

Assessment of Awareness of Benefits and Hazards Posed by Agricultural Pesticides to Farmers in Selected Communities of Bayelsa State, Nigeria

Prince E. Kainga¹, Temitope A. Miller¹, Timothy T. Epidi²

¹Department of Agricultural Economics, Extension and Rural Development

²Department of Crop and Soil Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria

ABSTRACT

The scenario of growing problem of pesticide misuse in developing countries has continued to be of great concern among scientists and scholars. Developing countries such as Nigeria where subsistence agriculture is widely practiced, pesticides are serious potential health hazards because of illiteracy, lack of awareness of negative tendencies in the use of pesticides, and the public health issue of pesticide exposure among others. This study therefore, examined the awareness of the benefits and hazards posed by agricultural pesticide to farmers in selected communities in Bayelsa State, Nigeria. A sample of 100 respondents was selected through simple random method. Findings showed that the level of awareness of the respondents about the benefits and hazards associated with the use of agricultural pesticide was high and had significant impact on the farmers in terms of clean farm land and increased crop production. Nevertheless, pesticide misuse and overuse were harmful to human health, animal health, environmental and industrial health of farm workers in the study area. Furthermore, indications that most farmers lack formal education and without any form of training, and therefore need to be educated and trained on the hazard associated with pesticide usage was established. It was therefore recommended that Government should as a matter of urgency among others provide and enforce possible and strategic measures for the control of pesticide usage through training programmes on safety in the use of pesticide; and avenues for dissemination of potential hazards of unsafe pesticide use to the farmers should be established with daring political will. Farmers on the other hand should adhere strictly to recommended practices.

Key words: Assessment, Awareness, Benefits, Hazards, Agricultural Pesticides, Farmers, Bayelsa State

INTRODUCTION

Pesticides are widely used all over the world [11]; [1]. The foregoing is corroborated as there is gradual increase in the use of pesticides in the last half-a-decade in Bayelsa State, Nigeria. The term pesticide is defined as any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. That the term includes substances intended for use as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport [7]. Furthermore, [22] defined a pesticide as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest which can be insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses. According to [22], pesticide is often misunderstood to refer only to insecticides, but the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests.

Although pesticides contribute some benefits for agricultural production, they pose a number of risks and problems such as potential toxicity to humans, animals and negative impacts on the ecological environment [17]. In the same vein, unregulated and excessive use of pesticides has become a major

**Address for correspondence:*

princekainga@yahoo.com

bottleneck in the fight against insect pests [11]. Consequently, occupational risks among farm workers in developing countries have been attributed to exposure to pesticides [24]; [13]; [6];[23]. Human exposure to pesticides is through oral (by mouth), respiratory (by inhalation), or dermal (by skin contact) [25]; [11].

All over the world, the misuse of pesticide in farm business has often been associated with health problems and environmental contamination [20]; [19]. Misuse of highly toxic pesticides, alongside absent or unenforced legislative framework in the use of pesticides, is a major reason for high incidence of pesticide poisoning in developing countries [13]. Low education levels of the rural populace, lack of information and training on safety measures in pesticide usage, poor spraying technology, and inadequate protections during pesticide use have also been identified as a major problem ([8]; [4].

Other factors which include beliefs of farmers about pesticide toxicity, environmental hazards, and information about first aid and antidotes given by the label, the use of faulty spraying equipment or lack of proper maintenance of spraying equipment, and lack of use of protective gear and appropriate clothing during handling of pesticides, illiteracy, lack of awareness about the danger of misuse have been identified to be responsible to unsafe use of pesticides [8]; [2]. The use of domestic utensils and broken equipment for measuring and dispensing pesticides in developing countries is still on the increase [11]; and public education regarding pesticides handling has been identified to be entirely lacking [9]. In view of the adverse health effects from the unsafe pesticide use, there is a need to communicate to the farmers potential hazards of unsafe pesticide use and create awareness of the consequences of unsafe pesticide use and the relevance of extension and education programmes targeted at reducing risk [10]; [17]; [21]. Indeed, there is a growing need and use of pesticides yet, training needs to effective utilization is lacking. The study area is predominant with arable crop farming especially plantain and banana production. In some parts of the State, certain markets and market days are dedicated to this crop exclusively [12]. Nevertheless, studies have shown that industrial banana farming is pesticide-intensive because bananas are grown in massive monocultures without crop rotation, which makes it vulnerable to insect pests and fungal diseases [14].

The broad objective of this study was to assess the awareness of benefits and hazards posed by agricultural pesticides to farmers in selected communities in Bayelsa State, while the specific objectives were to: describe the socio economic characteristics of the respondents; ascertain the level of awareness of the respondents about the benefits and hazards associated with the use of agricultural pesticide; ascertain the benefits of agricultural pesticide by farmers; identify the pesticide misuse and consequences of overuse by the farmers and ascertain the environmental and health effects of pesticide. The outcome of this study could be of immense benefit to farmers since it will reiterate the benefits and hazards posed by agricultural pesticide and could equally help to promote the environmental and health of the farmers and dwellers of the area. It will also guide Government at all levels to drive legislative frameworks and programmes (if any) that will help raise awareness on the dangers posed by the usage of agricultural pesticides and strictly adhere to recommended safety measures in an attempt to increasing agricultural production.

RESEARCH METHODOLOGY

Study Area

The population of the study consists of farmers and dwellers of selected communities in Yenagoa Local Government and Southern Ijaw Local Government Area of Bayelsa State, Nigeria. Southern Ijaw Local Government Area (LGA) lies in 4°48'17"N 6°4'44"E with a coastline of approximately 60km on the Bright of Benin. It is the second largest local Government in Nigeria {landscape} after Toro Local Government in Bauchi State. The people and their language are known as Izon. It has an area of 2,682 km² and population of 319,413 at the 2006 census [16].

Yenagoa Local Government Area (LGA) which comprises the State Capital Territory lies in 4°55'29" N 6°15'51"E. The LGA has an area of 706km² and a population of 353,344 at the 2006 census. Yenagoa [16]. Both LGAs are located in the heart of the Niger Delta in South-South Nigeria, with high concentration of crude oil exploration and exploitation [3]; [5].

Method of Sampling and Data Collection

A sample size of one hundred (100) farmers and dwellers was selected. Out of this, fifty (50) respondents each in Yenagoa Local Government Area and Southern Ijaw Local Government Area respectively were selected. Furthermore, five (5) communities each were randomly selected from each of the two local government areas and ten (10) farmers each were randomly selected from each of the communities so selected. Communities in Yenagoa Local Government Area so chosen were Igbogene, Agudama-Ekpetiama, Azikoro, Gbarantoru and Ogbogoro while Communities in Southern Ijaw Local Government Area were Ayama, Egebiri, Oporoma, Amatolo and Amassoma. One hundred (100) questionnaire were distributed, however only 92 were recovered back.

Method of Data Analysis

Data collected for this study were analysed using Descriptive statistics such as Frequency distribution, simple percentages and Likert scale rating technique. A five-point likert scale was adopted. A statement was given, and at the end points corresponding to Strongly Disagree (SD), Disagree (D), Strongly Agree (SA), Agree (A), Undecided (U) to measure the Assessment of Awareness of Benefits and Hazards posed by Agricultural Pesticides were adopted. Scales with an even number of points do not have a midpoint and in that sense force a choice.

RESULTS & DISCUSSION

Socio-Economic Characteristics of the Respondents

The result showed that 20 (21.7%) were male while 72 (78.3%) were female. On marital status, the result showed that 23 (25.0%) were single while 64 (69.6%) were married and 5 (5.4%) were divorced. On age distribution the results showed that 12 (3.0%) were between the age range 16-25 years, 19 (20.7%) were between the age range of 26-35 years while majority, 24 (26.1%) were between the age range of 36-45 years, 32 (34.8%) were between the age range of 46-55 years and 5 (5.4%) were between the age range of 55 years and above. On education the results showed that majority 45 (48.9%) had no formal education, 32 (34.8%) were SSCE/GCE holder, and 10 (10.9%) were OND holder while 5 (5.4%) were BSC/HND holder. According to [18] in [15] on pesticides usage, most of the farmers are illiterate as a result they hardly know the correct way of spraying the pesticides; they get the information from older farmers or shop-keepers who sell these chemicals. Thus, most of the farmers are unaware of the health hazards they are facing. The results showed that 67 (72.8%) had between 1 and 10 years experience while 25 (27.2%) had between 11 and 20 years experience (Table 1).

Table 1: Socio-economic Characteristics of the Respondents

Sex	Frequency	Percent
Male	20	21.7
Female	72	78.3
Total	92	100.0
Marital Status	Frequency	Percent
Single	23	25.0
Married	64	69.0
Divorced	5	5.4
Total	92	100
Age	Frequency	Percent
16-25yrs	12	13.0
26-35yrs	19	20.7
36-45yrs	24	26.1
46-55yrs	32	34.8
55yrs And Above	5	5.4
Total	92	100
Educational Qualification	Frequency	Percent
No Formal Education	45	48.9
SSCE/GCE	32	34.8
OND/Diploma	10	10.9
B.Sc/HND	5	5.4
Total	92	100
Farmers Experience	Frequency	Percent
1-10yrs	67	72.8
11-20yrs	25	27.2
Total	92	100.0

Source: Field Survey Data, 2015

Level of Awareness about the Benefits and Hazards Associated With the Use of Agricultural Pesticide

Awareness of the risk associated with the use of pesticides

The results showed that 17 (18.5%) strongly disagreed the awareness of the risk associated with the use of pesticide, 5 (5.4%) disagreed while 6 (6.5%) undecided whether they were aware of the risk associated with the use of pesticide, majority, 43 (46.7%) agreed that they were aware of the risk associated with the use of pesticide and 21 (22.8%) strongly agreed of the awareness of the risk associated with the use of pesticide (Table 2).

Table2: Awareness of the risk associated with the use of pesticides

Response	Frequency	Percent
Strongly Disagree	17	18.5
Disagree	5	5.4
Undecided	6	6.5
Agree	43	46.7
Strongly Agree	21	22.8
Total	92	100.0

Source: Field Survey Data, 2015

Awareness of the use of pesticides

The results showed that majority, 53 (57.6%) indicated that the use of pesticide was always good while 34 (37.0%) indicated that it was sometimes harmful and 5 (5.4%) said they don't know (Table 3).

Table3: Awareness of the use of pesticides

Response	Frequency	Percent
Always Good	53	57.6
Sometimes Harmful	34	37.0
I Don't Know	5	5.4
Total	92	100.0

Source: Field Survey Data, 2015

Application of pesticides dusts or powders

The results showed that 5 (5.4%) indicated application of pesticides by hand while 49 (53.3%) was from a can or plastic tube and 38 (41.3%) by using a mechanical device (Table 4).

Table 4: Application of pesticides dusts or powders

Response	Frequency	Percent
With Hand	5	5.4
From a Can or Plastic Tube	49	53.3
Using a Mechanical Device	38	41.3
Total	92	100.0

Source: Field Survey Data, 2015

Prevalence of pest on farm land

The results showed that 8 (8.7%) strongly disagreed of prevalence of pest on their farmland, 15 (16.3%) disagreed while 5 (5.4%) undecided on the prevalence of pest on their farmland, 21 (22.8%) agreed of prevalence of pest on their farmland and majority, 43 (46.7%) strongly agreed of prevalence of pest on their farmland (Table 5).

Table5: Prevalence of pest on farm land

Response	Frequency	Percent
Strongly Disagree	8	8.7
Disagree	15	16.3
Undecided	5	5.4
Agree	21	22.8
Strongly Agree	43	46.7
Total	92	100.0

Source: Field Survey Data, 2015

General use of pesticides by farmers to protect farmland against pest

All the respondents, 92 (100.0%) strongly disagreed that pesticides are commonly or generally used by farmers to protect pest in farmland, probably due to the cost implication.

The Benefits of Agricultural Pesticide to Farmers

All the respondents 92 (100.0%) strongly agreed that the use of pesticides has helped to increase agricultural output, clean farmland and generally beneficial to farmers.

Consequences of Misuse and Overuse of Pesticides by Farmers

The effect of pesticide usage on the health of unprotected agricultural and industrial workers

The results showed that majority, 38 (41.3%) strongly disagreed that pesticides usage by farmers has no effect on the health of unprotected agricultural and industrial workers, 19 (20.7%) disagreed while 8 (8.7%) undecided, 15 (16.3%) agreed that pesticides usage has no effect on the health of unprotected agricultural and industrial workers and 12 (13.0%) strongly agreed in same manner (Table 6). Thus the effect on unprotected agricultural and industrial workers, as a result of pesticide misuse or overuse cannot be overemphasized. The relatively high rate of agreement that pesticides usage has no effect on the health of unprotected agricultural and industrial workers could be attributed to ignorance and/ or implications or lack of training on safety measures. The implications of the unregulated and excessive use of pesticides as a major bottleneck in the fight against insect pests cannot be overemphasized. The foregoing affirms [24]; [13]; and [6]. They affirmed that exposure to pesticides is one of the most important occupational risks among farmers in developing countries and is of great interest in order to identify the hazards of pesticide use and the establishment of safe methods of pesticide handling. Notwithstanding, the findings that most farmers in the study area lack formal education and without any form of training, and therefore need to be educated and trained on the hazard associated with pesticide usage cannot be overemphasized. This is in tandem with [15] who found that majority of the farmers were illiterate and a small group are educated/ literate. He also found that 99% of the farmers were not at all trained and do not know the proper use of agro-chemicals, they simply use by learning from their elders, which may not always be correct. Furthermore, Regulatory System of Controlling Pesticide Use proffered by [23] is eminent. According to him residual pesticide is probably a problem that worries consumers the most when they buy agricultural products and public concern about pesticides in the environment and their impacts on human health is rising.

Table6: *The effect of pesticide usage on the health of unprotected agricultural and industrial workers*

Response	Frequency	Percent
Strongly Disagree	38	41.3
Disagree	19	20.7
Undecided	8	8.7
Agree	15	16.3
Strongly Agree	12	13.0
Total	92	100.0

Source: Field Survey Data, 2015

Damages caused with the use of pesticide

The results showed that majority 46 (50.0%) indicated that the use of pesticides damages human health, 23 (25.0%) indicated that it damages water bodies while 13 (14.1%) indicated that it damages animal health and 10 (10.9%) indicated that it damages wildlife (Table 7).

Table7: *Damages Caused with the Use of Pesticide*

Response	Frequency	Percent
Human Health	46	50.0
Water Bodies	23	25.0
Animal Health	13	14.1
Wildlife	10	10.9
Total	92	100.0

Source: Field Survey Data, 2015

Severe damages to crops by pest

The results showed that 3(3.3%) strongly disagreed that their crops were damaged by pest, 11 (2.0%) disagreed that their crops were damaged by pest while 4 (4.3%) undecided whether their crops were damaged by pest, 19 (20.7%) agreed that their crops were damaged by pest and majority 55 (59.8%) strongly agreed their crops were damaged by pest (Table 8).

Table8: Severe damages to crops by pest

Response	Frequency	Percent
Strongly Disagree	3	3.3
Disagree	11	12.0
Undecided	4	4.3
Agree	19	20.7
Strongly Agree	55	59.8
Total	92	100.0

Source: Field Survey Data, 2015

Protection against the harmful effects of pesticide

The results showed that majority 48 (52.2%) indicated that they can protect against the harmful effects of pesticide while 35 (38.0%) indicated that they cannot protect against it and 9 (9.8%) were neither here nor there (Table 9). The role of majority could be attributed to unsafe measures of application.

Table9: Protection against the harmful effects of pesticide

Response	Frequency	Percent
Yes	48	52.2
No	35	38.0
I don't know	9	9.8
Total	92	100.0

Source: Field Survey Data, 2015

Types of pesticides formulation used, Training and Instructions to follow when preparing pesticides for application

All 92 (100.0%) indicated that they use liquid spray; though they have no training they follow instruction to prepare pesticides for application, probably through labels or informal instructors.

Pesticides use increases the level of crop production

The results showed that majority 75 (81.5%) indicated that the use of pesticides increases levels of crop production while 12 (13.0%) indicated that the use of pesticides did not increase levels of crop production and 5 (5.4%) were neither here nor there (Table 10).

Table10: Pesticides use increases the level of crop production

Response	Frequency	Percent
Yes	75	81.5
No	12	13.0
I don't know	5	5.4
Total	92	100.0

Source: Field Survey Data, 2015

Health and Environmental Effect of Pesticide

The need for pest control

The results showed that 14 (15.2%) disagreed that there was need for them to control pest occurrence while 25 (27.2%) agreed that there was need for them to control pest occurrence and majority (53)(57.6%) strongly agreed that there was need for them to control pest occurrence (Table 11).

Table11: The need for pest control

Response	Frequency	Percent
Disagree	14	15.2
Agree	25	27.2
Strongly Agree	53	57.6
Total	92	100.0

Source: Field Survey Data, 2015

The use of pesticides has been effective in controlling pest

The results showed that 35(38.0%) agreed that the use of pesticides has been effective in pest control while majority (57)(62.0%) strongly agreed same (Table 12).

Table12: *The use of pesticides has been effective in controlling pest*

Response	Frequency	Percent
Agree	35	38.0
Strongly Agree	57	62.0
Total	92	100.0

Source: Field Survey Data, 2015

CONCLUSION & RECOMMENDATIONS

The main objective of this study was to assess the level of awareness of the respondents about the benefits and hazards associated with the use of agricultural pesticides among others. Findings showed that the level of awareness of the respondents about the benefits and hazards associated with the use of agricultural pesticide was high and had significant impact on the farmers and their farm land. It also showed that the benefits of agricultural pesticide to farmers were to clean farm land as well as increase in crop production. Again, that pesticide misuse and overuse by the farmers were harmful to human health, animal health, environmental and industrial health of workers in the study area. Apart from exposure to pesticides as a major occupational risk among farmers, the implications of unregulated and excessive use of pesticides still pose a major bottleneck in the fight against insect pests. Furthermore, indications that most farmers in the study area lack formal education and without any form of training, and therefore need to be educated and trained on the hazard associated with pesticide usage cannot be overemphasized. It is therefore recommended that Government should as a matter of urgency provide possible and strategic measures for the control of pesticide usage in order to check occupational, environmental and industrial hazards in the study area. The foregoing could be corroborated with the establishment of safe methods of pesticide handling. Training programmes on safety in the use of pesticide; and avenues for dissemination of potential hazards of unsafe pesticide use to the farmers should be established with daring political will. Thus the push on promulgating or enforcing the legislative frameworks for controlling/restricting their uses and distributions based on the environmental, food and health risks posed by these chemicals and emphasis on agricultural sustainability indicators such as pesticide usage rate per hectare of farmland and the area of organic farming vis-à-vis green economy is of utmost relevance.

REFERENCES

[1] Ahad, K.; Mohammad, A.; Mehboob, F.; Sattar, A. & Ahamd, I. (2006). Pesticide residues in Rawal Lake, Islamabad, Pakistan. *Bull. Environ. Contam. Toxicol.*, 76(3):463-70.

[2] Ajayi, O.C. & Akinnifesi, F.K. (2008). Farmers understanding of pesticides safety labels and field spraying practices: a case study of cotton farmers in northern Cote d'Ivoire. *Sci. Res. Essays* 2., 204-210.

[3] Alagoa, E.J. (1999): *Land and People of Bayelsa State: Central Niger Delta*. Alagoa E.J.(ed) Onyoma Research Publications, Port-Harcourt, Rivers State.

[4] Atreya, K. (2008). Health costs from short-term exposure to pesticides in Nepal. *Soc. Sci. Med.*, Vol 67 Issue 4: 511-519

[5] Bayelsa State Government (BYSG), (2008): Brief on Bayelsa State. Bayelsa State Government, Yenagoa, Bayelsa State.

[6] Coronado, G.D; Thompson, B; Strong, L; Griffith, W.C.; Islas, I: (2004). Agricultural Task and Exposure to Organophosphate Pesticides Among Farm Workers. *Environ. Health Perspect.*, 112., 142-147.

[7] FAO. (2005). Food and Agricultural Organization of the United Nation. International code of Conduct of the Distribution and Use of Pesticides, Rome.

- [8] Hurtig, A.K., Sebastian, M.S., Soto, A., Shingre, A., Zambrano, D. & Guerrero, W., (2003). Pesticide use among farmers in the Amazon Basin of Ecuador. *Arch. Environ. Health*, 14 (58), 223-228.
- [9] Lovász, M & Gurzău, E.S. (2013): Case Study on Habits of Pesticides Use on Small Farms. *Paripex - Indian Journal of Research. Environment* Volume: 2 | Issue : 11 | Nov 2013: 106-108.
- [10] Ibitayo, O.O. (2006). Egyptian farmer's attitudes and behaviors regarding agricultural pesticides: Implication for pesticide risk and communication. *Risk Analysis* 26:989-995.
- [11] Imran, H & Dilshad, A. (2011): Adverse Health Effects of Pesticide Exposure in Agricultural and Industrial Workers of Developing Country In: *Pesticides - The Impacts of Pesticides Exposure* Edited by Prof. Margarita Stoytcheva. Publisher InTech Published online 21, January, 2011 Published in print edition January, 2011: 155-178
- [12] Kainga PE (2013). Resource allocation and utilization in banana and plantain production enterprises in Bayelsa State, Nigeria. PhD Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka.
- [13] Konradsen, F. Hoek, W; Cole, D. C.; Hutchinson, G; Daisley, H; Singh, S; & Eddleston, M: (2003). Reducing acute poisoning in developing countries-option for restricting the availability of pesticides. *Toxicology*, 192., 249-261.
- [14] Lunder, S (2014) Banana Cultivation Is Pesticide-Intensive. *Enviroblog. Environmental connections to public health*
- [15] Mazumder, B (2011) A Study on the Harmful Effects of Pesticides used in the Cultivation of Brinjal in Longai River Valley, Karimganj, Assam, India. *Assam University Journal of Sci&Tech : Biological and Environmental Sciences* Vol. 7 Number I 84-88, 2011
- [16] Nipost. From the original on 2012-11-26. Retrieved 2009-10-20.
- [17] Oluwole, O. & Cheke, R.A (2009). Health and environmental impacts of pesticide use practice: a case study of farmers in Ekiti State, Nigeria. *Int. J. Agr. Sustain.* 7. 153-163.
- [18] Pawar V.M., Borikar P.S. (2004). Impact of Indiscriminate use of Pesticides. *Environmental Impact of Agriculture Activities*, Indian Society of Env't. Sc. and Technology, Mumbai pp.70-84 In Mazumder, B (2011) A Study on the Harmful Effects of Pesticides used in the Cultivation of Brinjal in Longai River Valley, Karimganj, Assam, India. *Assam University Journal of Science & Technology: ISSN 0975-2773 Biological and Environmental Sciences* Vol. 7 Number I 84-88, 2011.
- [19] Remor, A.P; Totti. C.C; Moreira, D.A; Dutra, G.P; Heuser, V.D & Boeira, J.M. (2009). Occupational exposure of farm workers to pesticides: Biochemical parameters and evaluation of genotoxicity. *Environ. International* 35(2): 273-278.
- [20] Soares, W.; Almeida, R.M.V.R.; & Moro. S. (2003). Rural work and risk factors associated with pesticide use in Minas Gerais, Brazil. *Cadernos de Saude Publica.*, 19(4): 1117-1127.
- [21] Sosan, M.B. & Akinghohungbe, A.E. (2009). Occupational insecticide exposure and perception of safety measures among cacao farmers in southwestern Nigeria. *Arch. Environ. Occup. Health*, 64, 185-193.
- [22] United States Environmental Protection Agency (EPA) Office of Pesticide Programs: (July 12, 2001): <http://www.epa.gov/pesticides/about/> verified 19Feb2006.
- [23] Wen-Tien Tsai (2013): Analysis of Coupling the Pesticide Use Reduction with Environmental Policy for Agricultural Sustainability in Taiwan. *Environment and Pollution*; Vol. 2, No. 2; 2013. Published by Canadian Center of Science and Education 59.
- [24] Wesseling C, Aragon A, Castillo L, Corriols M, Chaverri F, de la Cruz E, Keifer M, Monge P, Partanen TJ, Ruepert C, van Wendel de Joode B: (2001). Hazardous pesticides in Central America. *Int. J. Occup. Environ. Health* 7. 287-294.
- [25] World Health Organization (WHO) (2004): Classification of Pesticides by Hazard and Guidelines to Classification 2004.

AUTHOR’S BIOGRAPHY



Prince Ebiowei Kainga holds a PhD in Agricultural Economics. He is a Senior Lecturer/ Ag. Head of the Department of Agricultural Economics, Extension and Rural Development, Niger Delta University, Wilberforce Island, Amassoma, Bayelsa State, Nigeria. He is a consultant in farm business management.



Temitope Abolanle Miller was born on a warm, sunny Thursday, 16th of November 1989 and hails from Somolu Local Government Area, Lagos State. She holds a Bachelor of Agriculture (B.Agric) Degree in Agricultural Economics, Extension and Rural development from Niger Delta University, Wilberforce Island, Amassoma, Bayelsa State, 2015. She has great potentials in Agribusiness Management.



Timothy Tubokeyi Epidi holds a PhD and is a Professor of Agricultural Entomology. Former Head of Department of Crop and Soil Science, Former Dean of Faculty of Agriculture, and currently Deputy Vice Chancellor Administration, Niger Delta University, Wilberforce Island, Amassoma, Bayelsa State, Nigeria. His areas of interest include Host plant resistance; Cultural practices and use of botanicals for insect pest control. He has widely published in National and International journals.