unveiled the effects of pesticides on man and the environment. The review succinctly elucidated the precautionary measures for pesticides application and safety practices to employ when applying pesticides to both field crops and stored products for maximum economic benefit

Keywords: Economic, Impact, Pesticides application, Farms, Improved Crop Productivity.

INTRODUCTION

Despite the fact that several pesticides are banned and restricted or unregistered in many countries despite them been listed as hazardous by the World Health Organization (WHO, 2012); Fagewonyomi (2015), Stated that many of them are still widely promoted and applied especially in developing countries where weak controls and dangerous work condition make their impact even more devastating. In view of the adverse environmental effects from the usage of insecticide, lack of awareness of health consequences by some farmers, it therefore becomes imperative to identify farmers and pest management practices in their farming activities by investigating farmer's awareness and perception about the effect of pesticides used in the environment.

The global population is projected to be 9 billion by year 2050, and food availability and people's access to the food are matters that are increasingly important. Pesticides can help reduce the yield losses caused by the pests (e.g. insect pests, pathogens, weeds), and to feed the increasing world's population (Verger and Boobis, 2013). Agriculture is one of the most dangerous occupations although it is the second largest sector in the world as a source of work force. A large number of agricultural workers and farmers suffer from work accidents and diseases every year (ILO, 2010). Each and all individuals are faced with some types of pesticide exposure, but farmers and farming workers are particularly at high risk of pesticide exposure due to added risk of occupational exposure (Hashemi et al., 2012a). Crop protection products particularly the use of pesticides against pests is one of several factors that are contributing to the huge growth in agricultural production. Pesticides are major inputs of the modern agricultural production, and due to their high capability and trustworthiness for crop protection against pests and warranty of high crop yields (Ahmed et al., 2011; Cooper and Dobson, 2007; Damalas, 2009; Fan et al., 2015). To protect human health against vector-borne diseases, for example, malaria, dengue, Zika fever, Chikungunya fever (Cuervo-Parra et al., 2016; WHO, 2009; Wilson and Tisdell, 2001), and to protect home sites, storages,

lawns from weeds, pathogens and both insect and mammal pests pesticides are also used (Nayak et al., 2015; Sarwar, 2016; Spliid et al., 2004).

Pesticides are chemicals usually synthetic sometime biologically used to kill or contain the activities of pests (Wikipedia, 2014). Crop damage from pest infestation often result in serious consequences, warranting the need to use pesticide. However, despites their benefits, pesticide are potentially hazardous to man and the environment when inappropriately handled (Larson, 2003). Factors such as balanced use, optimum dosing, correct application method and timing helps in ensuring improved agricultural productivity (Bhan, 2014). Use of agrochemicals has led to increased food production. However, exposure to other organisms during their application including human, is poorly controlled (Damalas, 2017). Their use has significantly increased the concentration of toxic materials in food and the environment, with negative effects on plant and animal health. (Anderson, 2016) The world health organization (WHO) has estimated that more than three million farmers in developing countries are poisoned by agrochemicals each year (WHO, 1992; Larson, 2003).

In Nigeria, agricultural sector is the major supplier of food, raw materials and 70% of Nigeria's population largely depend on this sector for survival (Olakunle, 2016). Due to the country's drive to increase agricultural production and the upsurge of different species of pest that damage and ravage agricultural products` in field and storage, farmers have resorted to the use of agrochemicals as an important control strategy (Ajibola, 2015). An estimated 125,500, 130,000 metric tons of pesticides are used annually (Asogwa, 2013). According to Rahman and Chime (2013), 7% of rice and yam farmers apply pesticides, and 41% of farmers apply pesticides to at least one food crop in Nigeria. The application of pesticides is often imprecise, with unintended worker exposures. Ogwa and Dongo (2013) on problems associated with pesticide usage and application in cocoa production in southern Nigeria found the use of pesticides for insect pest control has generated public health problems and environmental pollution in Nigeria.

Exposure to insecticides is one of the most important occupational risks among farmers in developing countries. In some situation exposure to insecticides can occur from accidental spills of chemical leakages of faulty spraying equipment (Ateya, 2016). The exposure of farmers increases in the case of not paying attention to the instructions on how to use the insecticides and particularly when they ignore basic safety equipment (Ajayi, 2018).

Concepts of Pesticides

The word pesticide is a general term used to describe a substance or mixture that kills a pest, or prevent or reduces the damage a pest may cause. A pest may be insects, mice, other animals, unwanted plants (weeds), fungi, bacteria, or viruses (WHO, 2013). Pesticides are chemical compounds that are used to kill pests or contain it (Wikipedia, 2014). Pesticides could also be defined as a substances used for destroying insects or other organisms harmful to cultivated plants or to animals. A pesticide is any chemical substance meant to kill organisms harmful to cultivated plants or animals (WHO, 2013).

Historical Perspective of Pesticides

Pesticides are used for a number of decades. People have been fighting with pest for centuries (Soloneski, 2016). Chemical experiment during the late 19^{th} and early 20^{th} centuries allowed human beings to begin to develop modern pesticides. Producing new mixtures with a right proportion made it possible to control unwanted organisms. Paris green was one of the first chemical insecticide uses in the united states in 1867 (Marcelo, 2016). By the late 19^{th} century U.S farmers were using calcium arsenate, nicotine sulphate and Sulphur to control insect pest in field crop except Paris green. Since the middle of the 20^{th} century these chemicals have been widely used to control pests. Crop damage from pest infestation often results in serious consequences warranting the need to use pesticides. However, despite their benefits, pesticide pose potential hazards to human health and the environment when in appropriately handled (Kishi, 2005). Despite increasing concern about overuse and misuse of pesticides in developing countries (Tijani, 2006). Where over 3 million people have suffered severe acute pesticide poisonings (Larson, 2003).

The indirect effect include negative impact on loss of biodiversity and irreversible changes to ecosystem (Ajayi, 2000), yet pesticides has been distributed throughout the world (Balaram, 2003).

In Nigeria, pesticides has proven to be indispensable tool in combating damage from pest and ensuring sustainable production with improved yield (Tijani, 2006). At the same time, the indiscriminate use of toxic substance has become a matter of national concern in Nigeria following revelations about high levels of DDT in the environment and human breast milk (Osibanjo, 2002). In Nigeria, as in many other developing countries, the largest proportions of chemical pesticide are used by resource poor rural farmers (Dinham, 2003).

It is likely that pesticide use and pesticide induced side effects will continue to increase in Nigeria where environmental legislation is either nonexistent or in effective (Osinbanjo, 2001) and such use is thus unsustainable.

Classification of Pesticides

There are different types of insecticides which include systemic pesticide, contact pesticides and ingested pesticides. All are either natural (organic), man-made (synthetic). Formulas, or preparations that are used to control or kill unwanted insect pest.

1.**Systemic Pesticides**

The most common application for systemic pesticides is through soil drenching. The pesticide is introduced into the soil where it is absorbed by plant roots. It then moves up through the plant to external areas leaves, twigs, fruits, branches) where it lays on the plant sure face area and is poisonous to any insect that come chewing on the plant (Stewart, 2018).

2. Contact Pesticides

Contact pesticides act like “bullets” aimed at a target and can only kill insects that are hit by its application. Common household insect spray acts much like a contact insect, it is ineffective as a preventative pesticide (Stewart, 2018)

3 Ingested Pesticides

Many other common household pest control substances are ingested pesticides that are placed throughout the home where insect will ingest the poison (Stewart, 2018).

4 Herbicides

These are yet another kind of insecticides that are used to kill infected plant. It is specifically used to destroy part of the plant that the insects feed on or the section of the plant where infection has spread. Fungicides are also from the same family of herbicides, they are used to kill weeds and fungi that are responsible for destroying the agricultural yield (Stewart, 2018)

5 Organic Pesticides

These are made from plant oils and fatty acids that are derived from plant or animals. They are eco-friendly and cause no harm to crops (Stewart, 2018).

6 Insecticides Soap

This is made of detergent or ivory liquid and can be sprayed on plant to protect it from being used to manage insects pests they are important for disease control and providing food and fibre for a growing world population (Wikipedia, 2014). Humans have attained important benefits from many uses of pesticides including (1) Increased yields of crops because of protection from defoliation and diseases (2) Prevention of much spoilage of stored foods (3) prevention of certain diseases which conserves health and has saved the lives of millions of people and domestic animals (Phillips, 2015).

ECONOMIC BENEFITS OF PESTICIDE

Pesticides enable farmers to produce safe, quality food at affordable prices. They also help farmers provide an abundance of nutritious all year round foods which are necessary for human health. Fruit and vegetable, which provide essential nutrients which are more abundant and affordable in grains milk and proteins which are vital to childhood development are more widely available because of lower cost to produce (Food animal feed (Food and Agricultural Organization, 2012)

Effects of Pesticides on Human Health

Health effect of pesticides may be acute or delayed in those who are exposed. Strong evidence also exists for other negative effect from pesticides exposure including neurological problems, birth defect, fatal death and neutron developmental disorder. According to Stockholm convention on pest and organic pollution (2012), nine (9) of the twelve (12) most dangerous and persistent chemical were pesticide).

Acute health problem may occur in workers that handle pesticides such as abdominal pain, distress, headaches, nausea, vomiting as well as skin and eye problems. Many student have examined the effect of insecticides exposure on the risk of cancer association have been found with leukaemia, lymphoma, brain, kidney, breast, prostate, pancreases, liver, and lung and skin cancer. This increased risk occurs with both residential and exposure (World Health Organization, 2013).Evidence link pesticide exposure to worsened neurologicalout comes strong evidence link babies exposed to insecticide with a low birth weight and had development defect, May be acute or delayed in those who are exposed. Many studies have examined the effect of pesticide exposure on the risk of cancer (Lowrence, 2017)

Association have been found north leukaemia, brain, kidney, breast, prostate pancreases, liver, lung, and skin cancer. This risk occurs with both

Residential and occupational exposure. Highly hazardous pesticides may have acute and chronic toxic

effect, and pose particular risk to children. Their wide spread use has caused health problems and often as a result of occupation exposure and accident or intentioned poisoning, however, the global impact of self-poisoning (suicide) from preventable insecticide ingestion has how ever been estimated to amount to 186,000 death and 4,420,000 disability adjusted life years (Dennis, 2002). Environmental consummation can also result in human exposure through consumption of residues of pesticides in food and possibly drinking water.

While developed countries have systems already in place to register pesticides and control their trade and use this is not always the case elsewhere. Guidance and legal frame works on the use management and trade on insecticides as well as proper storage and handing are available from international organization and international conventions these should be implemented globally (WHO, 2013).

A number of insecticides including dibromachloprophane and 24D has been associated with impaired and fertility in males. Insecticide exposure resulted in reduced fertility in number of Sperm, damage to germinal epithelium and altered hormone function. Additionally, studies have indicated that insecticides exposure is, associated with long term Respirationary problems (Phillips, 2014).

Precautionary Measures for Application of Pesticides

Pesticides are poisonous and must be used with caution; Read the label before opening a pesticide container; apply pesticides only on the crops in the situations stated on the label; don't carry pesticides together with food in a way that allows contamination of the edible items. Never transfer pesticides in a closed passenger vehicle. - keep pesticides in original containers until used store them in a level cabinet, building , or fenced area where they are not accessible to children, unauthorized persons, pests or livestock (Johnson, 2013).

Do not store food with pesticide, feed Insecticides are poisonous and unfortunately they can harm more than just the pests at which they are targeted. They are toxic and exposure to pesticides can cause a number of health effects, they are linked to a range of serious illness and diseases from respiratory problems to cancer. Pesticides can be acutely toxic, it means that they can cause harmful lethal effects after a single episode of ingestion, inhalation or skin contact (Alewu, 2012).

The Symptoms are evident shortly after exposure or can arise within 48 hours. They can be presented as:

Respiratory track irritation, sore throat and /or cough.
-allergic sensitization
-eye and skin irritation
- Nausea, vomiting, diarrheal.
- Headache, loss of consciousness.
- Extreme weakness, seizures and/or death (Alewu, 2014).

Pesticides can cause harmful effects over an extended period usually following repeated or continuous exposure at low levels. Low doses don't always cause immediate effects, but over time, they can cause very serious illness. Exposure to pesticides can be through contact with the skin ingestion, or inhalation. The type of pesticides, the duration and route of exposure, and the individual health status (e.g nutritional deficiencies and health/damaged skin) are determining factors in the possible health outcome. Within a human or animal body, pesticides may be metabolized, excreted, stored or bio accumulated in the body (Johnson, 2013).

The numerous negative health effects that have been associated with chemical pesticides include, among other effects, dermatological, gastrointestinal, neurological, carcinogenic, respiratory, reproductive and endocrine effects (Hayes, 2015). Carbamate pesticides, such as aldicarb, carbofuran and Ziram are another class of chemical pesticides that have been associated with endocrine-disrupting activity, possible reproductive disorders and effects on cellular metabolic mechanisms and mitochondrial function (Bouaziz, 2013).

Moreover, in vitro studies have revealed the ability of carbamate pesticides to cause cytotoxic and genotoxic effects in hamster ovarian cells and to induce apoptosis and necrosis in human immune cells, natural killer cells and also apoptosis in lymphocytes. There is also evidence for the ability of carbamate pesticides to cause neurobehavioral effects, increased risk for dementia and non-Hodgkin's lymphoma (WHO, 2014).

Current Agricultural pesticides include the wide production and extensive use of chemicals known for their ability to cause negative health effects in humans and wildlife and to degrade the natural environment (McConnell, 2012). Hazard or risk of using pesticides is the potential for injury, or the degree of danger involved in using a pesticide under a given set of conditions. Hazard depends on the toxicity of the pesticides and the amount of exposure to the farmers (WHO, 2014). The toxicity of a pesticide is a measure of its capacity or ability to cause injury or illness. Suspected chronic effects from exposure to certain pesticides include birth defects, toxicity to a foetus, production of being or malignant tumors, genetic changes, blood disorders, endocrine disruption and reproduction effects.

Some people are more vulnerable than others to pesticide impacts. For example, infants and adults to the toxic effects of pesticides, farm workers and pesticides applicators are also more vulnerable because they receive greater exposures. Immediate health effects from pesticide exposure includes irritation of the nose, skin causing burning, stinging and itching as well as rashes and blister (WHO, 2014).

Chronic health effects include cancer and other tumour, brain and nervous system damage, birth defects, infertility and other reproductive problems, and damage to

the liver, kidney, lungs and other body organs. Pesticides have been implicated in human studies of leukaemia, lymphoma and cancers of the brain, breasts, prostrate, testis and ovaries (Johnson, 2013).

Safety Practices to Employ when Applying Pesticides

The following preventive measures should be carefully observed when applying pesticides, (WHO, 2014 and Alewu, 2014)

1. Follow label direction.
2. Avoid splashing spilling, leaks spray drift and insecticides.
3. Always wear protective 'clothing when using insecticides.
4. Mix insecticides outdoors or in well ventilated areas.
5. When applying insecticides as a spray or dust outside, Avoid windy conditions and close the doors and windows of your home.
6. After using insecticides, wash your hand before eating.
7. Never carry insecticides along with food materials.
8. Use clean water.
9. Avoid storage insecticide in house premises.
10. Don't use products for pests that are not indicated on the label and don't use more pesticides than directed by the label.
11. Use protective measures when handling pesticides as directed by the producer; such as wearing impermeable gloves, long trousers and long sleeve shirts.
12. Before applying a pesticide (indoors or outdoors) remove children toys and pets from the area and keep them away until the pesticide has dried or as recommended by the label.
13. Don't spray pesticides on windy weather.
14. Keep away from the reach of children and livestock.
15. Do not expose to sun light or rain water.
16. Avoid carrying bulk pesticides on head, shoulders or on the back.
17. Always protect your nose, eyes, mouth, ears and hand.
18. Read the label on the container before preparing spray solution.
19. Prepare spray solution as per requirement.
20. Do not mix granules with water.
21. Concentrated pesticides must not fall on hands etc. while opening sealed containers.
22. Do not smell the sprayer tank.
23. Avoid spilling of pesticide solution while filling the sprayer tank.
24. The operator should protect his bare face and his hands with polythene bags.
25. Do not eat, drink, smoke or chew while preparing solution.
26. Select right kind of equipment's.
27. Containers, buckets etc. used for mixing pesticides should not be used for domestic purposes.
28. Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
29. Do not spray just before the rains and also after the rains.
30. Discard used containers at designated places
31. Discard used containers at designated places
32. Don't wash and use used containers
33. Don't wash sprayers in rivers or ponds (Johnson, 2013).

CONCLUSION

The paper critically reviewed the economic impact of pesticides application on farms to improved crop productivity.

RECOMMENDATIONS

Sequel to the findings of this review, the following recommendation were made to enhance farmer's effectiveness on pesticides usage and safety practices.

i. Farmers need training to encourage appropriate practices for safe use and handling of chemicals and pesticides by educating them about the risk involved in the misuse and abuse of the poisonous materials.
ii. Local suppliers are the major distributors of pesticides to farmers. They lack training on usage and storage at the shop level on safety practices. Regulatory and adequate monitoring policies are strongly recommended
iii. Government should intensify efforts at registering and controlling distribution of pesticide and banning hazardous ones.
iv. Government should enforce the making of less toxic pesticides available to farmers
v. The manufactures of pesticide should be enforced to fix label (warning) in the language users commonly understand and package chemicals in containers that can hardly be used.
vi. The Government should ensure that school curriculum in agriculture and science from the elementary schools contain pesticides usage and safety practices
vii. Government should provide approval places for disposal of empty pesticide containers and offenders apprehended, to minimize pollution on the environment.
viii. Prices of pesticides should be subsidized so that the very poor farmers can afford it. This is necessary because pesticide usage can boost agricultural output and reduce drudgery associated with farming.

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