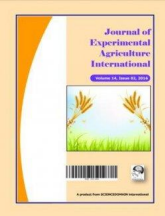

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Assessment of the Pesticides Usage in Selected Local Government Areas in Oyo State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author AAA wrote the protocol, designed the study. All the authors designed the questionnaires. Authors SOB and OA administered the questionnaires and performed the statistical analysis while author AAA wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: Importance of agriculture cannot be over emphasized globally. It is fundamental to livelihood and Oyo State happens to be one of the major agricultural producing States in Nigeria with some processing companies. The use of pesticide poses serious threats to farmers, consumers and the environment. Controlling pests by using pesticides has created health issues for the farmers mainly due to improper handling of these toxic chemicals as well as the non-use of personal protective clothing. The indiscriminate disposal of pesticide containers also has serious environmental implications. Apart from the hazards of pesticide use on farmers and the environment, consumers also face huge health risk by consuming food crops with high pesticide residues.

Materials and Methods: One hundred farmers were selected randomly five from Local Government Areas (LGAs) in Oyo State and structured questionnaires were used for data collection.

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Results: Almost all the respondents (94%) in the surveyed areas sprayed their crops with herbicides to weeds. The remaining 6% farmers use physical method (hand weeding), their decision is based on the small size of their farms. It was revealed from the results that most of the farmers (94%) had at least 2 acres of land for farming and farming happens to be their major occupation, which is their source of livelihood. Chemical pesticides were sprayed in combination (31 % farmers), and the efficacy of one may mask the inefficacy of others in the mixture. Most farmers (88%) focused on planting during the rainy season because of availability of water. This research also showed that 68% do not read nor follow the label instructions on the pesticides' containers. Farmers (14%) used complete protective kits (overall-apron, hand gloves, face masks, safety goggles, nose masks and safety booths) while spraying. This unprotected spraying practice presents a great potential for exposure of farmers to chemicals from both skin contact and inhalation. Also, 54% talks when spraying, making them prone to inhalation and accidental ingestion of these toxic chemicals. There is also inadequate disposal of empty pesticides' containers. Most of the crops that are often planted in these five LGAs belong to the "dirty dozen list'.

Keywords: Pesticides; herbicides; insecticides; protective kit.

1. INTRODUCTION

The use of chemicals in modern agriculture has significantly increased productivity but also has increased the risk of pesticides toxicity in food and in our environment, with associated negative effects on human and animal health. Annually there are dozens of million cases of pesticide poisonings worldwide [1] Moreover, it is well understood that pesticides have significant chronic health effects, including cancer, neurological effects, diabetes, respiratory diseases, fetal diseases, and genetic disorders. These health effects are different depending on the degree and the type of exposure. There are also effects on consumers through pesticide residues in food [2].

Pesticides are 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.

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. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transportation [3]. Pesticides can be classified by target organism (herbicides, insecticides, fungicides, rodenticides, and pediculicides) [4], chemical structure (organic, inorganic, synthetic, or biological (biopesticide) [5].

Humans and animals are occasionally and unintentionally exposed to lethal and sub-lethal doses of pesticides [6]. They can be directly exposed to pesticides by inhalation, ingestion, contact with skin and eyes. Apart from the direct exposure, indirect exposure occurs in animals by consuming food that contains high residues of pesticides Chemical pesticides are persistent and mobile thus can re-enter the land through precipitation and leaching, thus forming residues in crop [7].

The environmental impact of pesticides' use can be huge and several species including fishes and other aquatic creatures have experienced reduction in procreation and increased mortality as a result of pesticides' poisoning. The adverse effect of pesticide use has therefore led to wildlife distress, disruption with reproduction, birth defects as well as depressed immunity, which negatively affect wildlife numbers and the ecosystem as a whole [8]. The exposure of experimental animals or humans to some industrial chemicals including heavy metals has been shown to generate oxidative stress [9]. The application of pesticides in fields and for sanitary reasons is an essential evil.

Pesticides may cause acute and delayed health effects in people who are exposed [10]. Pesticide exposure can cause a variety of adverse health effects, ranging from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, mimicking hormones causing reproductive problems, and

also causing cancer. A 2007 systematic review found that "most studies on non-Hodgkin lymphoma and leukemia showed positive associations with pesticide exposure" and thus indiscriminate use of pesticides should be discouraged [2]. There is substantial evidence of associations between organophosphate insecticides' exposures and neurobehavioral alterations [11,12,13,14]. Limited evidence also exists for other negative outcomes from pesticides' exposure including neurological, birth defects, and fetal death [15].

The World Health Organization and the UN Environment Programme estimated that each year, 3 million workers in agriculture in the developing world experience severe poisoning from pesticides, about 18,000 of whom died thereof [16]. Owing to inadequate regulation and safety precautions, 99% of pesticides' related deaths occur in developing countries that account for only 25% of pesticide usage. According to one study, as many as 25 million workers in developing countries may suffer mild pesticide poisoning yearly [17]. There are several careers aside from agriculture that may also put individuals at risk of health effects from pesticide exposure including pet groomers, groundskeepers, and fumigators [18]. Gun et al. [19] stated that pesticide self-poisoning is a method of choice in one third of suicides worldwide, and hence recommended, among other things, more restrictions on the types of pesticides that are most harmful to humans.

Pesticide use raises a number of environmental concerns. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including non-target species, air, water and soil [16]. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas, potentially contaminating them. Pesticides are one of the causes of water pollution, and some pesticides are persistent organic pollutants and contribute to soil contamination.

In addition, pesticide use reduces biodiversity, contributes to pollinator decline, destroys habitat (especially for birds), and threatens endangered species [16,20,21]. Pests can develop a resistance to the pesticide (pesticide resistance), necessitating new pesticide. Alternatively a greater dose of the pesticide can be used to counteract the resistance, although this will cause a worsening of the ambient pollution problem.

Since chlorinated hydrocarbon pesticides dissolve in fats and are not excreted, organisms tend to retain them almost indefinitely. Biological magnification is the process whereby these chlorinated hydrocarbons (pesticides) are more concentrated at each level of the food chain. Among marine animals, pesticide concentrations are higher in carnivorous fishes, and even more so in the fish-eating birds and mammals at the top of the ecological pyramid [22]. Global distillation is the process whereby pesticides are transported from warmer to colder regions of the Earth, in particular the Poles and mountain tops. Pesticides that evaporate into the atmosphere at relatively high temperature can be carried considerable distances (thousands of kilometers) by the wind to an area of lower temperature, where they condense and are carried back to the ground in rain or snow [23]. There is therefore a need to evaluate and come up with a better and safer pesticide and its practices.

The aims of this study is to evaluate farmers' knowledge and compliance as regarded to pesticides usage in five selected local government areas of Oyo state, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in two zones (Oke-Ogun and Ibadan), which covers Iseyin, Saki West, Atibo, Ido and Akinyele Local Government Areas (LGAs) of Oyo State. The choice of these areas was on the basis that they are the prominent food crops producing areas in Oyo State. These areas lies between longitudes $8^{o}00'$N and latitudes $4^{o}00'$ E. Oyo State is bordered in the North by Kwara State, East by Osun State, South by Ogun State, West partly by Ogun State and partly by the Republic of Benin as shown in Fig. 1.

2.2 Sampling Procedure

A survey was conducted at the five selected Local Government Areas (LGAs) through Mr. Dare Ayoola (a contact person link with the farmers) and questionnaires (a closed-ended question) were validated by Dr. K.A. Thomas, Department of Agricultural Extension and Rural

Fig. 1. Map showing various local government areas in Oyo State and the study areas being shaded

Source: https://www.researchgate.net

Development, Faculty of Agriculture, University of Ibadan. Randomly sampling technique was used to administer the questionnaires.

2.3 Sample Size

Twenty farmers from each of the five selected LGA making the total sample size of 100 were picked at random sample to fill the questionnaires.

2.4 Data Collection Tools

A purposive and structured questionnaire was developed by referring different to literatures and modifying according to the objectives of this study. The questionnaire had seven parts which enabled to collect information on demographic information, herbicides, fertilizer application, Insecticides, diseases, storage and general knowledge on pesticides.

The Questionnaire is a-four pages containing questions based on demographic information, herbicides, insecticides, fertilizers application, diseases and storage. And it takes 10 minutes to complete. Some of the farmers filled themselves without assistance, while some were assisted. English and Yoruba (Native Language) were means of communication.

2.5 Statistical Analysis

Data collected in this study were analyzed using SPSS software version 21 (2012). Descriptive statistics distribution and percentages were used to describe the findings according to each specific objective.

3. RESULTS

3.1 Socio-Demographic Characteristics

The questionnaires were administered to 100 farmers, where 74% were male and 26% were female. The details of the questionnaires included age and education background as presented in Table 1.

Table 1. Socio-demographic characteristics of farmers

No.	Variables	Frequency	Percentage (%)
1.	**Sex**		
	Male	74	74
	Female	26	26
2.	**Age**		
	18-25	2	2
	26-35	20	20
	36-45	58	58
	46-above	20	20
3.	**Marital status**		
	Single	3	3
	Married	93	93
	Widow/widowed	4	4
4.	**Education background**		
	No formal	20	20
	Primary	31	31
	Secondary	25	25
	Tertiary	14	14
	Adult	2	2
	Quranic	8	8

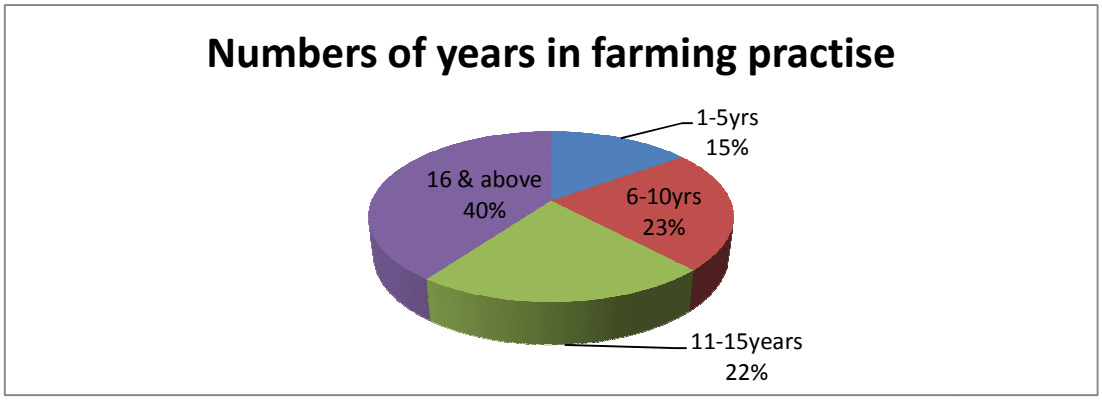

Fig. 2. Numbers of years in farming practice

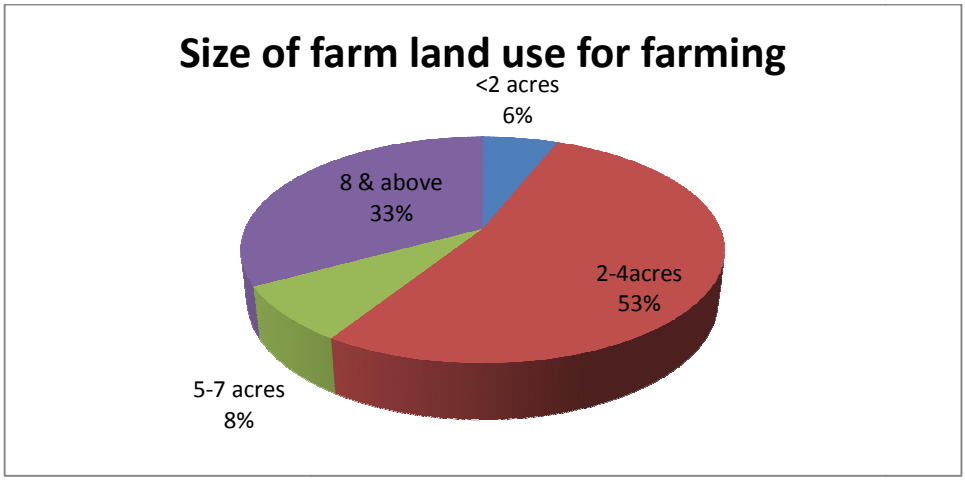

Fig. 3. Size of farmland use for farming

Table 2. Planting periods for both Rainy and Dry seasons in selected Local Government Areas

Season	Frequency	Percent	Valid percent	Cumulative percent
Rainy	88	88.0	88.0	88.0
Dry & Rainy	12	12.0	12.0	100.0
Total	**100**	**100.0**	**100.0**	

Table 3. Types of crops planted by farmers in selected Local Government Areas

Crops	Frequency	Percent	Cumulative percent
Corn	68	26	26
Cassava	57	21	47
Water melon	38	14	61
Cucumber	32	12	73
Tomatoes	26	10	83
Rice	10	4	87
Pepper	17	6	93
Yam	11	4	97
Vegetable	9	3	100

Table 4. Type of weed control method used by farmers in selected Local Government Areas

Weed control methods	Frequency	Percent	Valid percent	Cumulative percent
Physical method (Hand-weeding)	6	6.0	6.0	6.0
Chemical method	94	94.0	94.0	100.0
Total	**100**	**100.0**	**100.0**	

Table 5. Types of herbicides used by farmers in selected Local Government Areas

Herbicides	Frequency	Percent	Valid percent	Cumulative percent
Diuron	4	4.0	4.0	4.0
2,4,Dmine	7	7.0	7.0	11.0
Paraquat	60	60.0	60.0	71.0
Glyphosate	12	12.0	12.0	83.0
Atrazine	11	11.0	11.0	94.0
Metalachlor	1	1.0	1.0	95.0
Pendimenthalin	5	5.0	5.0	100.0
Total	**100**	**100.0**	**100.0**	

Table 6. Specific insecticide used by farmers in selected Local Government Areas

	Frequency	Percent	Valid percent	Cumulative percent
Cypermethrin & lambda-cyhathorin	24	24.0	24.0	24.0
Cypermethrin-dimetuate	1	1.0	1.0	25.0
Lambda-cyhalothrin &Dimethriate	48	48.0	48.0	73.0
Imiforce &Army force	3	3.0	3.0	76.0
Others	24	24.0	24.0	100.0
Total	**100**	**100.0**	**100.0**	

Table 7. Compliance of using protective kits during herbicides application in selected LGAs

Compliance	Frequency	Percent	Valid percent	Cumulative percent
Protective kits	14	14.0	14.0	14.0
Safety booths	15	15.0	15.0	19.0
Nose masks	1	1.0	1.0	20.0
None	80	80.0	80.0	100.0
Total	**100**	**100.0**	**100.0**	

Table 8. Spraying activities by farmers in selected Local Government Areas

Activities	Frequency	Percent	Valid percent	Cumulative percent
Eat	1	1.0	1.0	1.0
Talk	54	54.0	54.0	55.0
None	45	45.0	45.0	100.0
Total	**100**	**100.0**	**100.0**	

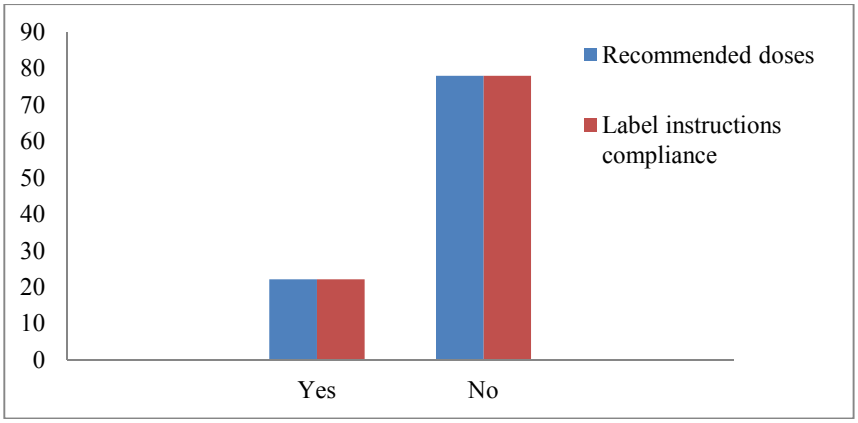

Fig. 4. Recommended doses and label instructions compliance of pesticides by farmers

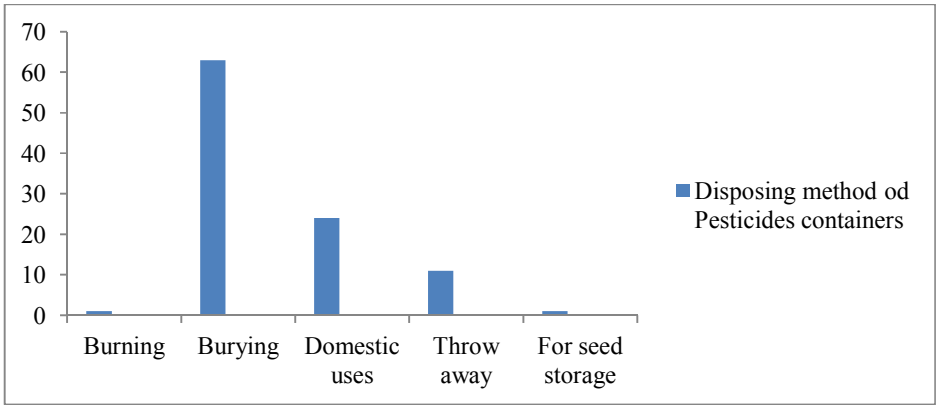

Fig. 5. Disposing methods of pesticides containers by farmers in selected LGAs

4. DISCUSSION

In this study, farmers were examined on socio-demographics, numbers of years in farming practice, size of farm land use for farming, planting seasons, types of crops planted, types of herbicides, insecticides use, recommended doses, label instructions compliance and ways of disposing empty pesticides containers among farm workers in Oyo State, Nigeria.

The response rate of invited participants to the questionnaire interview in the present study was relatively higher, indicating good intentions to participate. In the present study (Table 1), 58% of the participants were aged between 30 and 39 years and this is similar to results obtained by other researchers in other countries [24,25]. Some of the farmers (20%) in the study area have no formal education, and this is also similar to results reported in other developing countries of the world [24,26,27,28]. Farmers with little or no formal education might be at higher risk when using pesticides, possibly due to difficulties in reading and understanding the instructions and safety procedures included on the product labels. The use of protective measures is also poor.

Paraquat herbicide from this study show that 60% (Table 5) of the farmers use it to control weed, its poisoning is possible after skin exposure. Poisoning is more likely to occur if the skin exposure lasts for a long time, involves a concentrated version of paraquat, or occurs through skin that is not intact (skin that has sores, cuts, or a severe rash)If it is inhaled, paraquat could cause poisoning leading to lung damage. In the past, some marijuana in the United States has been found to contain paraquat [29] also glyphosate is the second most use herbicides (Table 5): glyphosate has been discovered to be the most important factor in the development of multiple chronic diseases and conditions that have become prevalent in westernized societies [30].

Lambda-cyhalothrin (Table 6) is the most used insecticides and it can cause corrosive effects when it comes in contact with the skin and eyes. Exposure to lambda-cyhalothrin may occur through inhalation, dermal absorption, or ingestion [31]. Inhalation may cause burning sensations, convulsions, coughing, labored breathing, shortness of breath, and sore throat. Contact with the skin and eyes may cause redness and pain. Ingestion can cause abdominal pain and coughing [32]. Extreme levels of exposure can also cause seizures and coma. The effects of respiratory diseases and skin disorders may intensify with exposure to lambda cyhalothrin [33].

The results (Figs. 2 and 3) showed that 85% of the farmers have been farming for more than five years and 41% of them farmed on land that is 2 acres and above. Most are breadwinners (Table 1), depending solely on farm produce to feed their families. Majority uses chemical method to control their weed and insect (herbicides and insecticides) (Tables 4-6).

Most farmers (88%) focused on planting during the rainy season because of availability of water (Table 2) but pests and diseases also proliferate more in this season, this is one of the reasons why farmers uses more than the recommended doses due to fear of pests destroying their crops.

This research also showed that 68% (Fig. 4) did not read nor follow the label instructions on the containers and this can be linked to lack of formal education by some of the farmers. Most of the crops (Table 3) that are often planted in the selected five Local Government Areas belong to the “dirty dozen list’ [34]. A lot of public enlightenment awareness is of principles on healthy living in which one’s diet has to be 50-70% of fresh fruit and vegetables. It is very important therefore, to intensify researches on pesticides residues in crops that belong to this list.

Having a land of 2 acres or above, a farmer will be exposing himself to pesticides while spraying for not less than 2 hours since most of them don’t use the complete protective kits (overall aprons, hand gloves, face masks, safety goggles, nose masks and safety booths).

This study also showed that high percentage of interviewed farmers disposed the empty containers by burying while others simply abandoned these carelessly on the field making it possible for some other undiscerning individuals to pick these up for reuse at home and in the process causing the general population to be exposed to the hazardous risks. Such practices were considered to be one of the main problems associated with pesticide use in developing countries [35]. Disposal of the empty containers in the field or by throwing them near or into local waste containers is a totally unsafe practice and has been reported as a major problem in a number of studies [24,28,36]. Burning of empty pesticide containers in open fires or burying of these empty containers should therefore not be used as a method of management and disposal of empty pesticide containers.

Distributors, suppliers and even local authorities often recommend these practices, but they are potentially hazardous to human health and the environment and should be discouraged and appropriate management encouraged. Safe burning procedures require a good understanding of pesticide chemistry, while safe burial requires adequate knowledge of local hydrology as well as of the environmental behavior of pesticides. Many users do not have such knowledge or cannot apply it properly to their particular circumstances. In many developing countries, empty pesticide containers are highly valued and are used or exchanged as storage containers for other materials such as fuel, other chemicals, and sometimes even as storing of seeds as was found in this study. Such practices are dangerous and should be prevented. For example, these empty empty pesticide containers that cannot be returned to the supplier should be punctured in accordance with WHO recommendations [37].

Basic objectives of education are to ensure that farmers understand the health hazards of relevant pesticides, use protective equipment properly, practice personal hygiene measures, become familiar with and adopt proper work practices, recognize early symptoms of overexposure to pesticides, and obtain first aid at the earliest time possible. The WHO has recommended the use of pesticides only by trained people [37]. For most pesticides, using protective measures result in a decrease of exposure to pesticides. The use of protective measures could contribute to decreasing the health effects of pesticides. Also, this would lead, as expected, to a decrease in poisoning prevalence parallel to the reduction in exposure.

5. CONCLUSION AND RECOMMENDATION

This study showed that, the use of pesticide poses serious threats to farmers, consumers and the environment. Controlling agricultural pests by using pesticides would create health issues for the farmers mainly due to improper handling of the toxic chemicals as well as the non-use of personal protective clothing. The indiscriminate disposal of pesticide containers also has serious environmental implications. Apart from the hazards of pesticides' use on farmers and the environment, consumers also face huge health risk by consuming food crops with high pesticide residues.

A lot of public enlightenment awareness is on principles of healthy living in which one's diet has to be 50-70% of fresh fruit and food crops. In particular, eating fruit and vegetables in their raw state provides increased nutrition and gives antioxidants for protection. Some of these fruits and vegetable belong to the 'DIRTY DOZEN LIST' (Crops that contain high pesticides residue in them) [38].

There is therefore a need to evaluate the pesticides residues in these crops as well among the farmers. The need for public enlightenment on proper pesticides usage and possible alternative to chemical pesticides use should be encouraged.

Based on the findings of this study, the following are recommended: There should be an integrated effort from governmental and non-governmental organizations that should focus on the awareness of farmers on proper pesticides management and related issues. Also comprehensive laboratory-based studies (residual analysis of blood from laboratory animals fed with crops treated with pesticides and farmers using pesticides on their farms, soil, water and crops) from the selected areas is recommended so that the extent of pesticide damage on public health and the environment could be affirmed.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDICES

UNIVERSITY OF IBADAN

FACULTY OF VETERINARY MEDICINE

DEPARTMENT OF PHARMACOLOGY AND TOXICOLOGY

QUESTIONNARIARE

This questionnaire is prepared to determine the nature of herbicides, insecticides and fertilizer usage in crops across Ibadan and Oke-Ogun Region of Oyo State.

Please answer the question with all sincerity as all information will be treated with almost confidence, kindly tick (√) where necessary and supply adequate information where requires.

Thank you.

SURVEY INFORMATION

Name of farmer:……

Name of Town/Village:……..

Name of L.G.A:……

DEMOGRAPHIC INFORMATION

1. Age: 18 – 25 ( ) 26 – 35 ( ) 36 – 45 ( ) and above ( )

3. Sex: Male ( ) Female ( )

4. Marital status: Single ( ) Married ( ) widow ( ) widower ( ) Single Parent ( )

5. Educational background: No formal education ( ) primary school ( ) secondary school ( ) Tertiary ( ) adult Literacy/Education ( ) Islamic/ Quranic Education ( ) others (please specify)……

6. Occupation: Farming ( ) Trading ( ) Civil servant ( ) other (please specify) …..

7. What kind of crop(s) do you grow? Cucumber ( ) water melon ( ) corn ( ) tomatoes ( ) others(please specify)…….

8. How long have you been into farming? …< 1 year( ) 1-3( ) 4 -6( ) 7 and above ( )

9. What is the size of your farm acreage under cultivation (in acres)? Less than 2 ( ) 2-5 ( ) 5 – 8 ( ) Greater than 8 ( )

10. Do you plant the same type of crop year in year out? Yes ( ) No ( )

11. Do you plant on the same piece of land year in, year out? Yes ( ) No ( )

13. Do you do shifting cultivation? Yes ( ) No ( )

14. What is the type of cropping system? Sole cropping ( ) Intercrop ( ) Mixed cropping ( )

15. If intercrops, with what crop(s)? Please list the crop(s)

(I) …… (II)……
(III)…… (IV)……

16. What season do you plant the crop? Rainy ( ) dry Season ( )

SECTION B: HERBICIDES

18. How do you control the weed? Cultural method ( ) physical method ( ) chemical method ( ) other …..

19. If chemical method, what type of herbicides used in control of weed?
(I) ……..(II)…….. (III)……

21. Do you use recommended dose specified on the label? Yes ( ) No ( )

22. Do you read and follow label instruction? Yes ( ) No ( )

23. When applying herbicides, what personal protective measure do you use on the farm? Protective jackets ( ) safety boots ( ) nose mask ( ) none ( )

24. Do you eat, ( ) smoke ( ) talk ( ) while spraying the herbicide?

25. What do you used for spraying? Muzzle sprayer( ), Knapsack Sprayer ( ) other …….

SECTION C: INSECTICIDES

26. What are the insect pests affecting production in your farm? Wire worms ( ) Beetle ( ) Aphid ( ) Leafhopper ( ) Other …….

27. What are the effects of these insect pests on your vegetable? Chew the leaves ( ) marks on the crops ( ) wilt on the leaves ( ) root rot ( ) late bling disease ( ) leaf perforation, leaf spot, leaf coloration

28. What type of control measure do you use to protect your crops? Physical control, Biological control, others ( ) chemical control ( )

29. If you are using more than one chemical at a time what are their names
(I) ……. …….. (II) …..……. (III)……..…

30. How do you dispose the containers of the chemicals after use? Burning ( ) Burying ( ), Returning to the company ( ), Domestic uses ( )

SECTION D: GENERAL

31. Where do you source for the chemicals used on your farm? Agrochemical industry ( ) farm cooperatives ( ) local market ( ) agro-dealers, ( ) extension agents ( )

32. What is your source of information on how to apply the chemicals? Local dealer ( ) Agric extension agent ( ) farm cooperatives ( )

Manufacturer's instruction ( ) agro- dealers

Thank you!

Peer-review history:
The peer review history for this paper can be accessed here:
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