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THE SOCIO-ECOLOGICAL AND HEALTH IMPLICATION OF MEETING THE CHALLENGES OF FOOD INSECURITY IN THE 21ST CENTURY IN THE AGRARIAN SOCIETY OF CROSS RIVER, NIGERIA

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ABSTRACT

The struggle to save humankind from hunger and starvation through the improvement of agricultural productivity using agrochemicals has gone a long way to settle an aspect of these challenges, but its social, health and ecological implication has always almost been forgotten. Due to man's indiscriminate land use/farming activities and the use of agrochemicals without adhering strictly to the user instructions included in the agrochemical package, this has affected man in no small way. This is so because of man's unregulated agricultural activities coupled with his faulty land use pattern. This has affected both the natural ecosystem and the agricultural farm produce thereby turning round to affect the health of man, his environment and his finances too. This paper therefore investigated the effect of these agrochemicals on health, environment and the social aspects. This research is therefore located within the northern senatorial district of Cross River State, which covers Ogoja, Yala, Bekwarra, Obudu and Obanliku local government areas. A total of 638 respondents including farmers, nurses, medical doctors and other laboratory scientists within the study area were randomly selected for the study using multistage random sampling technique. The instruments for the study include a structured questionnaire, personal interview and client case file, using independent t-test and simple percentage for data analysis, it was found that within the period the rural farmers started using these agrochemicals especially herbicides and those for crop storage, there has been an increase in the incidence of cancer growth, gastro-intestinal disorder and other health and birth complications within the study zone. These effects did not only affect the health of humans, it also affected

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the ecosystem and the finances of man. The authors are aware that a baseline data was needed to do a comparison between what was and what is in order to make a valid judgment, but unfortunately, not baseline data exist for the study, hence such comparison was not done. The authors therefore concluded that the use of agrochemicals has been done indiscriminately in the five local government areas under study. It was discovered that these chemicals are used without safety kits and are used for other purpose and not the function for which it was manufactured. The paper therefore proffered some recommendations and concluded that the current agrochemical usage in the study area is very faulty and contributes to some health, social and ecological implications.

Keywords: Agrochemicals, Point and non point pollutants, Food insecurity, Faulty agricultural practices, Ecological erosion, Euthrophication, Gastrointestinal disorder and cancerous growth.

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Contribution/ Originality

This study is one of very few studies that have studied the effects of the use of agrochemicals on both the environment and human health in man's quest to meet the food requirement for his teeming population. Trying to meet the food requirement has compelled man to exploit all avenues including the use of agrochemicals and this has been found to contribute to water pollution at both point and non point locations, this has also infected the crops so produced and in some situation the storage of these agrochemicals have leaked into the environment and all points to have a deleterious effects on all biological species and the environment as a whole.

1. INTRODUCTION

Food security refers to the availability of food and one's access to it. A nation, family or household is considered food secure when its occupants do not live in hunger or fear of starvation. Food insecurity on the other hand is the unavailability of food and one's access to it. A household or family may face food insecurity when they lack access to food in such quantity and quality that cannot guarantee their access to it asmay be required, making them live in perpetual fear of hunger and starvation. It is observed that worldwide around 920 million people are living in chronic hunger due to extreme poverty, while up to 2 billion people lack food security intermittently due to varying degrees of poverty, climatic conditions, health status and ragging war (Stern, 2009). Robert *et al.* (1986) defined food security thus "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food for a healthy and active life.*" Unfortunately, far too many people struggle to survive without access to even the most basic, minimal sustenance resulting in the kind of malnutrition that can be fatal if left untreated. According to Chen and Martin (2004), a lot of reasons have been identified as causes of food insecurity in most countries of the world. These reasons or causes range from a complicated combination of various factors like the socio-political situation of that country,

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environmental conditions on ground, poverty level of the country and its inhabitants, economic factors, environmental degradation facing the country including climate change, global warming, extent of agricultural development and growth policies, educational and technological level of thecountry and her citizen's socio-genderinequality, poor health status, corruption, national insecurity, conflict and ragging war, extent of dependency ratios and functional active population, population growth, national policies and politics, the political will of the government to combat food insecurity, barriers to trade, cultural insensitivity and natural disaster among others.

Ahmed *et al.* (2007) also observed that in recent times the growing increase in global demand for grains and its prices has forced many countries into food insecurity due to the decrease in global productions with concomitant lack of income required to purchase the required daily household needs (World Food Security, 2012). Food insecurity becomes imminent when all people at most times have constraint to accessing physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lives (World Food Security, 2012).

Modern researchers see food security as the ready availability of nutritionally adequate and safe foods and an assured ability to acquire acceptable foods in socially acceptable ways, that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies. It is however observed that other factors have been found to be responsible for food insecurity in the world. These factors include among others land degradation, as a result of man's consistent faulty agricultural activities leading to the exhaustion of soil fertility, and the resultant decrease or decline in soil productivity and yields. Climate change which has also altered crop yield through an astronomical increase in temperature, leading to observed impacts on forest resources, water supplies, melting of ice at the polar region leading to increased flooding and the exposure of more land to flood incidence and an alteration in the ecological balance. Poverty crises plaguing man with its pressure on the exploitation of free or open access resources like the forest, land, water and air. World water crises are due to the falling level of the aquifer in many countries. There is a wide spread over usage of water resources especially for industrial and agricultural land uses leading to a decrease in global water supplies (water footprint). However in recent times, authors like Borger (2008), Braun (2008) and Chugh (2010) have included greedy land deals through corporations and government buying rights to millions of acres of agricultural lands in developing countries to secure their own long term food supplies. In Nigeria, the issue of the land use act of 1978 which has collected land rights from indigenous owners to the government, where every land within any urban center or in the country belongs to government, any occupant of such land is only holding the land on trust for government. This situation has puts more pressure on the occupant of such lands to use the available land where for their agricultural needs while being afraid that government may wake up one morning and ask them to quit such lands.

It was Abraham Maslow in 1963 that said human needs are arranged in a hierarchical order, and once a need in the lower realm is met, the next level of need is automatically triggered to

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shows up. Robert *et al.* (1986) observed that in modern conventional agriculture where intensive monoculture and row cropping are often used, the resultant effects of these types of agricultural practices are soil erosion and runoffs which are accompanied by loss of soil fertility or nutrient as a result of indiscriminate use of agrochemicals like pesticides and herbicides. Robert *et al.* (1986) further observed that erosion sediments is one of the greatest pollutants of surface and groundwater in the United State and is a major carrier of agrochemicals into most water systems in most countries of the world. In an attempt to meet the food insecurity challenges, modern day agriculture is dependent on the use of agrochemicals for the improvement of soil nutrient and crop production. It is observed that most farming activities carried out in Cross River and indeed most African countries are carried out at the lowest level and scope with the least technology, where most agricultural inputs like herbicides, pesticides, insecticides, inorganic fertilizers and most chemicals used for preservatives are indiscriminately used without studying the chemical contents of these agrochemicals and their side effect with their concomitant preventive measures.

In Cross River State, Nigeria and Africa at large, the use of agrochemicals have become a recurrent situation in almost every household, this is seen as a method of reducing the stress of clearing the farm plots and increasing the soil fertility through the use of these agrochemicals. The use of most of these agrochemicals like herbicides e.g. Round up, *(glyphosate)*, Diutop *(diuron)*, Orisa plus *(propanil +2,4 dia'amine*) Paraq, *(paraquat dichloride)*. Insecticides like Zap *(lambda cyhalothrine)*, Uppercott *(cypermethrine + dimethoate)*, Termicid *(cholrpyriphos)*, Delthrine *(cypermethrine) and* preservatives like Gamaline 20, Aldrin formaldehyde, Aldrin dust etc are very prominent. Altrazine is another agrochemical that has very negative effect on underground water and this is in turn transferred to humans who use the water or through plants when man consumes such plants contaminated by the water. Endosophane is another agrochemical that is used as preemergent chemical before crops are grown or seeds germinate, but this is applied directly on the soil surface. DDVP is used for insect control, but it has become a preservative used by most farmers for preserving their grains instead of seeds. Seeds are not meant for consumption, but for planting, while grains are for consumptions, but most African farmers now use DDVP as preservatives. Even at this, when chemicals like these are used as preservative, they are supposed to be kept for a minimum of six months before such grains are consumed. But this is not the case in Nigeria and in the study area where selling of grains preserved with the DDVP chemicals begins in less than three months. This led to the death of more than 30 families in the study area some time in 2010. The use of fertilizer for optimum crop productivity has been on the rise in Nigeria. This is so because due to man's unsustainable agricultural and development activities, man has indiscriminately impacted very negatively on the environment especially through the use of faulty agricultural practices, hence most of the soils nutrient are almost completely wash out and the soils are now porous, hence the need for the use of fertilizer to boast agricultural productivities in most agrarian communities. Most fertilizer types used in Nigeria include Nitrogen, Phosphorus and Potassium popularly called NPK. This NPK fertilizer comes in

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different formulae, NKP, 15-15-15, 20-10-10, 12-12-17-2,17-17-17 and so on. There is also the ammonium sulphate or ammonium phosphates popularly call urea.

In the western world where most of these chemicals are produced or manufactured, most of these chemicals come with safety measures to be taken by farmers who may want to use the chemicals for agricultural productivities like the use of safety helmet, safety booths, glasses, nose or breathing covers, walking out of sprayed area as the spraying is done, but it is disheartening to know that in Nigeria, people spray their farms with most of these obnoxious chemicals and walk right into the sprayed area unknowingly. It is important to also note that most of the agrochemicals patronized in Nigeria today and in most African countries are the agrochemicals that have been banned in other foreign countries because of the health and environmental implications.

1.1. Effects of Agrochemicals on Humans and the Environment

Gittens (2001) observed that the fertilizer supplied to improve crop production is a source of nutrient enrichment to surface water. When this is transported by any means into any body of water, it increases the nutrient level of such water body resulting in algae bloom and euthrophication. A condition where nutrient rich water encourages the growth of algae which prevents oxygen on the surface from penetrating under the water for other plants and aquatic lives to breath and survive. Nitrogen is a potential contaminant of ground water. Conventional farming system does not completely recover fertilizer from the soil, rather the farming system recovers only about 50% of the fertilizer from the soil. Bell *et al.* (2001) observed in their study that the ability of crops to take up fertilizer is between 5-25% and for fertilizers like potassium, 40-75% of the amount applied, although more is taken up by subsequent crops (Robert *et al.*, 1986). The attachment of phosphorus and potassium to soil particles can only be carried away by erosion. It is however observed that nitrogen can contribute NO_3 into groundwater, where the concentration of groundwater above 10mg/l is said to be detrimental to human health. In most areas with shallow aquifer and sandy soils, this combination encourages rapid infiltration of NO_3 from chemical fertilizers used during agricultural productivities.

Most scholars have shown some serious concern over the use of pesticides and their effects on both human and wildlife health. This is worrisome because humans in developed countries can read and also be told about the harmful effects of these pesticides, but animals only act on instinct and inert behavior. This situation forced Dahlgren *et al.* (1972) to posit that the application of organochlorines has resulted in behavioral changes in pheasant chicks Dahlgren *et al.* (1972) that were mediated through both cocks and hens. When either parent was administered dieldrin or polychlorinated biphenyls (PCBs, an industrial chemical), offspring did more poorly than offspring of untreated birds on a visual-cliff test (used to test whether chicks would jump to the visually close or visually deep side). The effect was greatest where both the cock and hen received the chemical. Similarly, offspring of treated parents were more easily captured by hand. In the

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wild, birds must depend on innate behavior patterns for survival, such as the ability to avoid capture by predators. Use of DDT, dieldrin, and PCBs has been effectively controlled in the United States, but not before wildlife populations were exposed to possible behavioral effects and the documented eggshell thinning that endangered predatory birds and brown pelicans (Pelecanus occidentalis) (Klaas, 1982). Because chemicals were developed and in common use before their danger was recognized, and because full evaluation of any hazards they might pose is so costly that it might not be done, most wildlife biologists would rather do without chemicals.

Certain organochlorine pesticides have very long lasting effects on the environment. Some organochlorine like Dieldrin, Aldrin, DDT accumulate under the fatty tissues causing bioaccumulation thereby lowering the amount in the environment and magnifying the amount along the food chain consumed by both man and animals. It has been discovered that large amount of organochlorines are accumulated in top species like mammals and man. Substantial evidence abound that DDT and its metabolites DDE act as endocrine disruptors interfering with hormonal function of estrogen, testosterone and other steroid hormones. It is also observed by World Food Program Report (2007) posited that most organophosphate compounds have long half lives which delay the on-set toxicity to nerve cells, this often results to irreversible effects. Several studies have also found out that there are persistent deficit in cognitive functioning in workers chronically exposed to pesticides. Evidence also suggests that these pesticides may cause developmental neurotoxicity at much lower doses without depression of plasma cholinesterase.

Heeren *et al.* (2003) observed that there is a growing concern about the incidence of birth defect which has increased in the last few years as a result of agrochemical use among women of Mdantsane, Eastern Cape town, South Africa. They observed that although very few studies have been carried out in the developing world. Heeren *et al.* (2003) further found out that there is a link between exposure to agrochemicals and birth defects among women working in the study area. It was gathered that three types of exposure were observed, the first is the use of containers previously used for storing agrochemicals for storing water, the second is keeping of cattle's and other animals which needed to be dipped into these agrochemicals and the last was the use of a particular garden chemical by the women. The study concluded that most agrochemicals are detrimental to the health of people around the agricultural sites. It therefore suggested that educational programs on the possible dangers of the pesticides to their health and those of their babies and lastly elimination of the reuse of pesticides containers should be used as preventive measures to reduce these trends. Belik and Mauro (2003) opined that agricultural damages to the environment is mainly concerned with off-site effects, but it also affects the aesthetic values of any environment through the activities of gully and rill erosion and also damages plant by deposition of sediments on plants. The deposition of sediments also harms wildlife habitats by covering nesting areas and wildlife sources of food. It was also discovered by Stern (2009) that soil when carried from the field by runoffs or wind, the process of deposition is done by the

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reduction in the speed and capacity of either the wind or the water, hence the deposition is done not minding what is dumped on or where it is dumped.

It is however worrisome in recent times to know that almost every farmer in every agrarian society wants to improve or increase his crop productivity, and this by their thinking can only be achieved through the use of inorganic fertilizer and other obnoxious agrochemicals. It is also disheartening to know that in the western world where most of these fertilizers and agrochemicals are produced, soil sample analysis are usually run for every soil before they can identify the type of inorganic fertilizers to apply, but this is never the case in Nigeria. It is observed however that most of the chemicals including fertilizer use are indiscriminately used without proper knowledge of the surrounding situation and their side effect both in terms of human health and environmental consequences. It is on this thinking that the research was initiated to identify whether the use of agrochemicals in the study area has contributed to health disorder and environmental deterioration in any way.

2. METHODOLOGY

Survey inferential design was adopted for the study. The study area is the northern senatorial district of Cross River State, these covers Ogoja, Yala, Bekwarra, Obudu and Obanliku local government areas. A total of 638 respondents were sampled for the study. The research subjects include farmers, medical personnel (medical doctors and nurses and laboratory scientist) traders, civil servants and other self employed. Two sets of data were generated; the first is from the farmers directly in the communities. A total of five hundred (500) respondents were selected for these data collections within the rural communities, while a total of one hundred and thirty eight respondents were also randomly selected from the health facilities within this study area. The health facilities are Model Hospital Sankwala in Obanliku, Sacred Heart Hospital Obudu, Model Health Center Abuochiche, Nyanya, Ukpah and Gakem, General Hospital Ogoja and RCM Maternity Hospital Moniaya, Lutheran Hospital Yahe and General Hospital Okpoma Yala. Instruments for data collection include a well structured questionnaire, oral interview and documented client case files. A consent form was requested for and filled by the researchers before they were allowed to use client case files and other relevant documents in all the hospitals under study. Simple percentage and correlation analysis was then used to analyze the data. Results from the analysis are as shown on the tables that follow. The instruments were administered in twofold; the first set of questionnaire was administered to health care providers (doctors, nurses, community health workers and medical laboratory scientists) within the study area, while the second set of instrument was administered to farmers to get their views on the use of agrochemical and their perceived environmental and health related complications. Though the researchers are aware that a study of this nature needs a comparison between what was and what is in order to make a valid generalization that the current use of these agrochemicals have contributed to these cases of cancer and other gastro-intestinal and respiratory situations, the

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authors therefore admit that unfortunately there was no baseline data gotten from the study area before the commencement of the use of these obnoxious agrochemicals to meet the food insecurity challenges of the study area, hence no comparison could have been done without these baseline data.

3. RESULTS AND DISCUSSION

Table-1.1. Correlation analysis of relationship between agrochemical usage and incidence of cancer/respiratory tract infections cases in the northern senatorial district of Cross River State

Variables	Mean ($\bar{x}$)	S.D	r-value
Agrochemicals	8.88	1.42	
			0.40*
Cases of Cancer incidence	7.29	1.64	

*Significant at 0.05 level, critical r=.062, DF=635.

From the correlation analysis on Table 1.1, it was discovered that there exists a relationship between agrochemical utilization and the incidence of cancer and other respiratory tract infections among the rural farming communities in the study areas. The calculated r value is 0.40 while the critical r table value is 0.062. From the analysis, it is discovered that the calculated r-value is greater than the critical table value, hence the null hypothesis which stated that there is no significant relationship between agrochemical use and the incidence of cancer and other respiratory tract infections among the agrarian rural farmers of Cross River state is rejected while the alternate hypothesis which states that there is a significant relationship between agrochemical use and the incidence of cancer and other related respiratory tract infection is accepted. This therefore shows that there is a relationship between agrochemical use and the incidence of cancer and other related respiratory tract infection among the agrarian rural communities of Cross River State. The second research question asked whether in the course of using these agrochemicals, farmers adhere to all the safety measures prescribed by the manufacturers before they use the agrochemicals. 76 % (485) respondents disagreed that they are not aware and do not adhere to the precautionary measures prescribed by the chemical manufacturers, while 24% (153) respondents agreed that they are aware and also use all the precautionary measures prescribed by the agrochemical manufacturers. On the question of whether the farmers used the chemicals as prescribed by the manufacturers to do the same agricultural activities as the chemical producers manufactured it to be used, 68% (434) respondents disagreed that most times they used the chemicals for different purposes, while 24 % (154) respondents said they used all the agrochemicals they buy for the intended use for which the producers manufactured it for and 50 respondents representing 8%, were undecided whether they were using the agrochemicals according to prescription or not. On whether these agrochemicals have any environmental

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implications, 185 respondents (28.9%) said there are aware of the environmental implications of agrochemical use, 372 representing 50.3% disagreed that they are not aware of any environmental effects of agrochemical use, while 81 respondents (12.7%) were undecided on the environmental impacts of agrochemical use. This therefore means that a lot of these farmers use these agrochemicals without knowing the health and environmental implications. Data collected from the health facilities using client case files shows that there is an increase incidence of waterborne diseases, cancer growth and gastrointestinal infections and disorder among the study population. There is the possibility that some factors could be responsible for these adverse health situations, but it cannot be unconnected with the faulty use of these agrochemicals as is used by the people in the study area. The figure below therefore shows the bar chart of the incidence of reported or referred cases of cancer, gastrointestinal disorder and other health related complications connected to agrochemical usage in the study area within the period under study.

It was discovered that in 2006, Yala had the highest incidence of health related complications from agrochemical use followed by Obanliku. In 2007, Obudu had the highest incidence of these complications followed by Ogoja. This trend moved in 2008 to Yala again followed by Obanliku. In 2009, there was a shift in the trend to Bekwarra followed by Obudu and in 2010; the trend was still the same as Bekwarra had the highest incidence of health related complications traced to the use of agrochemicals followed by Obudu. But the case seems equitable spread in 2011 as Yala came first followed by Ogoja

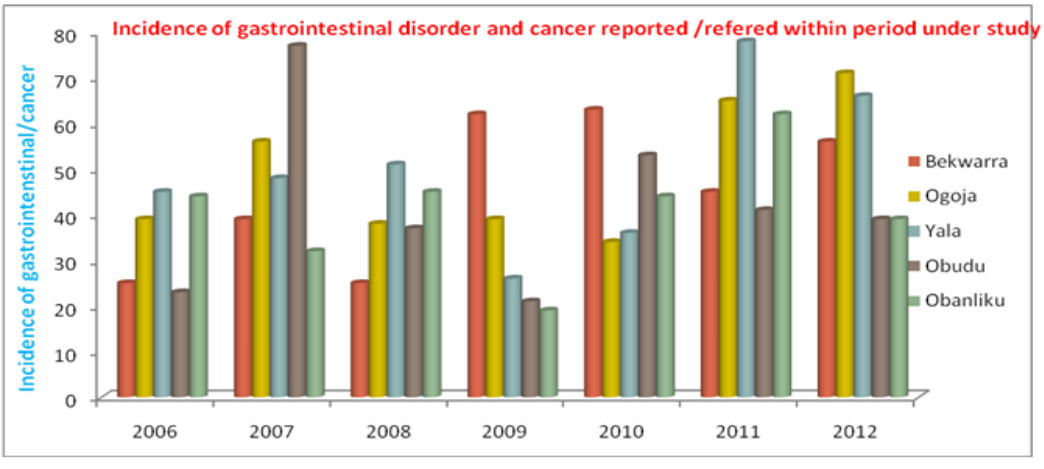

Figure-1. Incidence of respiratory/ cancer cases reported and referred from the health care facilities within the study area.

and Obanliku, whereas in 2012, the shift was again noticed in Ogoja, followed by Yal, then Bekwarra, while Obudu and Obanliku had a reduced incidence in this year. It therefore means that during the period under study, almost all the local government areas within the study areas suffered a great deal of health related complication as a result of the indiscriminate use of

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agrochemicals in their bid to increase their agricultural productivity, meet the challenges of food insecurity and improve their livelihood

4. DISCUSSION

It was discovered from the study that most rural farmers have at various times used most agrochemicals indiscriminately and these in recent times have affected their health through either direct contacts with the chemicals or through these agricultural products from such farms where these chemicals are used. The use of these agrochemicals as used without making reference to the safety precautions as provided by the agrochemical manufacturers. It was also discovered that the use of agrochemicals have been altered from what the chemicals were meant to be used for, e.g. the use of some preemergent chemicals for storage of grains like maize, beans, sorghum, rice etc.

It was further found that some of these agrochemicals enrich most water bodies during run offs with nutrient which contributes to causing euthrophication and also impede navigation. These findings confirmed the earlier findings of Bell *et al.* (2001).

While most agrochemicals if not dissolved, make the soil surface hard preventing percolation and penetration of air into the lower soils, this phenomenon is call clotting. This phenomenon was earlier discussed by Braun (2008) as being a major cause of environmental crisis in the arid region of the world, as this acts as catalyst to erosion, desertification, poor water percolation among others. Most agrochemicals also cover the surface of water bodies thereby increasing the internal temperature of such water bodies leading to the death of most aquatic species altering greatly the aquatic ecosystem. Heeren *et al.* (2003) saw this trend and called it the most current and devastating environmental deterioration causing man a lot of ecosystem functioning within the agrarian communities of Africa. Based on this study, it is disheartening to know that these chemicals are used without following due precautions and wrongly used too, hence they are liable to face these health situations. It therefore become imperative that rural farmers making use of these agrochemicals should be encouraged to adhere strictly to the precautionary measures as advised by the agrochemical manufacturers. While trying to meet the challenges of food insecurity, it is pertinent to take into cognizance environmental and health implications of these agrochemicals and their concomitant effect on the environment and human health. Unlike nutrition where treatment is guided by standard protocols based on human nutritional requirements, attempts to meet food insecurity challenges must take into account a wide range of factors such as climate, geography, socio-economic systems and political structures.

5. CONCLUSION

It is worthwhile to struggle to survive through agricultural activities, but such pursuit should be guided by some standard guidelines which promote healthy living for those using these chemicals and their resultants effects on the environment. The challenges of meeting food insecurity is enormous and a herculean task, the agricultural soils have become porous due to

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human action and activities, the use of agrochemicals have become a must do activity, but some checks need to be put in place to safeguard both the environment and human health within the rural and urban communities. It is in this view that the following recommendations were made.

6. RECOMMENDATIONS

- ✓ Government and the authorities concerned should put a check in place to control the type of agrochemicals introduced and imported into the country, since most of the agrochemicals used in the country are those already banned and listed as prohibited obnoxious chemical in the manufacturing countries.
- ✓ It is necessary to mention that agricultural experts should be encouraged to first run soil sample analysis to guarantee the type of soil, the type of nutrient needed and the rate at which such chemicals can be applied.
- ✓ Government and other regulatory agencies should also train and retrain agricultural extension workers on the proper use of agrochemicals especially away from water bodies.
- ✓ Government should open up bilateral talks with countries where agrochemicals are manufactured, so that such manufacturing companies could first conduct soil sample test and also identify the type of agrochemicals needed which are environment and human health friendly.
- ✓ Government should rather take up the importation of all agrochemicals into the country, so they can put a strong control over what should be imported and those not to be imported into the country.
- ✓ Improved seed varieties should also be cloned by local agrobiotechnologists and other professions charged with the improvement of seed supplies to help improve yields and combat food insecurity in the country.
- ✓ The use of organic and farm yard manure should be encouraged to replace the consistent dependence on foreign agrochemicals with serious disadvantages.

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