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NIGERIA'S SMALL SCALE FARMERS' AGROCHEMICAL USE THE HEALTH AND SAFETY IMPLICATIONS

[1] Toyin Samuel OLOWOGBON, [2] Segun Bamidele FAKAYODE,
[2] Ademola John JOLAIYA and [3]Adebola Omolara OKE

[1] Occupational Health and Safety Division of Vertext Media Ltd, Ibadan, Nigeria
[2] Department of Agricultural Economics, University of Ilorin, Nigeria
[3]Adebola Omolara OKE: College of Agriculture, Lafia, Nasarawa State, Nigeria.

ABSTRACT:

The quest to meet the challenges of global food insecurity and low total factor productivity in African agriculture necessitated the adoption of massive use of agrochemical by small scale farmers. Nigerian agricultural sector just like most developing countries is dominated by small scale farmers with increased usage of agrochemicals in this case limited to inorganic fertilizers, herbicides and pesticides. This study examined the health and safety implications of the massive agrochemical usage in Nigeria. Eighty nine farmers were randomly selected from farming communities in Ibadan metropolis, Nigeria. Simple descriptive statistics was used for data analysis. The study revealed that twenty four percent of the respondents had no formal education while sixty percent had below tertiary education. Eighty percent of the respondents were not aware of farm safety concept and procedure while eighty one percent do not use the recommended complete personal protective equipment during chemical application. Seventy four percent claim not to have regular contact with extension agents. Eighty seven, eighty nine and sixty nine percents of the respondents use herbicides, pesticides and inorganic fertilizers for their farming operation respectively. Eighty nine percent of the respondents do not use the material safety data sheet that accompanied chemicals while seventy nine percent do not calibrate sprayer before use. Integrated pest management, farmers training on material safety data sheet, personal protective equipment, and sprayer calibration, awareness on the health and safety implications of agrochemicals, national agricultural policies designed in line with global best practices and sustainable agriculture practices such as conservation agriculture were recommended.

Keywords: Agrochemicals, Health, Safety, Implications, Nigeria and Small Scale Farmers

INTRODUCTION

Agriculture belongs to the real sector of Nigerian economy. The roles of agriculture remain significant in the Nigerian economy despite the strategic importance of the oil sector. Agriculture provides primary means of employment for many Nigerians and accounts for more than one-third of total Gross Domestic Product (GDP) and labour force (FAO, 2003; World Bank, 2003). There is a consensus among Nigerian policy makers, her development partners, and experts in Nigerian agriculture that the wealth of the country can substantially be derived from agricultural production (Opara, 2010). It is generally believed that the small scale farmer holds the key to the realization of this possibility since small-scale farmers dominate the agricultural economy. Over 80 percent of the farming population in Nigeria are small holders residing mostly in rural areas. Anaman (1988) disclosed that small farms are mainly responsible for self sufficiency of food in Africa and cultivation of export crops. They are also very significant in world development with 50% of world's population depending on them. In a survey carried out in 1973/74 by the Federal Office of statistics as reported by Olayide (1980), the small-scale farms were classified to range between 0.1ha and 5.99ha and they constitute about 80.78% of all farm holdings, the medium scale farms range from 6.0 to 9.99ha and constituted about 13.59 % of all farm holdings while large farms range from 10.0ha and above and constituted about 5.63% of all farm holdings. However, the average Nigerian small scale farmer is poor, non-literate, and lacks access to most basic social amenities, as well as improved varieties of inputs and modern farming implements. The consequence of these has been low production and productivity (Opara, 2010). FAO (2003) and World Bank (2003) described these small scale farmers further, as a multitude of farmers scattered over wide expanse of land area, with small holding ranging from 0.05 to 3.0 hectares per farm land, rudimentary farm systems, low capitalization and low yield per hectare.

Isaac et al (2008) supported the claim that increasing agricultural productivity is critical to stimulating the rate of economic growth in Africa. The improved productivity is based on many important and often complementary determinants of agricultural productivity such as fertilizer and improved seed, without intending to imply that they are the only or most significant productivity determinants. Other key factors are adequate water availability, labour, crop choice, and other input etc. This implies that to achieve the desired level of agricultural productivity modern methods and inputs must be adopted.

Population growth is also concentrated in developing countries and the growth is overwhelmingly urban. Inherent in the demographic pressure is the challenge to ensure matching food security in an environmentally sustainable manner. Part of the challenge to global food security is the issue of pest. In the developing world, pests caused an estimated $12.8bn, $145.2bn and $21.72bn losses in Africa, Asia and Latin America respectively in 1988-1990

Table 1: Estimated losses for eight crops during 1988-90

Region	Pathogens	Insects	Weeds	Total
Africa	4.1	4.4	4.3	12.8
Asia	43.8	57.6	43.8	145.2
Latin America	7.1	7.6	7	21.7

Source: Oerke (1994)

Crop loss data and farmers' perceptions of risks posed by pests drive investments in pest management strategies. Over the years pesticides have made significant improvements in global food security (Oerke, 1994). However, in response to increasing food demands and emerging market opportunities, farmers tend to quick acting solutions to pest problems.

Widespread food deficits in tropical developing countries have compelled national programs and international donors to place high priority on improving the agricultural productivity and the economic well-being of the small farmer (Matteson et al. 1984). Developing countries import pesticides, herbicides fertilizers, farm machinery, and improved varieties of crops because of the need for increased food production; however, pesticides are often used on cash crops before they are used on food crops. Efforts to increase food production in Africa previously emphasized developing technology for large-scale farming, and it omitted socioeconomic systems in rural communities. Traditional multiple cropping systems were thought to be less productive than large-scale monoculture. However, multiple cropping is a vital factor in the food supply in Africa and contributes to increased agricultural production (Youtl-owei 1987).

The conventional methods of raising farm productivity since the World War II has centred on employing the use of externally acquired inputs like fertilizers and protection chemicals among others (Avav and Oluwatayo, 2006). Agrochemicals refer to substances used to help manage an agricultural ecosystem, or the community of organisms in a farming area.

Agrochemicals are important agricultural inputs to protect crops from diseases, pests and weeds. The uses of agrochemicals contribute not only to healthy growth of crops and animals but also to improve farm work efficiency and stable supply of tasty agricultural produce (Kughur 2012). Agricultural chemicals include fertilizers, pesticides, herbicides, rodenticides to mention but just a few used to eliminate the presence of living things that causes injury or diseases to crops and to improve production. Although many kinds of chemicals are used in agriculture, they can be categorized into simple groups according to the functions they performed. This includes insecticides, herbicides, fungicides, molluscides, and rodenticides, just to mention but a few (Ayoola, 1990). In the 1940s manufacturers began to produce large amounts of synthetic herbicides and their use became widespread. Some sources consider the 1940s and 1950s to have been the start of the agrochemical era. According to Miller (2002), agrochemical use has increased 50 fold, since 1950 and 2.3 million tonnes (2.5 million short tonnes) of industrial pesticides are now used each year. Seventy-five percent (75%) of all herbicides in the world are used in developed countries however; its use in developing countries is increasing. Many herbicides can be grouped into chemical families. Prominent pesticide families include organocholrines, organophosphates and carbamates.Organochlorine hydrocarbons (DDT) could be separated into dichlorodiphenylethanes, cyclodiene compounds, and other related compounds. Prominent families of herbicides include

pheoxy and benzoic acid herbicides (2, 4-D) tyriazines (atrazine), Ureas (diuron), and Chloroacetanilides (alachlor). Many commonly used herbicides are not included in these families, including glyphosate. (Kughur 2012).

However, the increased use of pesticides in agricultural soils causes the contamination of the soil with toxic chemicals. When pesticides are applied, the possibilities exist that these chemicals may exert certain effects on non-target organisms, including soil microorganisms (Simon-Sylvestre and Fournier, 1979). The microbial biomass plays an important role in the soil ecosystem where they fulfill a crucial role in nutrient cycling and decomposition (De-Lorenzo et al., 2001). During the past four decades, a large number of herbicides have been introduced as pre and post-emergent weed killers in many countries of the world. In Nigeria, herbicides have since effectively been used to control weeds in agricultural systems (Adenikinju and Folarin, 1976). As farmers continue to realize the usefulness of herbicides, larger quantities are applied to the soil. But the fate of these compounds in the soils is becoming increasingly important since they could be leached; in which case ground waters is contaminated or immobile, and persist on the top soil (Ayansina et al., 2003).

In the case of inorganic fertilizers, they are chemical combinations of the nutrients that plants must have to grow, and available in a form they can use. The main nutrients in inorganic fertilizers are three essential elements: Nitrogen (N), Phosphorus (P), and Potassium (K) (Louis, 1997). The use of inorganic fertilizer is important in Africa because Africa's depleted soils can no longer deliver enough organic matter to maintain soil health (IFDC, 1996). If the world's 1.5 billion hectares of farm land were farmed organically, enough food would be available for only about 2.4 billion people, leaving more than half the world's 6.5 billion people without food. Organic sources of mineral nutrients are certainly not available in sufficient quantities to feed sub-Saharan Africa's current population of about 750 million-and that population will be 1.1 billion by 2020(Otunaiya, Okuneye and Aihonsu 2012). Inorganic fertilizer seems to be the one of the practical way to provide enough plant nutrients to restore Africa's nutrient-depleted soils and feed Africa human population (Ahemba, 2009). To feed her growing population, Nigeria must increase food production by 4% per year for the next 10 years. To accomplish this challenge, the use of inorganic fertilizer must increase from an average of 10 to 50 kg/ha; since organic sources of soil nutrients will not be sufficient (Okoloko, 2006). This means that the use of inorganic fertilizers must increase at the rate of 18% per year, which is significantly more than the increases observed in South Asia (13%) and Southeast Asia (9%) from the early 1960s to the late 1980s (Yanggen., 1998; EPAT, 1993; Harold *et al*., 1994). If fertilisers are to be used therefore, the necessary safety procedure must be applied.

Despite the fact that millions of people throughout the world have benefited from the increased food and economic benefits resulting from the introduction of modern agricultural technology, and speculations for increased use of agrochemicals; traditional agricultural systems sustained over centuries with low but stable food production can be seriously "jeopardized by untested and carelessly introduced modern inputs" (Glass and Thurston 1978). Furthermore, a "change from traditional agriculture which provides food for half of the world population to a more modern agriculture should not and perhaps cannot be based on the intensive use of agricultural chemicals" (Glass and Thurston 1978). Experience in the USA, Great Britain, and other developed countries where pesticide overuse has been documented should alert developing countries to the hazards of pesticide misuse (Atteh 1987). Accurate estimates on the total amount of pesticide use in West Africa are very difficult to document. In fact, data on pattern and amount of pesticide use in Africa is very difficult to obtain and almost impossible to estimate for any single African country due to a lack of

detailed lists of imports into these countries (Youm,*et al* 1990). However, pesticide imports and use in Africa are increasing (Abrahamse and Brunt 1984). In West African countries, a dramatic increase in pesticide use is largely due to advertisements suggesting pesticide use will increase crop yields. These advertisements have resulted in the "displacement of traditional" pest control methods in countries such as Nigeria (Atteh 1984, 1987).

It has been estimated that about 125,000 - 130,000 metric tons of pesticides are applied every year in Nigeria. (Ikemefuna 1998). Many of the Class I (highly or extremely toxic) pesticides are still being used in developing countries (Friedrich, 1996).

A major cause of poisoning when using knapsack or trombone sprayer is the spilling of pesticides over the back of the operator because of a faulty locking cap of the container. Cracks and leaks in containers and in over aged rubber hoses, and not renewing or loosing washers are a great cause for leakages that often poison the user, wastes pesticides, causes environmental pollution and may become phytotoxic where pesticides fall on crops at high doses (Meijden, 1998). Lack of safety precautions causes 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. In Nigeria generally, farmers do not wear any protective materials at all, no matter what pesticide 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 pesticides and empty containers are not properly disposed as the containers are sometimes washed and used for domestic purposes. There is evidence of poor pesticide education and misuse in Nigeria, for instance a situation where over dosage for the purpose of effecting rapid kill of crop pests is common among government trained, or agency trained and assisted small-scale farmers (Ivbijaro, 1998). It has also been noticed that these farmers sometimes use these pesticides for purposes other than that for which they are manufactured. Some stunning revelations of pesticide misuse have been reported by some scientists (Ivbijaro, 1977; Youdeowei, 1989; Ivbijaro, 1990, 1998).

Over reliance on synthetic chemicals to control pests has given rise to a number of problems, which may affect the food chain and impacting negatively on biological diversity. The wrong use of synthetic pesticides can lead to secondary outbreaks of pests that are normally under natural control resulting in their rapid proliferation. There have also been cases of pests becoming tolerant or resistant to pesticides, resulting in the use of double and triple application rates (Stoll, 2000). Pesticides use on cocoa farms has over the years become more specific and less toxic but environmental pollution still exists. However, since practically no data exists on this issue in Nigeria, the extent of the pollution of the agrarian communities can only be guessed.

PAN UK Food and Fairness (2008), reported that it is hard to make accurate estimates of indirect costs of using agrochemicals because so little data exists and very little effort is made to collect any. The Mali researchers used the limited data they could get in terms of poisoning incidents (always severely under-reported) and extrapolated other estimates from studies in other countries. Up to 110, 200 poisonings are estimated to take place a year in Mali, with between 329 and 2,570 cases being hospitalised. Days of labour lost could be between 54,000 to 251,000 and between 1,150 and 1,980 people becoming less productive for the long-term. The highest cost comes from the value of lost working time, rather than treatment costs. Health costs were the second highest indirect cost estimated for Mali's national total, greatly exceeded by the costs to agriculture from ineffective pest management, due to pesticide resistance and

destruction of natural enemies. These were estimated at over US$8.5 million, just in cotton - a huge sum, never considered by cotton companies or agriculture ministries. Replacing contaminated water could cost at least US$64,200 (not including any harm to fish or livestock) and loss of honey production from bee kills at least US$33,189. Mali spends a further US$121,000 on government services involved in regulating and controlling pesticides and US$193,000 on getting rid of obsolete pesticides and empty containers. This in my opinion is a huge burden to the agricultural sector of the African continent instead of a yielded return from the use of agrochemicals.

The only African national assessment of external costs was done in Mali in 2001 as reported by Ajayi et al (2002). Again, the costs are seriously underestimated because there were no data to quantify impacts from residues in food, on soil fertility and biodiversity or environmental pollution. The study estimated annual external costs at almost US$10 million, or 40% of Malian market value of pesticides.

These studies highlight how the costs of health effects frequently faced by poor farmers can undermine the economic benefits from applying pesticides. Poisoning symptoms were mainly caused by poor practices, notably the lack of protective clothing, and the hazardous nature of commonly available pesticides. Household health costs include traditional cures, medical consultation and drugs, transport to a clinic and partial or total days of work lost. Farmers in Ghana reported that insecticide exposure during spraying made them so weak and sick that they had to stay in bed for 2-7 days afterwards to recover after each application. Many farmers cannot afford to seek medical help. In Cote d'Ivoire only 2% of farmers consulted formal medical services.

Hidden costs can be enormous. Recent expert research shows that a very conservative estimate of these costs in Germany, UK, US and China (rice only) amounts to between US$8-47 per hectare of arable land, or an average US$4.28 per kg of pesticide active ingredient applied In the Chinese case, these external costs exceeded the market value of the pesticides for every US$1.0 worth of pesticide applied, costs to society in the form of health and environmental damage averaged US$1.86.(Pretty and Waibel, 2005) This may be a good reflection of the situation in other developing countries, where the majority of global pesticide poisonings occur with no adequate knowledge of farm safety as well as the role of a good farm safety record could play in solving the problem.

It has been said that the chances are good that small farmers in Africa will increasingly depend on pesticides alone to control insect pests, and without satisfactory understanding of the associated hazards. This also implies that based on different policies of the government on agriculture will lead to massive increase in the use of fertilizer, herbicides and pesticides with little or no knowledge of the health, safety and environmental implications. Despite this there is programme or policies in place addressing these challenges probably because there no research documentations on the severity of the issue. In an attempt to provide an overview of the issue necessitated this study.

MATERIALS AND METHODS

The study was carried out in Ibadan metropolis in Oyo State, Nigeria. The state has thirty-three Local Government Areas. Its population is 1,338,659 according to census results for 2006.With Coordinates 7°23′47″N, 3°55′0″E and Area 1,189.2 sq mi (3,080 km^2)**.** Ibadan has a tropical wet and dry climate, with a lengthy wet season and relatively constant temperatures throughout the course of the year. Ibadan's, wet season runs from March through October, though August

sees somewhat of a lull in precipitation. This lull nearly divides the wet season into two different wet seasons. The remaining months forms the city's dry season. Like a good portion of West Africa, Ibadan experiences the harmattan between the months of November and February. Agriculture is the main occupation of the people of Oyo State. The climate in the state favours the cultivation of crops like maize, yam, cassava, millet, rice, plantains, cocoa, palm produce, cashew etc (Ibadan Wikipedia, 2011) .Data were obtained with the aid of a structured interview schedule, administered to 89 farmers. These respondents were randomly selected from the faming population in the area; this was supplemented with secondary data from reports, publications and internet. Simple statistics such as mean, mode, percentages and frequency, were used for the data analysis

Table 2: Result

Demographic and Socio economics characteristics	**Frequency**	**Percentage %**
Age (years)		
20-30	26	29
31-40	40	45
>40	23	26
Sex		
Males	69	78
Females	20	22
Marital Status		
Single	24	27
Married	65	73
Educational background		
No formal education	21	24
Primary	36	40
Secondary	18	20
Tertiary	14	16
Farming Occupation		
Primary source	67	75
Secondary source	22	25
Farm size(Ha)		
Less than 1.0	21	24
1.1-2.0	44	49
2.1-3.0	12	13
3.1-4.0	8	9
4.1-5.0	4	5
Farming Experience		
Less than 10	23	26
11-20	47	53
21-30	19	21
Farm safety Awareness		
No	71	80
Yes	18	20
Use of complete Personal protective equipment (PPE)		

No	72		81	
Yes	17		19	
Regular contact with extension agents				
Yes	23		26	
No	66		74	
Agrochemical used				
Herbicides		77		87
Pesticides		79		89
Fertilizer		61		69
Application of agrochemicals				
Self applied	69		78	
Professionals' service		9		10
Professional and self		11		12
Use of material safety data sheet before chemical mixing and application				
Yes	11		12	
No	78		88	
Ability to calibrate sprayer before use				
No	70		79	
Yes	19		21	

DISCUSSION

From table 2: The result revealed that the modal age group for the respondent was 31-40 with a percentage of 45.This shows that majority of the farmers are still young and agile. Male respondents were majority with a percentage of 78 reflecting a male dominated occupation. 73% of the respondents were married and 27% were single. 24%, 40% and 16% had no formal education, primary education and tertiary education as the highest level of education attained respectively. This has a great implication for technology adoption. Since many researchers has pointed out education as a crucial factor for rate of technology adoption. The study further revealed that 1.1-2.0 hectares were the modal farm size of the respondents which is in line with the fact that the Nigerian farming population is dominated by small holders. 53% and 26% of the respondents had 11-20 and less than 10 years farming experience respectively.

The Study revealed that 80% of respondents were not aware of farm safety concept and procedures. Also 81% of the respondents do not use complete recommended personal protective equipment during mixing and application of agrochemicals. This has a great implication for the health and wellbeing of the farmers. This may lead to chemical ingestion, absorption, inhalation and intoxication. This will in turn lead to higher rate of lost time, and farm accident burden which will reduce the efficiency and productivity of the farming population.

74% of the respondents claim not to have a regular contact with extension agents. This is implies that information dissemination to these farmers is hampered probably due to this factor. This also includes farm safety information needed for proper application of agro chemicals. This finding is underscored by Bull (1982), who reported that inadequate extension services and limited resources also contribute to the regular and widespread incidence of poisoning and misuse of pesticides. 87%, 89% and 69% of the respondents acclaimed the use of herbicides, pesticides and inorganic fertilizers for their agricultural activities. This is a reflection of the huge quantity of agrochemicals consumed in the Nigerian agricultural sector and hence the importance of farm safety measures. Furthermore, 78% of the chemicals applied are self applied. 10% engage the service of professionals while 12% combine both.

88% of the respondents do not use the material safety data sheet that accompanied the chemicals, most of them depend on a prior knowledge or information on chemicals and 79% do not calibrate their sprayer before usage. This means that the proper use in terms of quantity and procedures is not guaranteed since the manuals are not consorted before application. This in line with the observation of Asogwa and Dongo (2009), sprayer calibration is usually proposed and taught in research and training institutions, but is hardly ever done in practice, which usually results in the use of wrong dosage of pesticides. Calibration of sprayers is very essential even when they are in perfect working conditions. The spraying of cocoa farms with overdose of pesticides will result in farmers incurring huge financial losses due to wastage and phytotoxicity, which will decrease the yield. However, the major risk of overdose or underdose is the increased likelihood for the pests to develop resistance against pesticides, which can have devastating large-scale effects on cocoa production (Meijden, 1998).

However, integrated pest management can assist small scale farmers to produce stable crop yields more cheaply through political, socioeconomic and environmental considerations (Youdeowei and Service 1983). Implementation of integrated pest management (IPM) tactics and collaborating with farmers, such as conducting pest management trials on their fields, can provide farmers with safer and more economical alternatives to pesticide dependency.

Understanding and acceptance of IPM is often not easily achieved, especially in farming systems in countries such as Gambia where pesticides are applied in farmers' fields free of charge by mobile crop protection service teams (Sagnia 1983). Thus, educating farmers on patterns of pesticide use and pesticide safety is essential. Also less use of inorganic fertilizer should be encouraged. Instead the use of organic fertiliser, organic farming and conservation agriculture should be encouraged in line with the United Nations best global environmental and sustainable practices.

RECOMMENDATIONS

- Integrated pest management practices should be encouraged
- Farmers should be trained on the use of material safety data sheet
- There should be massive awareness on the health and safety implications of agrochemicals
- There should be massive sensitisation on the use of personal protective equipment
- National agricultural policies should be designed in line with global best practices
- Farmers should be trained on proper mixing, sprayer calibration and application of agrochemicals
- Sustainable agriculture such as conservation agriculture should be encouraged

CONCLUSION

In this paper, the health and safety implications of massive use of agrochemicals by Nigeria's small scale farmers had been examined. Past studies such as El Batami, 2003; Oluwagbemi, 2007 and Ide, 2008, had identified that agriculture chemical exposures such as are pesticides, herbicides and fertilizers, vapours, fumes and some organic dusts from grains and even poultry dusts have been known to have health effects, such as carcinogenicity (the capacity to cause cancer), mutagenicity (the capacity to induce mutations), teratogenicity (the capacity to affect the foetus), psychiatric disorders and delayed neuropathy. However, in some quarters it has been argued that for the global food insecurity problem to be abated there must be massive usage of agrochemical to achieve the feat. I believe sustainable agricultural methods such as integrated pest management, conservation agriculture will give a better productivity if well harnessed with less chemical usage. It is reasonable to conclude that if agrochemicals are to be used, they should be used as directed on the material safety data sheet using appropriate techniques and protective equipment in line with the global best practices.

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ABOUT THE AUTHORS:

Toyin Samuel OLOWOGBON: Occupational Health and Safety Division of Vertext Media Ltd, Ibadan, Nigeria

Segun Bamidele FAKAYODE: Department of Agricultural Economics, University of Ilorin, Nigeria

Ademola John JOLAIYA: Department of Agricultural Economics, University of Ilorin, Nigeria

Adebola Omolara OKE: College of Agriculture, Lafia, Nasarawa State, Nigeria.