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Farmers' knowledge and perception of agrochemical risk in southwestern Nigeria

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Abstract

The indiscriminate use of agrochemicals has led to adverse effects on crops and human health. The knowledge and perception of farmers in agrochemical usage are of high significance. Hence, this study examined farmers' knowledge and perception of agrochemical risk in Southwestern Nigeria. Multi-stage sampling procedure was used to select 134 farmers from Oyo and Ogun States. Data on farmers' knowledge and perception of agrochemical risk were collected using a well-structured questionnaire. Descriptive and inferential analyses revealed that farmers were; aged 49.6±11.0 years in Ogun and 47.0±12.0 years in Oyo, male (90.5%). Farmers in Oyo mostly used contact herbicides ($\bar{X}$ = 2.43) relative to insecticides ($\bar{X}$ = 2.00) in Ogun. While 61.9% of the respondents had positive attitude towards risk behaviours on agrochemical use in Oyo, the figure was 52.4% in Ogun. Knowledge of agrochemical use was higher in Oyo (66.7%) than Ogun (61.9%). Significant relationships existed between education and risk indicators of agrochemical use; Ogun (χ^2=9.418, p=0.024) and between cropping system and risk indicator in Oyo (χ^2=3.791, p=0.010). Considering that farmers have adopted the use of agrochemicals, continuous professional development and capacity enhancement on risk prone areas should be the focus of government and other extension agencies.

Keywords: Pesticide; Herbicide; Environment; Production

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1. Introduction

Agriculture plays an important role in the economy of most countries and in the lives of local populations, since it provides stable jobs and income to many families. According to Ghafai etal, (2017) agricultural workers face numerous occupational hazards as a result of their professional activities including exposure to pesticides and other agro based chemicals which are among the greatest potential hazards.

Agrochemicals refer to the broad range of pesticides including insecticides, herbicides, fertilizers, fungicides, rodenticides, moluscicides, nematicides, plant growth regulators and others (Konstatinos et al., 2025). They are chemicals used to kill, destroy, prevent or control pests. Common environmental pests include vertebrate pests (e.g. rabbits) insect pests (e.g. locusts and millipedes), and plant pests (weeds). Many weeds, pests, and diseases affect primary production. Pesticides can be insecticides for insect control, herbicides for weed control, fungicides for the control of fungi and rodenticides for the control of rodents etc.

Considering the geometric increase in the population of the country and heavy dependence on agriculture for raw materials and food, farmers have adopted some strategies in the bid to increase productivity of crops. These are intensive use of land, agrochemical usage, irrigation, disease and pest resistant varieties and so on. According to Ngowi (2012), the use of pesticides by farmers to control weeds, increase agricultural productivity, and preserve agricultural produced has reached a crescendo thereby calling for urgent actions. There are concerns about indiscriminate use of agrochemicals with non-adherence to safety precautions of agrochemicals used by farmers. The use of PPE remains a thing of choice. Other precautionary measures like avoidance of eating, drinking and smoking during agrochemical application are still not adhered to by farmers.

Generally, there are four major routes through which pesticides reach the water; they may drift outside of the intended area when sprayed, may percolate, or leach through soil, may be carried to the water as runoff, or may be spilled. Vapour from sprayed pesticides will be released into the air, and if the chemical compound is very stable, vapour may travel beyond the project intervention sites. Whether pesticides are applied by spraying or by surface application, air is usually the medium through which the chemicals move to their intended and unintended targets. While some of the active ingredients in pesticides stay in the atmosphere for only a short while, others may last longer and may have the potential to contaminate the air, affecting humans and animals. According to Wudili et al. (2022) reliable data on how pesticides behave in air, such as distance travelled are lacking, because adequate monitoring is unavailable.

The environmental impact of pesticides consists of the effects of pesticides on non-target species. Over 98 percent of sprayed insecticides and 95 percent of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields. Runoff can carry pesticides into aquatic environments while wind can carry them to other fields, grazing areas, human settlements and undeveloped areas, potentially affecting other species. Other problems emerge from poor production, transport and storage practices. Over time, repeated application increases pest resistance, while its effects on other species can facilitate the pest's resurgence. To minimize these potential environmental harms, pesticide use by commercial spray contractors and other operators whose business involves the use of pesticides need to be consistent with provisions in the Environment Protection Act 1993 and the Environment Protection (Water Quality) Policy 2015 (Water Quality Policy). The 'General Environmental Duty' under Section 25 of the Environment Protection Act reads: A person must not undertake any activity that pollutes, or might pollute, the environment

unless the person takes all reasonable and practicable measures to prevent or minimize any resulting environmental harm.

The use of agrochemicals particularly pesticides has become an integral part of the nation's farming system, being used on cash crops, fruits and vegetable production. Pesticides are frequently applied without precision, which leads to a number of adverse effects on human health, from acute intoxication to chronic diseases that include various types of cancer (Perin et al.,2021)

Instead of farmers properly disposing of empty containers of agrochemicals, they use them for fetching water, keep cooked foods in them, store seeds in stock for next season usage and so forth. Many farmers lack adequate knowledge and information on the health hazard associated with handling and use of pesticides. According to Okoffo et al. (2016) inappropriate use of pesticides to control pests and diseases has major health implications for small holder farmers and this is now in the global scale attracting global attention of researchers, policy makers and the general public. Improper use and disposal of containers are mainly caused by inadequate knowledge, inadequate equipment, and storage application of unregistered and non –approved pesticides and the use of excessive dosage.

Though, manufacturers of different agrochemicals, agro input dealers, extension agents, other government and Non-Government Agencies have been exploiting several methods to create awareness for farmers and other agrochemical usage on health implications of agrochemical use. This study therefore seeks to assess farmers' knowledge and perception of agrochemical risk in Southwestern Nigeria. The study is expected to contribute significantly to information and knowledge on safe and responsible use of agrochemicals The study will also provide information to policy makers and agricultural extension officers and will enable them to come out with effective training modules for farmers.

1.1. Purpose of the study

The general objective of the study was to assess farmers' knowledge and Perception of Agrochemical risk in Southwestern Nigeria.

The specific objectives were to:

- identify social-economic characteristics of farmers.
- determine extent of use of agrochemicals by farmers in the study area.
- determine respondents' perception towards risk in agrochemical use.
- assess sources of information available to farmers on agrochemical use
- determine respondents' knowledge of agrochemical use

2. Methodology

The study area is Southwestern part of Nigeria. The area is predominantly agrarian with rainforest and derived savannah vegetation. Farmers in the Southwestern part of Nigeria grow different types of arable and tree crops. Multi-stage sampling procedure was used for the study. The first stage involved random selection of two states out of six states in the Southwestern Nigeria. The states selected are Oyo and Ogun States. One agricultural zone was picked in each of the selected states. Ibadan/Ibarapa zone was picked in Oyo State while Abeokuta

zone was picked in Ogun State. From Ibadan/Ibarapa zone of Oyo state, two blocks were randomly selected out of which one cell was purposely selected from each block. The cell selected was the one which had the record of high use of agrochemicals.

The same selection process was used in Ogun State, 67 farmers with high records of constant or regular usage of agrochemicals were selected in the 2 cells of Oyo State while 67 farmers in the same pattern were also selected in the 2 cells of Ogun State making a total number of 134 respondents that were used in this study. Data were collected through a well-structured questionnaire with both open and close ended questions.

Data on personal characteristics, agrochemicals use by farmers, perception of farmers to risk indicators on the use of agrochemicals, farmers' knowledge on agrochemicals and sources of information on agrochemical use were collected with the use of questionnaire. Data were analyzed using descriptive and inferential statistics.

3. Results and discussion

Results in Table 1 reveals that the mean age of farmers were 47.0 and 49.6 years in Oyo and Ogun respectively. This means that majority of the respondents were in their active age. Majority of the respondents in the two states were males (90.5%). This implies that there is dominance of male farmers who used agrochemicals in the study area. This finding corroborates Amusat and Omirin (2023) who opined that since most farming work or activities carried out is energy demanding, hence men tend to be more involved especially in production while marketing and processing of food crops are often the chores of women. Majority of respondents in the study area were married, Oyo (95.2%) and Ogun (81.0%). Majority of respondents in Ogun (66.6%) had between 11- 30 years farming experience while 47.6% of respondents in Oyo had 11-20 years of farming experience.

Majority of the respondents (85.7%) in Ogun State had secondary and tertiary education while in Oyo State only 47.6% of the respondents had secondary and post-secondary education. This implies that respondents in Ogun State are more educated and will be able to read product labels and may thereby possess better knowledge of safe and responsible use of agrochemicals than respondents in Oyo State. All the respondents in Oyo State had one form of education or the other while 28.0% of respondents in Ogun did not have any form of education. This implies that there is high percentage of literate respondents in the 2 states. This will avail them the opportunity of being able to read label instructions on the agrochemicals to be used on the farm.

On farmers' cropping system, the data reveals that majority of farmers (80.9%) in Oyo State practiced mixed cropping while data from Ogun State reveals that 38.1% of farmers practiced mixed cropping while the same percentage (38.1%) of farmers in the same state were also involved in mono-cropping. Data across the two states revealed that majority of farmers in the study area practiced mixed cropping, this is to serve as insurance and guide against crop failure.

The mean household size of the respondents in Oyo State is 6.1, while that of Ogun State is 5.4; this indicates that the household size of the respondents is fairly large in the study areas; the farmers have an average size of between 5-6 people in their household depending on them for living. The dependent could be of assistance to the farmers in terms of availability of farm labour to carry out some agronomic practices including spraying of agrochemicals on their farm.

Table 1. Socio-economic characteristics

Variable	Ogun	Oyo
Age		
≤ 40	19.0	23.8
41 – 50	43.0	47.6
51 – 60	19.0	14.3
61 – 70	19.0	9.5
≥ 70	0.0	4.8
Mean	49.6±11.0	47.0±12.0
Sex		
Male	90.5	90.5
Female	9.5	9.5
Marital status		
Single	4.8	4.8
Married	81.0	95.2
Divorced	9.5	0.0
Widowed	4.8	0.0
Major income source		
Farming	90.5	81.0
Trading/marketing	0.0	14.3
Processing	0.0	4.8
Civil servant	4.8	0.0
Farm size (acres)		
≤ 10	71.4	33.3
11 – 20	23.8	47.6
21 – 30	4.8	14.3
31 – 40	0.0	4.8
Mean	8.1±5.1	5.3±9.1
Farming experience		
≤ 10	33.3	19.0
11 – 20	33.3	28.6
21 – 30	23.8	38.1
31 – 40	4.8	9.5
> 40	4.8	4.8
Education		
No formal	0.0	28.6
Primary	14.3	23.8
Secondary	61.9	14.3
Tertiary	23.8	33.3
Family size		
≤ 3	4.8	0.0

Variable	Ogun	Oyo
4 – 6	76.1	85.7
7 – 9	14.3	9.5
≥ 10	4.8	4.8
Mean	5.4±1.8	6.1±2.0
Cropping system		
Mixed cropping	38.1	80.9
Sole cropping	14.3	4.8
Intercropping	9.5	14.3
Mono-cropping	38.1	0.0

Source: Field survey, 2024

Table 2. Extent of agrochemical use by farmers in Ogun and Oyo States

Agrochemicals	Ogun ($\overline{X}$)	Rank	Oyo ($\overline{X}$)	Rank
Pesticides	1.86	2nd	1.76	3rd
Herbicides (Contact)	1.71	4th	2.43	1st
Herbicides (Systemic)	1.81	3rd	2.00	2nd
Insecticides	2.00	1st	1.57	4th

Source: Field survey, 2024

Table 2 reveals that insecticides ($\overline{X}$ = 2.00), systemic herbicide (($\overline{X}$ = 1.8) and contact herbicides (($\overline{X}$ =1.71) were ranked 1st, 2nd and 3rd in Ogun State while it was revealed that Contact Herbicides (($\overline{X}$ = 2.43), systemic herbicides (($\overline{X}$ = 2.00) and insecticides (($\overline{X}$ = 1.57) ranked 1st, 2nd and 3rd respectively in Oyo State. It can be inferred from the findings that herbicide (contact and systemic) was highly used by farmers in Oyo State while insecticide was the most used in Ogun State.

On the whole, it was established that the use of agrochemicals (herbicide and insecticides) is being embraced in the study area. This may be due to high cost and scarcity of labour in the study area. The need to crop large hectarage of land may also necessitate the use of input such as agrochemical in the study area.

The findings in Table 3 showed the perception of farmers to risk indicators on the use of agrochemical in Ogun and Oyo States. The results show that majority of respondents in Oyo State were more positive than in Ogun State with the following statements; reading the labels of a particular agrochemical is not necessary after several use of the brand $\overline{X}$ = 1.42, agrochemicals in small litre bottles are too risky to use in the household environment for safety reasons $\overline{X}$ = 1.35, agrochemicals should not be stored close to farm produce $\overline{X}$ = 1.37 while in Ogun State respondents were more positive in the following statements than their counterparts in Oyo State; washing of sprayers before use help to ensure adequate quantity of chemicals for each spray $\overline{X}$ = 1.0.8, wearing safety kits is very compulsory for kids and first users during spraying of agrochemicals $\overline{X}$ = 1.08 and washing of sprayers in water/rivers after use is not good $\overline{X}$ = 1.18.

Table 3. Perception of farmers towards risk in agrochemical use

SN	Statements	Mean Ogun	Mean Oyo
1.	Reading the labels of a particular agrochemical is not necessary after several use of the brand	1.30	1.42
2.	Washing of sprayers before use help to ensure adequate quantity of chemicals for each spray	1.08	0.67
3.	Wearing safety kits is very compulsory for kids and first users during spraying of agrochemicals	1.08	0.51
4.	Mixing agrochemicals before spraying has proven to be very effective	1.06	0.70
5.	Prescribed quantities of agrochemical by producers are the normal dosage required by any crop	1.03	0.60
6.	Following the direction of wind when spraying agrochemicals is not always necessary	1.03	1.18
7.	Washing of sprayers in water/rivers after use is not good	1.18	0.96
8.	Agrochemicals in small litre bottles are too risky to use in the household environment for safety reasons	1.20	1.35
9.	Safety kits used for spraying agrochemicals are not to be used for any other purpose other than spraying	1.17	1.27
10.	Exposure to agrochemical hazards requires immediate medical attention	0.70	1.21
11.	Farmers need enlightenment on agrochemical usage	1.10	1.28
12.	Long term use of agrochemicals is detrimental to the environment	1.18	1.15
13.	Farmers should not purchase agrochemicals from the open markets/local hawkers	0.92	1.34
14.	High cost of labour encourages the use of agrochemicals	0.89	1.29
15.	Agrochemicals should not be stored close to farm produce	0.89	1.37

Source: Field survey, 2024

The findings in Table 3 indicate that respondents in the two states (Oyo and Ogun) were aware and conscious of some risk indicators in agrochemical usage that can be harmful to them. This may be due to the enlightment programme on agrochemical usage on radio and by extension officers of Agricultural Development Programmes (ADPs) in south west zone of Nigeria where the study was carried out.

Table 4. Categorisation of farmers on their perception towards risk behaviours on agrochemical use.

Risk behaviour level	Ogun	Oyo
Favourable	52.4%	61.9%
Unfavorable	47.6%	38.1%

Source: Field survey, 2024

The discussion on Table 4 on categorization of farmers' attitude towards risk behaviour on agrochemical use reveal that 61.9% of the respondent had favourable attitude in Oyo State compared to 52.4% of respondents in Ogun State who had favourable attitude towards risk behaviour on agrochemical use. The finding may however be due to the fact that majority of the farmers in the two states have been exposed to Research – Extension – Farmers – Input linkages system (REFILS) which train farmers on good agronomic practices including safe and responsible use of agrochemicals.

Table 5. Source of information on agrochemical use

Information source	Ogun		Oyo	
	Mean	Rank	Mean	Rank
Radio	0.73	1st	0.62	2nd
Television	0.51	6th	0.51	3rd
Extension Agent	0.74	2nd	0.63	1st
Fellow Farmers	0.69	3rd	0.40	6th
Agro Input Dealers	0.62	4th	0.48	5th
Social Media	0.60	5th	0.51	3rd

Source: Field survey, 2024

Results in Table 5 showed the different sources of information available to the respondents on agrochemical use. The result shows that radio ($\overline{X}$ = 0.73) and extension agent ($\overline{X}$ =0.73) were the most popular information sources available to the respondents in Ogun State as they ranked 1st among various sources of information available to the respondents.

In Oyo State, extension agent ($\overline{X}$ = 0.63) and radio ($\overline{X}$ = 0.62) were the most common sources of information to farmers as they ranked 1st and 2nd respectively. The findings revealed that respondents were exposed to wide range of information sources on agrochemicals. Radio and extension agents were the most popular. This is in line with Nwobodo et al. (2022) who reported that radio is a very effective medium of disseminating new agricultural innovation and other information to farmers and radio also has other numerous advantages such as portability, cheapness and the ease in its operation.

Extension service is also a popular means of information dissemination to farmers because of inherent advantage of prompt feedback that is embedded in it. Television was one of the least sources of information available to the respondents in the study area probably because of the high cost, electricity, difficulty in getting signal and its operation (Amusat et al., 2019).

On knowledge of farmers concerning risk indicators on agrochemical use, Table 6 reveals that majority of respondents in Oyo State; 90.5%, 85.7% and 85.7 % had more knowledge on; reading of labels on the package/container is necessary before use, safety of bottles/packages of agrochemicals along with food items and determination of wind direction before and during spraying compared to the respondents in Ogun State. On the other hand, majority of respondents in Ogun State; 76.2 %, 71.4 %, and 71.4 % had more knowledge on washing of hands with soap after spraying agrochemicals, effect of overdose of agrochemicals on crop yields and use of personal protective wears when spraying respectively. The implications of this finding is that

farmers who used agrochemicals within the study area are aware of some risk elements in their use such as herbicide, insecticides and fertilizers and they are likely taking measures against the inherent risk associated with agrochemical use. Their consciousness and knowledge of the risk indicators in the use of agrochemicals may not be unconnected with the various training and enlightenment programmes organized by various agencies such as WAIDA, ADPs and radio programmes sponsored by agricultural research institutes to create awareness and teach farmers on safe and responsible use of agrochemicals.

Table 6. Knowledge of agrochemical use

SN	Risk indicators	Ogun (%)	Oyo (%)
1.	Reading of labels on the package/container is necessary before use	66.7	90.5
2.	Seeking help from others if i cannot read	61.9	71.4
3.	The toxicity of agrochemicals	28.6	52.4
4.	Labels can be read by others if you cannot read	61.9	71.4
5.	Eating, drinking, or smoking while spraying agrochemicals…	52.4	71.4
6.	Washing of hands with soap right after spraying agrochemicals	76.2	71.4
7.	Safety of bottles/packages of agrochemicals along with food items	42.9	85.7
8.	Washing of the sprayer in the pond/canal/river	66.7	66.7
9.	Determination of wind direction before and during spraying	42.9	85.7
10.	Facing the direction of wind when spraying	57.1	61.9
11.	Application of recommended dosage	71.4	61.9
12.	Application of two or more pesticides types together	52.4	71.4
13.	Effect of overdose of agrochemicals on crop yield	71.4	66.7
14.	Use of agrochemical containers to store foodstuffs for consumption or feeding animals	57.1	57.1
15.	Use of personal protective wears when spraying agrichemicals	71.4	66.7

Source: Field survey, 2024

Table 7. Categorisation of farmers' knowledge level on agrochemical use

Knowledge level	Ogun	Oyo	Mean	SD
Low	38.1	33.3	8.21	2.34
High	61.9	66.7		

Source: Field survey, 2024.

Table 7 reveals categorization of farmers' knowledge on the safe and responsible use of the agrochemical in the study area. The table reveals that majority of respondents (66.7%) and (61.9%) had high level of

knowledge of agrochemical use in Oyo and Ogun States respectively. Having more knowledge indicates that respondents were more aware of risk indicators and possessed competence in agrochemical handling and application, as a result would be more careful and responsible in the use of agrochemicals. The difference in respondents' knowledge in the study area might be due to the fact that more efforts were being put into dissemination of information that would enhance the knowledge of farmers in Oyo than in Ogun state by the state extension workers, though the difference is insignificant. It can be inferred from the result that majority of respondents are conscious of safety measures in the use of agrochemicals, this may be due to their literacy level and exposure to different training on the right use of agrochemical. Also, the input dealers have also taken it as a point of duty to be educating farmers and other stakeholders on the danger of using agrochemical wrongly and not observing necessary safety procedures.

Table 8. Relationship between selected personal characteristics (education, crops cultivated and cropping system) and risk indicators of agrochemical use

		Ogun			Oyo	
Variables	X^2	Df	p-value	X^2	Df	P- value
Education	9.418	3	0.024*	1.271	2	0.530
Crops cultivated	24.242	15	0.061	24.737	11	0.376
Cropping system	3.791	3	0.285	1.956	2	0.010*

Source: Field survey, 2024

Table 8 shows that significant relationship existed between education of respondents and their risk indicators in Ogun State while there was no significant relationship in the education of respondents and their risk indicators in Oyo State. On education, it was discovered that majority of respondents in Ogun State were better off than their counterparts in Oyo State as majority of them had secondary and tertiary education. The implication of this finding is that educated and knowledgeable farmers are at advantage of understanding the right and responsible ways of using agrochemicals and also adopting modern techniques of farming.

Significant relationship also existed between cropping system and risk indicators of agrochemical use in Oyo State. This was due to the fact that all the farmers in Oyo State were practicing mixed cropping which will afford them the opportunity of using different agrochemicals especially herbicides as compared to majority of farmers in Ogun State who were practicing monocropping.

4. Conclusion and recommendation

The study concluded that respondents used different types of agrochemicals and sourced information from radio and extension agents. Furthermore, it was found that majority had high knowledge and favourable attitude towards the use of agrochemicals in the study area. It is recommended that continuous professional development and capacity enhancement of farmers on areas such as importance of reading labels on

agrochemicals, right use of personal protective wears and determininig the right direction of wind during spraying or when using agrochemicals should be the focus of government and other extension agencies as farmers in the study area have largely adopted the use of agrochemicals as a key component of their farming practices.

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