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ANALYSIS OFADOPTION OF SAFETY MEASURES BY SPRAY SERVICE PROVIDERS (SSPs) IN KANO STATE, NIGERIA

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ABSTRACT

The study analyzed the adoption of safety measures by Spray Service Providers (SSPs) in Kano State, Nigeria. Multi-stage sampling technique was used to select 185 respondents for the study. Data were collected from primary sources by the use of an interview schedule questionnaire administration technique and analyzed using descriptive statistics and multiple regression. The findings indicated that the entire (100%) respondents were male and educated with mean age of 30 years; 45% were married. They had mean household size and spraying experience of 3 people and 5 years, respectively. The multiple regression results showed that age ($P<0.01$), years of spraying experience ($P<0.01$), access to credit ($P<0.01$) and educational level ($P<0.05$) positively and significantly influenced adoption of safety measures. The result further revealed that use of Personal Protective Equipment (PPE) had the highest adoption score of 95%. High cost and non-availability of PPE (63.78%), Triple rinsing of equipment after application (54.05%) and inadequate application equipment such as gloves, coveralls, boots and hats (49.72%) were the most serious constraints facing SSPs. Use of PPE, knowledge of mixing and selecting of the right pesticides were adopted. The study concluded that safety measures were highly adopted by the SSPs which may help in safeguarding farmers health and the environment of the study area. The study recommended that priority should be given to provision of this PPE and at affordable price to SSPs.

Keywords: Spray service providers; safety measures; adoption; Kano

INTRODUCTION

Agrochemicals use have been increasing in both developing and the developed nations. The unsafe handling and use of agrochemicals are a call for concern which can lead to accumulation of hazardous chemicals substance in the body, causing adverse effects on human health and the environment. Agrochemical sprays for control of pesticides and herbicides have been in use in Nigeria for a very long time. Pesticides have proven to be indispensable tools in both pre-harvest and post-harvest stages by combating damage from pests and ensuring sustainable food production with improved yield and greater availability of food throughout the year. Crop farmers use a wide range of pesticides at different levels

to reduce losses from pests and diseases. However, most farming activities like spraying of pesticides predispose farmers and their communities to health hazard because some users of these hazardous substances deliberately refuse to observe necessary precautionary measures (Olowogbon and Jolaiya, 2012).

Human exposure to pesticides results in a number of harmful effects depending on the type of pesticide and duration of exposure. The most common signs of exposure are headache, excessive salivation, lacrimation, nausea, diarrhoea, respiratory depression, seizures, and loss of consciousness (Medline Plus, 2015; Pesticide Safety Education Program [PSEP], 2015). Similarly, research conducted by Kachaiyaphum *et al.* (2010) showed that farmers were experiencing different kinds of health problems due to use of pesticides, including dizziness, headache, and nausea or vomiting. Luckily, the toxic residues of pesticides in the environment and food can be minimized by educating farmers and exposing them to training on the safe usage of pesticides (Ahmed *et al.,* 2011; Khan *et al.*, 2010).

In developing countries, farmers face great risks of exposure due to use of toxic chemicals that are banned and/or restricted in other countries, incorrect application techniques, poorly maintained or totally inappropriate spraying equipment, inadequate storage practices, and often re-use of old pesticide containers for food and water storage (Ibitayo, 2006; Asogwa and Dongo, 2009). Poorly regulated and unsafe use of pesticides coupled with the absence of adequate education has led to increasing pesticides impact on public health and, in particular, on the health of farm workers (Tijani, 2006). Also, Dey *et al.* (2013) posited that the public health effects of pesticides have long been known and the undesired effects of chemical pesticides have been recognized as a serious public health concern during the past decades.

However, the methods for safe storage, handling and application of pesticides are not widely used in most developing countries (Dinham, 2003), particularly in Africa (Williamson *et al*., 2008) posing serious health threats to resource-poor rural farmers as they are users of largest proportions of chemical pesticides (Oluwole and Cheke, 2009). The mortality rate associated with the use and handling of agrochemicals has been shown to be high in developing countries, such as Nigeria (Ojo, 2016). The problem is that while potential importance of safe handling of chemicals is known, in addition to the health issues resulting from the use of agrochemicals, little is known about the safety measures required in the use and handling of agrochemical in the study area. In view of these challenges, CropLife Africa Middle East has developed the Spray Service Providers (SSPs) concept to improve access to quality pesticides, correct application and use of safety devices through the trained SSPs. An SSP is a farmer who has received a special training to apply pesticides and who hires out his services to (fellow) farmers to spray their crops. The purpose of the SSP network is to ensure pesticides are only handled by those that are trained; to reduce the risk towards human health and the environment; to ensure the correct pesticides are used at the right dosage, for effective pest control and increased yields; to plan the purchase of pesticides and avoid the accumulation of obsolete stocks; and to safely dispose used containers.

Although the topic agrochemicals use and handling has received attention in recent times mostly as separate independent studies, however, only few studies have investigated the adoption of safety measures by Spray Service Providers (SSPs) in the study area. It is against this background that the study was designed to analyse the adoption of safety measures by SSPs in Kano State, Nigeria. Specifically, the study sought to: describe the socio-economic characteristics of SSPs in the study area; determine the socio-economic factors that influence adoption of safety measures; ascertain the extent of adoption of the

safety measures by SSPs, and describe the constraints faced by SSPs in carrying out their services.

MATERIALS AND METHODS

The Study Area

The study was carried out in Kano State, located in North-Western Nigeria. It occupies an area approximately 20,131km^2. The State lies approximately between latitudes 10^o 33` N and 12$^o$ 23`N and longitudes 7^o 45`E and 9$^o$ 29`E, with an average altitude of 484m above sea level. The State has a population totalling 9,401, 288 according to 2006 National Population Census (NPC,2006). The annual growth rate was 3.34% and the projected population as at 2019 was 13, 483, 327 with proportion of 7,096,352 males and 6,386, 974 females (Ahamed, 2014). The State is bordered to the Northwest and Northeast by Katsina and Jigawa State, respectively, while to the South and Southwest, with Bauchi and Kaduna States respectively (KNSG, 2006).

The climate of the area is the tropical dry and wet type. The movement of the Inter-Tropical Discontinuity (ITD) gives rise to two distinct climatic condition/seasons. The wet season spans the period between May to mid-October with a peak in August while the dry season extends from mid-October to mid-May. The annual mean rainfall is between 800mm to 900mm; and variations about the mean annual values are up to 30%. The mean annual temperature is about 26^{o}C (Abaje, Ndabula and Garba, 2014).

Kano state features Savannah vegetation with a semi-arid climate. It witnesses an average precipitation of about 690mm per year, the bulk of which falls from June to September. The State is typically hot throughout the year, though noticeably cool from December-February. It has a well-drained ferruginous soil.

The inhabitants of the State are predominantly of Hausa/Fulani ethnic origin-though religious and ethnic diversity remains one of Kano's chief characteristics. Other ethnic groups inhabiting the State include Yoruba, Igbo, Nupe, Kanuri, Tiv, Ebira as well as other ethnic groups from West Africa, Middle East and Asia especially Niger, Yemen, Lebanon, China and India. Farming is among the major occupation of the people and crop production is characterized predominantly by mixed cropping. Subsistence and commercial agriculture are mostly practiced in the State. The major food/vegetable crops grown in the State includes millet, sorghum, soybean, cowpea, maize, cotton, groundnut, rice, tomato, pepper, onion, garden egg, sweet potato. Other agricultural activities carried out in the State are animal husbandry, fishery, processing and marketing of agricultural products.

Sampling Techniques

Purposive selection of six (6) Local Government Areas (LGAs) out of the ten (10) participating LGAs in the SSP project in Kano State based on concentration and intensity of the projects in those six (6) Local Government Areas. Secondly, the entire 185 (100%) SSPs

from the 6 LGAs namely Dawakin Kudu (30), Tofa (32), Gwarzo (31), Dambatta (30), Wudil (30) and Makoda (32) were considered for the study.

Data Collection Procedure

Data for the study were collected from primary sources using structured questionnaire which was supported with interview schedule in a situation where the respondents could not understand the questions. The questionnaire was designed in accordance with the objectives of the study. The secondary sources of information were crop life Nigeria for the information on respondents and local government areas covered by the project. Other secondary sources include review of empirical studies from journals and other publications.

Method of Data Analysis

The data were analysed using descriptive statistics (frequency distribution, percentages, mean, standard deviation and adoption score) and inferential statistics (multiple regression). The multiple regression model was specified as:

Yij = XP + U……..... (1)

The explicit form of the multiple regression model can be expressed in the following model:

$Y = P0 + P_1X_1 + P_2X_2 + P_3X_3 + P_4X_4 + P_5X_5 + P_6X_6 + P_7X_7 + U$……... (2)

where;

Y = Number of Safety measures adopted

X_1 = Age (years)

X_2 = Marital Status (1 = Single, 2 = Married, 3 = Divorced, 4 = Widowed)

X3 = Education (No. of years spent in formal schooling)

X_4 = Household size (number of household members)

X_5 = Years of experience(years)

X_6 = Credit access (1= access, 0 =no access)

X_7 = Extension Visits. p_0= Constant

p_1-p_6= Parameters to be estimated

U =Stochastic error term

Also, adoption index was used to determine the levels of safety measures adopted among individual SSPs using the following formula:

$AIi = \frac{ATi}{RTi} \times 100$ …… (3)

AIi is adoption index of SSP,

ATi = Obtained Adoption Score of SSP,

RTi= Maximum Obtainable Score

It was measured on a three-point continuum as full adoption, partial adoption and non-adoption by assigning the score 2, 1 and 0 respectively. Also, extent at which the SSPs adopt the safety measures was measured using five (5) steps of adoption; viz.; awareness, interest, evaluation, trial and adoption and scored 1, 2, 3, 4, and 5, respectively. The percentage of farmers at each step for each technology was worked out, mean adoption score and grand mean adoption score was also evaluated.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Spray Service Providers (SSPs)

Results in Table 1 shows the distribution of Spray Service Providers by certain socio-economic characteristics. It revealed that average age of SSPs is 30 years. This implies that the SSPs were relatively young and within active age of production. The findings were similar to that of Bello *et al.* (2010) who reported 35 years as average age of farmers in their study area.

Table 1: Socio-economic characteristics of spray service providers (SSPs) (n=185)

Variables	Minimum	Maximum	Mean	Std. Deviation
Age (years)	21	49	30	6.0
Household size (number)	1	20	3	3.25
Farming/Spraying experience (years)	1	20	5	3.8
Farm Size (Hectare)	0.4	5.0	2	1.2

Source: Field Survey (2019)

The average household size of SSPs in Table 1, was found to be 3 persons per household. This shows that most of the SSPs had below the national average of 5 persons per rural household as reported by Living Standards Management Study/National Bureau of Statistics [LSMS/NBS] (2016). This is a small size and could positively influence the adoption of safety measures by SSPs. This finding is in line with the findings of Kinuthia (2019) who reported an average of 5 members per household.

The years of farming/spraying experience shown in Table 1 revealed 5 years on average. This means that SSPs had relatively enough years of experience for adoption of safety measures since SSPs were likely to understand the precautionary measures required in handling agrochemicals. This agreed with the findings of Kinuthia (2019) who reported 7 years of farming experience in her study area.

The average farm size cultivated by SSPs was 2 hectares as shown in Table 1. This shows that farmers in the study area were small-holder farmers and production is done on small land holdings. Living Standards Management Study [LSMS/NBS] (2016) reported that each agricultural household holds an average of 2.6 plots at an average of 0.5 hectares in size. This is in line with Bello *et al.,* (2010) who found an average farm size of 2.6 hectares in their study area.

Socio-economic Characteristics of Spray Service Providers (SSPs) Continuation

The result in Table 2 indicated that the entire (100%) the SSPs were male. This implies that spray services were dominated by males which may be as a result of religious and cultural restrictions which prevent females from interacting freely with their male counterpart. This is in line with Bello *et al.* (2010) who reported that women were constrained in terms of opportunities, access and control over resources and the benefits derived.

Table 2: Socio-economic characteristics of the SSPs Cont.……. (n=185)

Variables	Frequency	Percentage
Sex		
Male	185	100
Marital Status		
Single	100	54.1
Married	85	45.9
Educational level		
Qur'anic	1	0.5
Primary	2	1.1
Secondary	78	42.2
Tertiary	104	56.2
Extension contact		
Contact	159	85.9
No contact	26	14.1
Access to Credit		
Access	88	47.6
No access	97	52.4

Source: Field Survey 2019.

The result in Table 2 showed that more than half (54.1%) of the SSPs were single. This indicates that they were youths and still had strength to work on the farm without hiring labour. This is in line with the report of Bello *et al.* (2010) who reported that most of the farmers in their study area were single. It is also in line with Anderson *et al.* (2017) who reported that majority of smallholder farmers in Nigeria were not married.

Table 2 further revealed that more than half (56.2%) of the SSPs had tertiary education. Also, almost all (99.5%) the SSPs had acquired a basic education (at least primary education) which is important in making decision relating to safety measures. This inferred that the SSPs had a good proportion of literate people and may lead to high adoption rate of safety measures. This agreed with the findings of Lami and Abraham (2013) who reported more than half of their farmers in their study area had tertiary education.

Results from Table 2 shows that majority (85.9%) of the SSPs had contact with extension agents. Contacts with extension agents provides farmers the opportunity of sharing new ideas and knowledge on improved farm production practices through interacting with other farmers (NAERLS and FDAE, 2014). This is in contrast with Famuyiwa *et al.* (2014) who discovered very low extension contact among their respondents.

Access to credit has been empirically proven to be an important factor that influenced productivity. Result in Table 2 revealed that more than half (52.4%) of the SSPs had no access to credit. The expectation was that SSPs could have more access to credit vital for purchase of required resources and other inputs needed for their operation which may increases the likelihood of using safety measures.

Factors Influencing the Adoption of Safety Measures by SSPs

Adoption of safety measures by the SSPs was influenced by a number of socio-economic factors. Table 3 presents the results of multiple regression model. The coefficient of age, access to credit, farming/spraying experience and educational level were positive. Age was found to have a positive and significant influence ($P < 0.01$) on adoption of safety measures suggesting that the younger the SSPs, the higher the probability of adoption of safety measures in the study area. These results agree with the findings of Bello *et al.* (2010) who found a positive and significant relationship between age and adoption at 5% in their study area.

A positive and significant relationship ($P<0.05$) was found between SSPs 'educational level and adoption of safety measures. This implies that the SSPs will have higher adoption rate of safety measures. A result consistent with the findings of Lami and Abraham (2013) who reported that almost all the farmers had post-primary education in their study area.

Table 3: Socio-economic factors influence of SSPs on adoption of safety measures

Variable	Unstandardized Coefficient	Standardized Coefficient	Standard Error	t-stat	P-values
Constant	2.089		0.222	9.399	0.0182**
Age	0.964	0.509	0.148	6.501	0.0311**
Marital Status	-164.63	-0.123	1132.46	-0.150	0.8847
Educational Level	301.04	0.054	344.95	0.871	0.0051*
Household Size	47.84	0.216	261.43	0.181	0.8552
Experience	1072.94	0.249	414.36	2.59	0.0112**
Access to credit	0.485	0.250	0.166	2.923	0.0265**
Extension (No. of visits)	-0.072	-0.043	0.058	-1.240	0.2171
R^2	0.564				
R^2-adjusted	0.542				
F-value	25.44				0.001***

*** Significant at 0. 1% ($p<0.001$), ** at 1% ($p<0.01$). *at 5% ($p<0.05$)

A positive and significant relationship ($P < 0.01$) was similarly found between years of farming/spraying experience and adoption of safety measures. The general perception is that individuals with more experience in using agrochemicals would have a likelihood of adopting safety measures relative to those with little or no experience. This agreed with Wang *et al.* (2018) who indicated that farmers with more experience have more skills (through practice) to control pesticide application (manage pest and diseases) without excessive use of pesticide.

Access to credit was found to be positive and statistically significant ($P < 0.01$). This implies that access to credit may increase the probability of SSPs to adopt safety measures by purchasing safety equipment needed for their work.

It was hypothesized that there is no significant relationship between SSPs' socio-economic characteristics and adoption of safety measures in Kano State. The positive and significant relationship found between some of the explanatory variables and adoption of

safety measures, was therefore contrary to the stated null hypothesis, hence, the null hypothesis was rejected.

Extent of Adoption of Safety Measures by the SSPs

The extent of adoption of safety measures by the SSPs was presented in Table 4. The fourteen safety measures considered for the study reveals that use of PPE was the highest with mean adoption score of 0.95, followed by knowledge of mixing with a mean adoption score of 0.86. It was closely followed by selecting the right pesticides with mean adoption score of 0.81. The least adopted safety measure was proper disposal with mean adoption score of 0.49. The grand mean adoption score was 0.68, which implies that most (68%) of the safety measures were adopted by the SSPs in Kano State. The findings disagreed with the finding of Ekwempu, (2019), who reported a low level of adoption for the use of Personal Protective Equipment in her study area. Andrade-Rivas and Rother (2015) argue that workers' socio-cultural context (gender dynamics and social status) among other factors play an important role in the adoption of PPE, and therefore given the complexity of PPE compliance, exposure reduction interventions should not rely solely on PPE use promotion.

Table 4: Distribution of SSPs according to their adoption of safety measures

	Adoption stages (%)					Total	Mean adoption score
Safety measures	Awareness	Interest	Evaluation	Trial	Adoption		
Reading the label	89.6	80.1	50	62.3	60.6	342.6	0.69
Scouting	89.2	60.9	75.4	85.1	80.2	390.8	0.78
Selecting the right pesticides	90	75.3	82.1	80	78.4	405.8	0.81
Use of PPE	99.5	96.2	94.6	92	91.3	473.6	0.95
Triple rinsing	90.4	50.6	49.6	52.6	40	283.2	0.57
Proper storage	89	60.1	65	50.9	49.6	314.6	0.63
Proper transport	87	57.6	60	43	53.7	301.3	0.60
Knowledge of mixing	98.9	95.1	94.6	70.9	69.3	428.8	0.86
Proper disposal	73	47	45	39.6	40.8	245.4	0.49
Use of correct applicators	97.8	56.1	61	47.8	41.2	303.9	0.61
Avoid using expired product	91	52	51.5	42.3	39.6	276.4	0.55
Using the right dose	92	59	63.1	60	43.1	317.2	0.63
Pre-harvest	98.9	71	60	53.1	53	336	0.67
Avoid eating during work	99	53	56.1	62	54	324.1	0.65
Grand Mean Adoption Score							0.68

Constraints to Adoption of Safety Measures by Spray Service Providers

The most mentioned challenges that SSPs encountered in adoption of safety measures, as shown in Table 5 were high cost and non-availability of PPE (63.78%), triple rinsing of equipment after application (54.05%) and inadequate application equipment such as gloves, coveralls, boots and hats (49.72%). The least constraint according to the SSPs was found to

be little/no training on pesticides safety use /expertise advice by extension agents as reported by 25.41%. This finding corroborates that of Issa (2016) who reported adulteration and high cost of agrochemicals as the most important constraints in his study area. This result is also consistent with the findings of Osabuohien and Omoregbee (2017) which asserted that lack of money to buy protective equipment and little or no extension expertise advice were the major challenges associated with adoption of pesticide safety measures among users in their study area.

Table 5: Constraints to adoption of safety measures by SSPs

Constraints	Frequency*	Percentage	Rank
High cost and non-availability of PPE	118	63.78	1st
Triple rinsing of equipment after application	100	54.05	2nd
Inadequate application equipment Such as gloves, coveralls, boots and hats	92	49.72	3rd
Unclear labelling of pesticides container	75	40.54	4th
Measuring and mixing of pesticides	68	36.76	5th
Storage of pesticides	55	29.73	6th
Little/no training on pesticides safety use /expertise advice by extension agents	47	25.41	7th

Source: Field Survey 2019. *Multiple Responses

CONCLUSION

The study concluded that safety measures were highly adopted by the SSPs which may help in safeguarding the health of the SSPs and the environment of the study area. Use of PPE, knowledge of mixing and selecting of the right pesticides were technologies highly adopted. However, the spray service providers in the study area were facing some challenges in their services. The major identified constraints were high cost and non-availability of PPE, triple rinsing of equipment after application and inadequate application equipment such as gloves, coveralls, boots and hats. Therefore, the following recommendations were made:

Although the SSPs in the study area were largely educated, there is a need to provide a clear labels of pesticides containers to enable the SSPs to read and understand information written on agrochemical containers; All the SSPs in the study area were males, therefore, females should be encouraged to partake as spray service providers in the study area; Majority of the SSPs who received training on the use of safety measures were trained by NGOs. It is therefore, logical for government to upgrade the capability of extension agents to train other SSPs on the safety measures required during agrochemicals application; Findings from the study established that farmers had good knowledge of safety measures required in the use and handling of agrochemicals. To increase SSPs usage of PPE, priority should be given to provision of this PPE and at affordable price to SSPs.

REFERENCES

Abaje, I.B., Ndabula, C. and Garba, A.H. (2014). Is the changing rainfall pattern of Kano State and its adverse impacts an indication of climate change? *European Scientific Journal*, 10(2): 192-206.

Ahamed, M.I. (2014). How far is too far? The facts and figures on human population in Kano State. *International Journal of Humanities and Social Science Invention,* 3(4): 61-64.

Ahmed, A., Randhawa, M.A., Yusuf, M.J. and Khalid, N. (2011). Effect of processing on pesticide residues in food crops: A review. *J. Agric. Res.* 49 (3), 379–390.

Andrade-Rivas, F. and Rother, H. A. (2015). Chemical exposure reduction: Factors impacting on South African herbicide sprayers' personal protective equipment compliance and high-risk work practices. *Environmental Research,* 142: 34-45

Anderson, J., Marita, C., Musiime, D. and Thiam, M. (2017). CGAP Working Paper. National Survey and Segmentation of Smallholder Households in Nigeria. Understanding their Demand for Financial, Agricultural and Digital Solutions. 1-93.

Asogwa, E.U., Dango, L.N. (2009). Problems associated with pesticide usage and application in Nigerian cocoa production: A review. *African Journal of Agricultural Research.* 4:675-683.

Bello, M., Ibrahim, H.I., Salau, E.S., Kaura, A.G. and Age, A.I. (2010). Factors influencing the adoption of agrochemical technology by small-scale farmers in Kwali Area Council of Abuja FCT, Nigeria. *Journal of Environmental Issues and Agriculture in Developing Countries,* 2 (1): 176-190.

Dey, K. R., Choudhury, P. and Dutta, B. K. (2013). Impact of pesticide use on the health of farmers: A study in Barak Valley, Assam (India). *Journal of Environmental Chemistry and Ecotoxicology*. 5(10):269-277

Dinham, B. (2003). Growing vegetables in developing countries for local urban populations and export market: problems confronting small-scale producers. *Pest Management Science*, 59: 572–582.

Ekwempu, A.I. (2019). Safe Chemical Handling by Agrochemical Users in Plateau State, Nigeria. Walden Dissertations and Doctoral Studies. Pp1-127

Famuyiwa, B.S., Torimiro, D.O., Obatolu, B.O. and Uwagboe, E. O. (2014). Preventive measures adopted by Nigerian farmers for the environmental hazards in cocoa plantations. *Journal of Agricultural Extension,* 18 (2): 99-111.

Ibitayo, O.O. (2006). Egyptian farmers' attitudes and behaviours regarding agricultural pesticides: Implications for pesticide risk communication. *Risk Analysis*, 26:989–95.

Issa, F.O. (2016). Analysis of Adoption of Recommended Agrochemical Practices among Crop Farmers in Kaduna and Ondo States of Nigeria. *PhD Thesis*, Ahmadu Bello University (ABU) Zaria, Nigeria. 1-206.

Kachaiyaphum, P., Howteerakul, N., Sujirarat, D., Siri, S., Suwannapong, N. (2010). Serum cholinesterase levels of Thai chilli-farm workers exposed to chemical pesticides: Prevalence estimates and associated factors. *J. Occup. Health,* 52 (1), 89–98.

Khan, M.J., Zia, M.S., Qasim, M. (2010). Use of pesticides and their role in environmental pollution. *World Acad. Sci. Eng. Technol.* 72, 122–128.

Kinuthia, C. W. (2019). Determinants of pesticides use and uptake of alternative pest control methods among small scale tomato farmers in Nakuru County, Kenya. M.Sc. Thesis, Egerton University.

Kano State Government [KNSG] (2006). Kano State Government. National Population Commission, Census Reports. Retrieved from http://www.population.gov.ng

Lami, A.N. and Abraham, E.A. (2013). Perception of agrochemical use and organic farming in Makurdi, Benue State. *International Journal of Environmental Protection,* 3 (8): 48-52.

Living Standards Measurement Study (LSMS) and National Bureau of Statistics (2016). Integrated Surveys on Agriculture. General Household Survey Panel 2015/2016. A Report by the Nigerian National Bureau of Statistics in Collaboration with the Federal Ministry of Agriculture and Rural Development and the World Bank. 1-92.

Medline Plus, (2015). Insecticide Poisoning. US National Library. www.nlm.nih.gov › Home › Medical Encyclopedia (accessed 03.11.15).

National Agricultural Extension and Research Liaison Services and Federal Department of Agricultural Extension (2014). Agricultural performance survey of 2014 wet season in Nigeria, *Executive summary*. Pp 23.

National Population Commission (2006). Population Census of the Federal Republic of Nigeria Report at the National Level Census Report. Pp. 30 – 35.

Ojo, J. (2016). Pesticides use and health in Nigeria. *Ife Journal of Science,* 18(4), 981-991. Retrieved from **http://scholar.oauife.edu.ng/ijs/publications/pesticides-use** and health-Nigeria.

Olowogbon, S. T. and Jolaiya, A. J. (2012). Economics in occupational health and Safety: The agricultural perspective. *African Newsletter on Occupational Health and Safety*, 22(1):9-11

Oluwole, O. and Cheke, R.A. (2009). Health and environmental impacts of pesticide use practices: A case study of farmers in Ekiti State, Nigeria. *International Journal of AgriculturalSustainability*, 7(3):153–163

Osabuohien, J. I. and Omoregbee, F. E. (2017). Constraints associated with pesticide safety measure adoption among users in oil palm farms in Edo, Delta and Ondo States, Nigeria. *Ethiopian Journal of Environmental Studies and Management,* 10 (5): 610-617.

Pesticide Safety Education Program (PSEP) (2015). Symptoms of Pesticide Poisoning. Cornell University, Cooperative Extension, Module 9. **http://psep.cce.cornell.** edu/Tutorials/core-tutorial/module09/index.aspx.

Tijani, A.A. (2006). Pesticide use and safety issues: The case of cocoa farmers in Ondo State, Nigeria. *Journal of Human Ecology,* 19:183–190.

Wang, J., Chu, M. and Ma, Y. (2018). Measuring rice farmers' pesticide overuse practice and the determinants: A statistical analysis based on data collected in Jiangsu and Anhui provinces of China. *Sustainability,* 10 (677): 1-17.

Williamson, S., Ball, A. and Pretty, J. (2008). Trends in pesticide use and drivers for safer pest management in four African countries. *Crop Protection,* 27:1327–1334.