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Knowledge, perception and utilisation of pesticides among crop farmers in Northwest, Nigeria

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ABSTRACT

This study examined the knowledge, perception and utilization of pesticides among crop farmers in Northwest, Nigeria. Multistage sampling technique was used to collect data from 700 respondents across the 7 states of the northwest through interview schedule. Data obtained were analyzed using descriptive and inferential statistics. Results revealed that the respondents were predominantly between 31 and 40 years of age with limited educational backgrounds (50% possessed only a primary school certificate), indicating a low socio-economic profile. A 67% of the respondents had a low knowledge on pesticide utilization, exacerbated by minimal contact with information sources on pesticides utilization (78%, at most twice in a year). Additionally, 55% of the respondents expressed an unfavourabe perception of pesticides, often shaped by anecdotal experiences rather than informed decision-making. Despite nearly half (48%) of the respondents using pesticides, the study highlights significant health concerns and environmental implications, as evidenced by reported problems faced during pesticide application. These findings align with similar studies across developing regions, underscoring a broader trend of inadequate pesticide knowledge and training among farmers. To promote sustainable crop farming, it is imperative for stakeholders, including government and NGOs, to enhance extension services and support systems, empowering farmers with essential knowledge for safer pesticide practices.

Keywords: Crop farmers; knowledge; perception; pesticides, utilisation

INTRODUCTION

Nigeria is an agricultural country with various agro-ecological zones that produce a diverse range of crops; as a result, farmers have increased their usage of pesticides and fertilizers to boost production. Similarly, due to market demand for pest-free and attractive products, these pesticides have been used in excess of certified quantities (Bakand *et al.*, 2012; Adejori and Akinnagbe, 2022). In fact, pesticides are now used by farmers to increase agricultural output and protect crops from various insects, pests, and diseases. While pesticides play an essential role in agriculture, its improper utilisation could be catastrophic. Pesticides aid in controlling insect pests and eradicating weeds that compete with field crops (Khan *et al.*, 2010; FAO, 2022). There are 1500 types of chemicals used as pesticides worldwide, and owing to their chemical nature, they can cause serious environmental (soil,

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water, and air) and health problems (Bolognesi and Merlo, 2011). The global pesticides trade has significantly increased up to $41.1 billion in 2020 (FAO, 2022). In developing countries, demand for pesticides is increasing, accounting for a quarter of global pesticides use (EU, 2021). But the death rates as a result of pesticide poisoning are quite high in the developing countries (Sharma *et al.*, 2019). Human exposure to pesticides results in a number of harmful effects depending on the type of pesticide and duration of exposure.

Pesticides effects on environment and food can be reduced by educating farmers and providing them with training on safe use (Ahmed *et al.*, 2011; Mubushar *et al*., 2019). Pesticides safety concerns are aggravated by poverty and illiteracy, which are prevalent in most developing nations' farming communities, including Nigeria (Tolera, 2020). Some of the primary reasons for pesticides application safety precautions not being applied have been recognized as negative attitudes, as well as a lack of information and education among farmers (Bhandari, *et al.* 2018; Sapbamrer and Thammachai, 2020). A number of studies in many countries such as Ethiopia and Iran have indicated linkage between inappropriate use of pesticides and farmers' weak knowledge, and inappropriate attitude towards pesticides use (Gesesew *et al.*, 2016; Rezaei *et al.* 2018). Whereas others have found a strong association between knowledge, attitude, and perception of farmers on pesticides use (Mohanty *et al.*, 2013).

Likewise, precarious farming practices in pesticides utilisation and inadequate use of protective equipment were found to have direct relationship with occupational poisoning rates and environmental pollution (Yang *et al*., 2020). Wrong perceptions, lack of knowledge, and education were also reported as some of the key causes for non-implementation of safety precautions among farmers during pesticides application (Bhandari *et al*., 2018; Sapbamrer and Thammachai, 2020). It was reported that agricultural labourers in India who believed pesticides application poses a high danger exhibited more safety practices (Coppens, 2016). Similarly, in Ethiopia, high rates of improper utilisation of pesticides were mainly caused by lack of awareness on pesticides toxicity among farmers (Damte and Tabor, 2015). Wrong perceptions, lack of knowledge, and education were reported as some of the key causes for non-implementation of safety precautions among farmers during pesticides application (Bhandari *et al.*, 2018; Sapbamrer and Thammachai, 2020).

So, in order to avoid pesticides exposure, farmers' knowledge on potential pesticides dangers is critical (Damalas *et al.*, 2006). According to Kalipci *et al.* (2011), a significant educational mobilization needs to be launched in collaboration with various institutions in order to educate farmers and raise their knowledge on pesticides utilisation. Therefore, the first stage in developing effective pesticide training programs is to determine the scope of the problem by looking at farmers' knowledge, attitude, and perceptions about pesticides safety, and factors that influence farmers' pesticides usage (Ibitayo, 2006; Shetty *et al.*, 2010).

Researches highlighted earlier have shown that knowledge, perception and utilisation of pesticides among farmers in agricultural settings is an issue of concern, but with regards to northwest, Nigeria the issue has not been adequately documented. In Nigeria, specifically northwest (where the bulk of the country's grains are produced) such studies are quite scanty or unavailable in public space. Pesticides related studies in the area largely focused on epidemiology (Isah *et al.*, 2020; Oridupa *et al.*, 2020) which emphasizes health implications of pesticides use. The study focused on crop farmers' knowledge, perception, and utilisation of pesticides at farm level in northwest, Nigeria.

METHODOLOGY

Description of the Study Area

Northwest is the most populous geopolitical zone in Nigeria, having 35,786,969 million inhabitants (NPC, 2006). It covers 221,437 km^2 of the total land mass of Nigeria. It is composed of seven states: Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara. Northwest is semi-arid with mean annual temperature of about 27°C. It experiences a single rainy season (May to October) with mean annual rainfall of 508-1016 mm. The growing season ranges from 100-150 days. The major inhabitants of Northwest Nigeria are farmers and herders (Hassan *et al.,* 2013).

Sampling Procedure and Sample Size

A multistage sampling technique was used in the research to generate the required data using interview schedule: First, five local government areas were purposively selected from each of the seven states in the zone based on pesticides use. Second, two villages were purposively selected from each selected Local Government Areas based on the preceding reason. Finally, 10 respondents were selected randomly from each of the villages to make a sample size of 700 respondents.

Measurement of Key Variables

Farmers' knowledge on pesticide use was measured via 10 constructed questions that cover relevant areas of pesticide use. Two marks were allotted for each question. A respondent was given full marks for a correct answer; half for a partial answer and zero for an incorrect or no answer. Thus, the highest marks that can be scored were 20.

Perception on pesticides use was measured using Likert-type scale. The scale contained 10 statements that addressed perception on pesticides use on a 5-points continuum. The 5-points continuum included: 5 scores for 'strongly agree', 4 scores for 'agree', 3 scores for 'neutral, 2 scores for 'disagree' and 1 score for 'strongly disagree' responses depending on the nature of the attitudinal statement. Thus, the highest marks that can be scored was 50.

Pesticides utilisation was measured using the following formula adapted from Hedayet (2011):

$$\frac{\text{Area under pesticide use by the respondent}}{\text{Potential area under pesticide use by the resepondent}} \times 100$$

Data Collection

For collection of data, an interview schedule was used. In order to collect the required data, the interview schedule was developed relative to the research objectives. The data were collected through face-to-face interviews. Subsequently, the data were coded (given numerical coded values) and analyzed.

Data Analysis

Descriptive statistical measures such as frequency, and percent, were used to describe and interpret the data. The Statistical Product and Service Solutions (SPSS) software was used for data analysis.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

The results presented in Table 1 provided an overview of the socio-economic characteristics of the respondents involved in the study. Notably, most (63%) of the respondents were within the active age group of 31 to 40 years. This age demographic often represents a period of peak productivity and engagement in agricultural activities. Additionally, many of these respondents possessed only a primary school certificate, with half (50%) reporting this level of education, which may limit their access to advanced agricultural training or information.

Table 1: Distribution of the respondents based on socioeconomic characteristics (n = 700)

Variables	Categories	Frequency	Percent
Age (years)	up to 20	73	10
	21-30	152	22
	31-40	439	63
	Above 40	36	5
Educational qualification	Primary	347	50
	Secondary	82	12
	Tertiary	45	6
	No educational qualification	226	32
Family size	up to 5 members	61	9
	5-10 members	453	65
	Above 10 members	186	26
Farm size	0.5-1.0 ha	96	14
	1.01-1.5 ha	201	29
	>1.5 ha	403	57
Annual income (₦)	up to 200,000	54	8
	201,000-500,000	307	44
	Above 500,000	339	48
Contact with pesticides information sources	Once in a year	51	7
	Twice in a year	544	78
	More than twice in a year	105	15

Furthermore, a significant portion of the respondents belonged to relatively large households, with 65% indicating that their families comprised between 5 and 10 members. This household size could have implications for labour availability and resource sharing within farming operations. In terms of land ownership, the respondents predominantly managed farms larger than 1.5 hectares, with 57% reporting this land size, and most had an annual income exceeding 200,000 naira. However, it is concerning that none of the

respondents had more than two contacts with any information source regarding pesticides use in a year, highlighting a potential gap in access to critical agricultural knowledge.

The findings presented in Table 1 suggest a low socio-economic profile among the respondents, particularly when considering their low educational level. These observations align with similar findings reported by Ali *et al.* (2020) among smallholder crop farmers in Bangladesh, as well as Tijjani *et al.* (2018) among vegetable crop farmers in the Jere Local Government Area of Borno State, Nigeria, indicating a broader trend that may affect agricultural productivity and sustainability in the developing countries.

Knowledge on Pesticides Use in Crop Farming

The results obtained, as indicated in Table 2, revealed a concerning trend regarding the respondents' knowledge about the specific roles of various pesticides employed in agricultural practices, the quantities applied, and the procedures for their application. A significant number (67%) of the respondents exhibited a largely low level of understanding in these critical areas. Alarmingly, only 4% of the respondents demonstrated high knowledge regarding pesticide utilization. This lack of knowledge among the respondents in relation to pesticide use in crop farming can likely be attributed to their limited contact with information sources as shown in Table 1.

Table 2: Distribution of the respondents based on knowledge on pesticide use (n = 700)

Knowledge on Pesticides	Frequency	Percent
Low (score up to 7)	467	67
Moderate (score 8-14)	203	29
High (score above 14)	30	4

It is essential to recognize that inadequate knowledge in this case can lead to improper pesticide application, which may result in decreased crop yields and negative environmental impacts. Similar findings were reported by Mergia *et al.* (2021), who conducted a study among vegetable farmers along the littoral of Lake Ziway in Ethiopia, highlighting a broader issue within the agricultural community that warrants immediate attention and intervention. Addressing this knowledge gap is crucial for improving agricultural practices and ensuring sustainable crop farming.

Perception on Pesticides Use in Crop Farming

In the present study, perception is viewed as the stance of the respondents regarding pesticides and their effects on the environment, as well as how they act in relation to that understanding. It is often the case that farmers who possess a favourable perception of pesticides tend to use them more judiciously and responsibly. This careful application can lead to better environmental outcomes and potentially healthier crops. Results presented in Table 3 reveal that a significant number (55%) of the respondents held an unfavourable perception of pesticide use in crop farming, indicating a widespread concern regarding the implications of such practices.

Table 3: Distribution of the respondents based on perception on pesticides use (n = 700)

Perception on Pesticides	Frequency	Percent
Unfavourable perception (< 17 score)	386	55
Favourable perception (17-32 score)	270	39
Highly favourable perception (above 32)	44	6

It was observed that the respondents' perception was largely influenced by instinct, trial and error, or the shared experiences of fellow farmers within their community. These factors undeniably shape their thought about pesticide utilization. Findings reported by Ben Khadda (2021) from the Fez Meknes region of Morocco resonate closely with the results obtained from this study, highlighting a common thread in the perceptions surrounding pesticide application and its environmental implications. This similarity of results underscores the importance of addressing the educational and informational needs of farmers to foster more sustainable agricultural practices.

Utilization of Pesticides in Crop Farming

For this study, utilization refers to the employing of pesticides in crop farming by the respondents involved in the study. As shown in Table 4, pesticides were found to be in high use by nearly half (48%) of the respondents in the study area. This noteworthy level of pesticide application raises concerns regarding the potential health and environmental impacts associated with such practices. Perhaps the high use of pesticides could be linked to indiscriminate application due to low knowledge or poor implementation of environmental laws and regulations designed to protect both the ecosystem and human health.

Table 4: Distribution of the respondents based on utilization of pesticides (n = 700)

Pesticides Utilisation	Frequency	Percent
Low utilization (up to 33%)	161	23
Moderate utilization (33-66%)	206	29
High utilization (Above 66%)	333	48

It is crucial to consider that inadequate training and a lack of access to alternative pest management strategies may further exacerbate this issue. This situation highlights the need for targeted education programs to improve farmers' understanding of sustainable crop farming practices. It is essential to recognize that the high usage of pesticides may not stem from informed decision-making but rather from a lack of knowledge and training, leading to indiscriminate application practices. Similar results were reported from Barbados by Yawson (2022), indicating that this is not an isolated problem but rather a widespread challenge from crop farmers in various countries of the developing world.

Problems Faced by Crop Farmers during Pesticides Use

Table 5 clearly illustrates that each of the respondents encountered one or more problems while using pesticides during their crop farming. Particularly, except for dizziness, which was reported by only 6% of the respondents, all other problems were experienced by the majority. The remaining problems were experienced by the respondents in a descending

order of frequency, with dwindling crop output being the most significant concern at 21%. This was followed by redness of the eye (19%), itching (18%), burning sensation (13%), excessive salivation (12%), and vomiting (11%). These findings highlight the multifaceted problems faced by crop farmers and agricultural workers alike while utilizing pesticides. Adesuyi *et al.* (2023) reported results akin to those obtained in this study, specifically in some local government areas of Lagos State, Nigeria, where similar problems were documented. Also, Mubushar *et al.* (2019) provided evidence of dwindling crop output directly attributable to the utilization of pesticides among crop farmers in the Sahiwal district of Punjab, Pakistan. This suggests that the problems surrounding pesticide use are not isolated and may reflect a broader trend affecting agricultural productivity across countries.

Table 5: Distribution of the respondents based on problems faced during pesticide use (n = 700)

Problems	*Frequency	Percent
Redness of eye	176	19
Burning sensation	119	13
Dizziness	54	6
Itching	163	18
Excessive salivation	113	12
Vomiting	98	11
Dwindling output	196	21

*Multiple responses

CONCLUSION

Pesticides utilization in crop farming is an important issue that impacts the agricultural value chain, the environment and the health of farmers. Deducing from the findings of this study, crop farmers in northwest Nigeria have predominantly low to moderate knowledge, unfavourable perception, and utilise pesticides beyond an acceptable level. Thus, there is a pressing need for enhancing the socio-economic profile of crop farmers to improve their knowledge and practices regarding pesticide utilization. Addressing the gaps in knowledge and the unfavourable perceptions observed among the respondents is crucial for promoting sustainable crop farming practices. Stakeholders, including government agencies, NGOs, and other agricultural extension service providers, must collaborate to provide training, resources, and support to farmers. By fostering a better understanding of pesticide safety and environmental stewardship, it is possible to mitigate the negative impacts currently associated with pesticide utilization in the agricultural sector. Empowering farmers with knowledge and resources will eventually lead to improved crop yields, healthier communities, and a more sustainable agricultural landscape.

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