

Agricultural Pesticide Residues: An Emerging Environmental and Health Threat to Life in Ebonyi State, Nigeria.

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Abstract

In recent years, people have been exposed to several types of substances with broad spectrum due to the rapidly evolving technology. One of these chemical substance groups are pesticides. Pesticides have been an essential part of agriculture to protect crops and livestock from pest infestations and yield reduction for many decades. Despite their usefulness, pesticides could pose potential risks to food safety, the environment, and all living things. Concern about the environmental impact of repeated pesticide use has prompted research into the environmental fate of these agents, which can emigrate from treated fields to air, other land, and water bodies. The importance of agricultural pesticides for developing countries is undeniable. However, the issue of human health and environmental risks has emerged as a key problem for these countries in accordance to a number of studies. In the last five decades, pesticide usages increased the quantity and improved the quality of food. However, with the increasing amounts of their usage, concern about their adverse effects on non target organisms, including human beings, has also grown. The purpose of this publication is to explain the nature of pesticides and their history, classification, risks, and effects on health and the environment.

Keywords: Organic pollution, Human Health, Environment Risks, Pesticides, Environment Health.

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I. Introduction

Pesticides include a wide range of environmental interventions with the objective of reducing to suitable levels of insect pests, weed population and plant pathogens. Common pesticides used in the environments and agricultural field include insecticides, fungicides, herbicides, rodenticides, nematicides etc. Without pest control food and fibre production and environmental health in all countries would seriously be threatened (Kennedy, 1998). Losses arising from pest activities have constituted a major reason for low agricultural outputs in most parts of the world. Direct yield losses caused pests account for between 20% and 40% of global agricultural productivity (Savary et. al., 2012). Direct effects of these actions include poor growth and performance, low yields, increased pest build-up while indirect effects include food shortage, low economic returns, job losses arising from discontinuance or abandonment of farming enterprise, environmental degradation arising from pesticide usage and public health issues such as consumption of contaminated and or infested/infected products (Enikuomehin, 2018).

In Nigeria, pesticides are mainly imported without proper control to the effect that quality and safety are compromised. Untrained farmers handle these chemicals to the detriment of their health, environment and even that to be protected. Left uncontrolled and unregulated, the current nature of pesticide use in Nigeria (Ebonyi State inclusive) will in the very near future spell doom for various stakeholders.

THE FATE OF PESTICIDES IN THE ENVIRONMENT

Most of the pesticides reach a destination other than their target. Pesticides contaminate land and water when they escape from production sites and storage tanks, when it runs off from fields, when it is discarded, sprayed aerially and sprayed into water to kill unwanted plants (Ikpesu and Ariyo, 2013). When pesticides are applied to destroy pests and pathogens, only about 15% of the applied amount hits the target with the remaining 85% being distributed in soils and air (Erhunmwunse et. al., 2012). Pesticide residue in the soil can move from the surface when they get dissolved in running water (Miller, 2004) or percolatedown through the soil and through several kinds of intermolecular interactions by adsorption and desorption equilibrate with the soil and persist (Katagi 2004; Kobara et. al., 2003). Pesticides largely move with water in soil to ground water on soil to surface water. The movement in soil is leaching and percolation (penetration) while movement on soil is runoff and drainage (Kobara et. al., 2006). Factors that affect a pesticide's ability to contaminate water include solubility, the distance from an application site to a body of water, weather, soil type, presence of a growing crop and the method used to apply the chemical (Erhunmwunse et. al., 2012). In the air, pesticides contribute to air pollution. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas potentially

contaminating them. Through air volatilization, pesticides applied to crops drift to other areas or may adhere to dust particle (Seth et. al., 1998).

THE GENERAL OUTLOOK OF PESTICIDE USE IN EBONYI STATE AND NIGERIA.

Because of the prevailing low economic status of many nations of the Sub-saharan Africa, Ebonyi State of Nigeria inclusive, the following conditions are easily prevalent according to Enikuomehin (2018):

- Absence of specific and practicable policy plant protection as an ingredient of the agricultural development programme of government (at all levels).
- Lack of funding for capacity building initiatives that will effectively strengthen the principles practice of pesticide use.
- Diffused and diverse responses of farmers and various tiers of government to tackle pest problems with the attendant effect being that no records of pest incidence, type or efficiency of response and the outlaws are available.
- There is little or no regulation of chemical usage in Nigeria's agricultural systems. This leads to indiscriminate use of pesticides in Nigeria resulting in environmental pollution, food poisoning and toxicity to non-target organisms.
- Researches into general plant protection are uncoordinated and are rarely pursued to a logical conclusion.

While most developed countries have banned the use of the older pesticides e.g. persistent organochlorines due to potential toxic effects to man and environment, developing countries like Nigeria still use them for reason of cost and efficacy (Ikpesu and Ariyo 2013). A list of commonly used pesticides in Nigeria is shown in Table 1. Pesticide residues have been shown to biomagnify/bioaccumulate in animal tissue, human blood, adipose tissue and breast milk (Metcaf, 1997). In Nigeria documented evidences of pesticidal effects in liver and environment have been shown. Ezemonye et. al. (2010) recorded concentrations of organochlorines, organophosphates and carbamates in Warri River. Adeyemi et. al. (2008) has detected organochlorine pesticides from fishes in Lagos Lagoon. Ogan (2011) has shown presence of Lindane, Diazinon and Aldrin in pre storage samples of beans while Awofadeji (2008) observed the presence of high levels of Lindane in cooked and uncooked beans Doma, Gombe State which led to food poisoning of 120 students of Government Girls Secondary School Doma.

IMPACT OF PESTICIDES

The adverse effect of pesticide contamination is not limited to the environment but extends to human health. The severity of any effect from exposure to pesticide depend on the dose, the route of exposure, how easily the pesticide is absorbed, the type of effect and persistence in the body, the health status of the individual (WHO 2006). The following common effects of pesticide use have been identified:

- **Soil quality:** pesticides have led to reduction of soil fertility by killing other soil microbes beneficial to agriculture specifically involved in aeration and decomposition of organic matter. For example common herbicides like Glyphosates used in most farms and especially in Ebonyi State have been found to inhibit the growth and activities of nitrogen fixing bacteria in the soil (Santos and Flores 1995), 2-4-D reduces the nitrogen fixation by bacteria that live on the roots of beans (Fabra et al 1997). Aikpokpodion et. al. (2010) observed significantly increased acidity, magnesium and iron content in Ibadan soils treated with Endosulfan-35EC while the concentration of calcium, potassium and sodium got reduced.
- **Water:** pesticides have been found in surface and underground water. Evidences of the presence of organochlorine polychlorinated residues have been identified in some rivers Northern Nigeria (Okaniyia et. al., 2009) from extensive use of Lindane in fishing and Aldrin leachates from cultivated lands nearby. In Ebonyi State, Nwani et. al. (2013) observed acute toxicity of the herbicide- butachlor to freshwater Tilapia zillii caught from rivers, ponds and other water bodies in Ebonyi State. Osibanjo and Aiyejuya(1994) in their study have shown evidence of some pesticides in underground water. It is observed that total DDT and heptachlor found in Ibadan ground water exceeded the WHO limits. The occurrence organochlorine pesticides in major rivers in Nigeria (Ebonyi State inclusive) which serve as drinking water source as well as other domestic and industrial purposes have been established by Osibanjo (2002).
- **Effect on living organism:** Ize-iyamu et. al. (2007) observed that organochlorine pesticides present in fish samples from the same river. This was attributed to the fact that pesticides have affinity for fat they settle after ingestion then dermal absorption and bioaccumulate before being consumed (Erhuwunse et. al., 2012). Osibanjo and Jensen (1980) reported that the deliberate killing of fish with Lindane and DDT as the cause of high concentration value of the pesticides in fish samples. David et. al. (2008) found out that the mean concentration of the organochlorine pesticides ranged 0.01 – 8.92 ppm, though below the extraneous residue limit of 5ppm set by Codex Alimentarium Commission of FAO, WHO (1997), but above the allowable Federal Environmental Protection Agency (FEPA). Widespread application of pesticides can eliminate food sources that certain animals need causing those animals to relocate, change their diet or starve. The herbicide, Paraquat on exposure to bird eggs cause growth abnormalities in embryo and reduces the number of chicks.
- **Impact on humans.** Exposure to pesticides can range from mild skin irritation to birth defects, tumors,

genetic changes, blood and nerve disorders, endocrine disruption and even coma or death (Ritter et. al., 2007). The immediate symptoms of pesticide contamination include headache, body weakness, blurred vision, vomiting, impaired concentration and abdominal pain. The chronic effects include inhibition of human immune system, alteration of acetyl cholinesterase glutathione-s-transferase activities, changes in the concentrations of superoxide dismutase and cortisol. Human exposures to pesticides include consumption of contaminated foods, contact, inhalation and absorption. Biological indicators of pesticides include urinary residues, and their metabolites, adipose and serum residues, breast milk residue, skin and hair residue etc (Davies et. al., 1982).

• Food: Etonihu et. al. (2011) have analysed for the presence of pesticides in several Nigerian foods such as grains, white beans and sorghum purchased randomly from open markets in Nasarawa and Plateau States. Out of a total of the collections, 28 pesticides were represented. Osibanjo (2002) showed that 217 fruits and vegetables, four major cereals (rice, maize, sorghum and soyabean) as well as foodstuffs of animal origin were analysed for presence organochlorines. Meat, pulses and cereals were discovered to contain DDT, Aldrin, and Dieldrin above maximum residue limit (MRL) while others contain the pesticides below MRL.

REDUCING THE RISKS OF PESTICIDES IN FOODS AND ENVIRONMENT.

Two major approaches are adopted in managing cases of pesticide use and abuse with their resultant residues challenges viz mitigation and remediation strategies. Ikpesu and Ariyo (2013) listing numerous mitigation strategies pointed out that to reduce pesticide input into water bodies the source of diffusion (spray drift, leaching, runoff and erosion) and point source input especially farmyard runoff must be checked. Three main types of on-site remediation methods have been identified (Yogo 1998, Ikpesu and Ariyo, 2013). These include phyto remediation by using plants, bioremediation by using microbes and chemical remediation. Otani and Seike (2006) successfully picked up Drins (dieldrins and endrins) in the polluted soil using grafted cucumber plants with pumpkin rootstocks). Bioremediation using engineered microorganisms or plant-microbial systems are common. Fujii et. al. (2006) found bacteria that degraded triazine in subsoil, water and groundwater. Chemical remediation is useful in single or combination with the other methods.

In managing pesticide use, Kennedy (1998) outlined three main logical steps to be considered:

- Minimizing pesticide input. This can be achieved by minimizing the number and rate of applications. Users are expected to determine the economic threshold as we apply appropriately the concept of Integrated Pest Management (IPM) Programme.
- Containing the pesticide to the application site. By minimizing erosion, the transport of chemical-associated eroded soils may be reduced.
- Select for use pesticides with minimal environmental impact. The physical and chemical properties of pesticides such as partitioning into soil organic matter, volatility, hydrolysis rates and effect of pH all contribute to their mobility in the ecosystem.

II. Conclusion And Recommendation.

The argument for or against pesticide use in agriculture and the environment can only be settled by taking a more realistic standpoint as the production of major food and cash crops in Nigeria would be virtually impossible without the use of pesticides. The importance of pesticides for and disease management in increasing farmers income and their effects on food quality, human health and environment simply demands a balanced and more sustainable application taking cognizance of their obvious challenges. Ebonyi State being one of the “food baskets” of the Nation and going by the low level of socio-economic development of the people, proper regulation, and enforcement of safe use of pesticides, quality assurance and testing for residues are pertinent.

Today in Nigeria, the hopes are high and rising. The present administration of Muhammadu Buhari has finally come up with the “Agricultural Promotion Policy (2016-2020) which contains among others strategies for effective and efficient use of pesticides and other crop protection chemicals in Nigeria.

There would be need for an aggressive follow up from all stakeholders to achieve full realization of the goals. In the of Ebonyi State as in most Southeastern Nigerian locations, the characteristic Mixed Cropping farming system, researchers should develop sustainable plant protection products and options for farmers to adopt. A full cooperation of farmers, researchers, manufacturers, and the various governments in exchange of information and technology will go a long way to alleviating this complex problem of pesticide residue.

References

- [1]. Ikpesu, T.O. and Ariyo A.B. (2013) Health Implication of Excessive use and abuse of pesticides by the rural dwellers in developing countries: The need for awareness. Greener Journal of Environmental Management and Public safety. 2(5)180-188.
- [2]. Adeyemi D, Ukpo, G., Anyakora, C., Unyimadu, J.P. (2008) Organochlorine pesticide residues in fish samples from Lagos Lagoon Nigeria. American journal of environmental sciences 4(6): 649-653.
- [3]. Awofadeji, S. (2008) Nigeria: Food poisoning: How many more will have to die? Thisday online newspaper.<http://www.thisday.com/nview.php>
- [4]. Ezemonye L, Ikpesu, T.O, Isioma I. (2010) Distribution of endosulfan in water, sediment and fish from Warri River, Nigeria. Africa journal of ecology 48(1) 248-254.

- [5]. Metcalf, R. (1997) Pesticides in aquatic environment. In Khan MAQ(ed). Pesticides in Environment, pp.127.
- [6]. Ritter, L., Solomon R., Forget, J., Stemerooff, M. and O'Leary,C. (2007). Persistent organic pollutants; an assessment report on: DDT, Aldrin, Dieldrin, Endrin, Chlordane, Heptachlor, Hexachlorobenzene, Mirex, Tooxaphene, polychlorinated biphenyls, Dioxins and Furans. Prepared for the International programme on chemical safety (IPCS) within the framework of the Interorganizational programme for the sound management of chemicals (IOMC).
- [7]. Santos, A., Flores, M.(1995) Effects of glyphosate on nitrogen fixation of freelifing heterotrophic bacteria. Letters of applied microbiology 20:349-352
- [8]. WHO(2006). Guidelines for drinking water quality. Vol. 1 Geneva.
- [9]. Savary, S., Bregaglio, S., Willoquet, L., Gustafson,D. Mason D'roz, D., Sparks, A.
- [10]. Castilla, N., Djurle, A., Allina, C., Mamta Sharma, R., Koo,J. and Garret, K. (2017). Crop health and its global impacts on the components of food security. Food security. 9: 311-327.
- [11]. Etonihu, A.C., Aminu, B.A., Ambo, A.I. and Etonihu, K. (2011). Iodine content and pesticide residues of some Nigerian food grains. Continental journal of agricultural sciences. 5(1): 26-32.
- [12]. Ize-Iyamu, O.K., Abia, I.O. and Egwaikhede, P.A. (2007). Concentration of residues from organochlorine pesticides in water and fish from some rivers in Edo State, Nigeria. International journal of sciences 2: 237-247.
- [13]. Okeniyia, S.O., Egwakhede, P.A.,Akporhonere, E.E and Obazee, I.E. (2009). Distribution of organochlorine polychlorinated pesticide residues in water bodies of some rivers in Northern Nigeria. Electronic journal of environment, agriculture and food chemistry. 8(11):1269-1274.
- [14]. Osibanjo, O and Jensen, S. (1980). Ecological and environmental perspective of pesticide pollution. In: Akinyele O., Omueti, (eds) proceedings of conference on water pollution and pesticide residue in food.
- [15]. David, A.,Grace, U., Chimezie, A. and Unyimadu, J. (2008). Organochlorine pesticide residues in fish samples from Lagos Lagoon, Nigeria. American journal of environmental science 4(6) 649-665.
- [16]. Davies, J.E., Freed, V.H. and Enos, H.F. (1982). An agrochemical approach pesticide management: some health and environmental consideration. University of Miami, Miami, 320pp.
- [17]. Yogo, Y. (1998). Approaches to the problems on pesticide residues in crops and soils in Japan. In: Kennedy,J.R.,Skerritt,J.H.,Johnson, G.I. and Highley, E. (eds) seeking agricultural produce free of pesticide residues – proceedings of an international workshop held in Yogyakarta, Indonesia, 17-19 Feb 1998.
- [18]. Awasthi, N., Manikam, N., and Kumar, A. (1997). Biodegradation of endosulfan by a bacterial coculture. Bulletin of environmental toxicology. 59:928-934.
- [19]. FAO/WHO (Food and Agriculture Organization/World Health Organization) 1986. Joint food standards programme, Codex Alimentarius Commission on pesticide residues vol.13 Rome.
- [20]. Seth, P.K., Raizada R.B. and Kumar, R. (1998). Agricultural chemical use and residue management in India. In: kennedy,I.R., Skerritt,J.H., Johnson, G.I. and Highley, E. (eds). Seeking agricultural produce free of pesticide residues. Proceedings of an International workshop held in Yogyakarta, Indonesia, 17-19 February 1998.
- [21]. Katagi,K.(2004) photodegradation of pesticides on plant and soil surfaces. Reviews of environmental contamination and toxicology. 182 Springer-Verlag. New York 1-195.
- [22]. Kobara, Y., Endo, S., Horio,T., Ishibara, S. and Ohtsu (2003). Photolysis of polychlorinated dibenzo-p-dioxins and enhanced detoxication by titanium dioxide photocatalyst on the soils surface, Organohalogen compounds, 63:369-372.
- [23]. Kobara, Y., Nishimori, M. Wei, Y.F. Ishibara,S., Yokoyama, A. and HORIO, T. (2006). The applicability of the environmental fate estimations of current-use-pesticides using a multimedia model based on poly-parameter linear energy relationships. Organohalogen compounds 68: 1123-1126.
- [24]. Otani, T and Seike, N. (2006). Comparative effects of rootstock and scion on dieldrin and endrin uptake by grafted cucumber (*Cucumis sativus*) Journal of pesticide science, 31:316-321.
- [25]. Fujii, K. Takagi, K., Hiradate, S., Iwasaki, A. and Harada, N. (2006). Biodegradation of methylthio-s-triazines by Rhodococcus sp strain FJ1117YT, and production of the corresponding methylsulphinyl, methylsulphonyl and hydroxyl analogues. Pest management science 63(3):254-260.

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