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Assessment of safety practices and farmers behaviors adopted when handling pesticides in rural Kano state, Nigeria

Abstract

Background: With the global population expected to reach 9billion people by 2050, current agro economy practices are expected to exacerbate human health threat, environmental and land pressures.Feeding the majority of the world population is challenging and the potential presence of using agrochemicals must be investigated to guarantee consumer chemical safety.To overcome this challenge, there is an urgent need to invest in innovative solutions for food production.

Objective: This study assesses safety practices and farmer's behaviors adopted when handling pesticides in Kano State, Nigeria.

Methods: A structure questionnaire was developed focusing on sociodemographic characteristics, knowledge and experience of adverse health effects related to pesticide use, details of work practices and an inventory of pesticides used on the farm.Of the 400 copies of questionnaire administered 392 copies representing 98% of the administered questionnaires were retrieved and found useable.

Findings: The result showed that less than half of these farmers who make use of pesticides protect themselves by wearing mask, boot or impermeable clothes, 72.6% of the respondents use stock in mixing pesticides, 17.7% made use of their bare hands while 9.7% use other methods, In terms of what they do after applying pesticides 70.4% wash their hands with soap and water, 25.4% claimed that they wash their hands with waters only, 29.1% store pesticide in their rooms, 38.5% stored it outside house while 32.5% of the respondents stored pesticides inside house, 47.0% of the respondents dispose pesticides containers by throwing it in open field, 38.7% throw it in dustbin while 14.2% returns the containers to the seller.

Interpretation: There is need to provide cautionary tales for researchers, various stakeholders, and decision-makers to agree on the data needed to build confidence in using new methods for specific purposes.Confidence building measures can have the potential to play an increasing role in screening for hazardous properties, prioritizing chemicals for further testing, identifying safer alternatives, assessing environmental media, improving emergency response, and, overall, providing greater protection of public health and the environment.Also, pesticide regulations on farmers should be enforced in a way that will protect public health and those who are being exposed outside of regulations.

Keywords: public health and environmental protection, agro economy, safety practices, pesticides, kano state

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RAIMI Morufu Olalekan,[1&2] ISAH Hussain Muhammad,[2] UDENSI Lawrence Okoronkwo,[3] EFEGBERE Henry Akpojubaro[4]

[1]Department of Community Medicine, Environmental Health Unit, Faculty of Clinical Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
[2]Department of Environmental Health Science, Kwara State University, Malete, Kwara State, Nigeria
[3]Department of Sociology, Federal University of Kashere, Gombe State, Nigeria
[4]Department of Community Medicine, Faculty of Clinical Sciences, College of Medical Sciences, Edo University, Iyamho, Edo State, Nigeria

Correspondence: RAIMI Morufu Olalekan, Department of Community Medicine, Environmental Health Unit, Faculty of Clinical Sciences, Niger Delta University,Wilberforce Island, Bayelsa State, Nigeria, Email ola07038053786@gmail.com

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Introduction

Nigeria's population is projected to hit 410.6million humans by 2050 and consequently, making it the third most populous country in the world, most of which are ambitious youths.[1-4] Agriculture, the world'slargest industry, accounts for more than 60% of the working population.The industry has reputation for the quality of its operation but it remains one of the most dangerous sectors in the world.This has necessitated the need to prioritize raising agricultural productivity to achieve food self-sufficiency.One of the key factors identified as having the capacity to promoting agricultural productivity and achieve food security is access to and efficient use of input, particularly pesticides i.e.phosphate fertilizer.The snag, however, is that Nigerian and indeed, much of the developing world, has not been able to effectively acquire and use this critical input to increase yields. Nigeria appears to be worse hit.For example, at two (2) kilogramme/hectares per pesticide application rate is far below the global average of 16kg/hectare.Nigeria also ranks below her peers on the continent such as Kenya and Ethiopia, which parade 19kg/hectare and 13kg/hectare pesticides application rates.Of course, the damageis certainly not lost on stakeholders and the authorities in the agro economy.This is so, considering the need for increased crop production to ensure food self-sufficiency for the projected population by 2050.[3]

Different governments worldwide define a maximum residue level (MRL), referring to the permitted residue level on a commodity.This level is based on the largest residue proportion that can be obtained on a crop when the pesticides are used on the basis ofstandard agricultural practices, also called Good Agricultural Practices or GAP.[5] The MRLs does not interfere with safety, implying that a stricter MRL does not necessarily indicate that food product is safer. Hence, when detected residue levels exceed the crop's MRL, the risk

to human health and safety must be assessed in situ.Safety limits when evaluated withAcceptable Daily Intake (ADI) for long-term exposure and the Acute Reference Dose (ARfD) for short-term exposure. Unless, if a pesticide's MRL is not considerably lower than the public health safety limit (ADI), the pesticides are prohibitedduring the authorization process.In Global South, the residues in pesticide in fruits and vegetables are a major concern to consumers due to their possible negative health effects.Although such residues have also been found in processed products, several researcheshave suggestedthat food processing reduces pesticide residues.[6] There is also a growingawareness of pesticide residues in agricultural produce which is also increasing in emerging countries.Monitoring pesticide residues in food can be tricky to consumers because the majority of samples contain no detectable levels of pesticide residues.Therefore, and counterintuitively, the recitation of findings from regulatory monitoring programmes is of little value in terms of assessing the potential health risks posed by the consumption of the tested foods. This is due to the fact that the admissible residue levels are not indicators of safety but rather reflect enforcement tools to assess whether Good Agricultural Practices have been followed.[7] As such, excessive residue levels often indicate violations of Good Agricultural Practices but only on very rare circumstances represent cases of health concern.[8] According to the Codex Alimentarius, a risk is determined by a function of the probability of an adverse health effect and the severity of that effect, consequential to hazards in food.The potential health risks posed by pesticide residues in foods can best be assessed by developing estimates of dietary exposure to pesticides and comparing exposure estimates to toxicological indicators of health concern such as the ARfD or ADI.The total numberof dietary pesticide exposure requires data on specific levels of pesticide residues detected (not just whether the residues were legitimate or excessive) as well as estimations of consumption amounts of all foods for which residues are detected.Several studies have shownthat both the probability (due to wrong use, inappropriate equipment) and severity (e.g.banned, adulterated pesticides) of pesticide hazards for consumers seem higher in emerging countries than, for example, in EU member states. However, it is difficult to improveaccurate assessment of pesticide food safety in emerging countries as the calculation require data on pesticide residues in the foodproducts combined with knowledge of food consumption.These data are available inonly a few developing countries.[9] The dietary risk assessment has traditionally been done for an individual compound in a single crop.But, in real life, humans are often exposed to multiple compounds in their diet.These combined exposures may have toxicological effects which may be independent, dose additive or interactive (i.e.synergistic or antagonistic).Until cumulative risk assessment tools are provided, it will always be difficult to determine whether it is good forpublic health, agriculture and economical points of view to continuously lower residue levels towards zero makes sense.In developed countries, risk assessments are frequently performed to investigate where measures should be taken to lower health risk.An example is the Belgian risk assessment study[10] which used official monitoring data on pesticide residues and food consumption data.This study showsthat pesticide residues on fruit and vegetables do not pose major risks to public health.However, it has been shownthat, although exposure of the adult population to pesticide residues appeared to be under control, a high consumption of fruit and vegetables by young children may be exceeding the ADI levels.This suggests that risks associated with the use of pesticidesand the acceptable residue level depends on the context.To further reduce coincidental risks, the safety of pesticides is currently being studiedseparatelyin differentEurope for several pesticides – food commodity combinations.

Objectives of the study

The aim of this research is to examine the risk assessment associated with pesticides application especially on selected agricultural farmland in Kano State, Nigeria.

The specific objectives are to:

i. To assess safety practices adopted by the farmers in handling pesticides in the fields by farmers in Kano state.

ii. To assess the farmers behaviours when using pesticides in Kano state.

Materials and methods

Research design

The descriptive survey research design was adopted for the study.The descriptive survey design according to Gift and Obindah Osuala[11] is a kind of research design in which the researcher collects data from a cross section of the study population in respect of the variables.This design was considered appropriate for the study since it solicits information from a target group.The design involves collection and analyzing data gathered.Funmilayo et al., [12] described descriptive survey design as a type of design to be employed when a study involves the use of questionnaire to seek the opinion of the respondents.Funmilayo *et al.,* added that the descriptive survey type of design is the most convenient way to obtain real facts and figures in which the results of the analyses will be used for decision making or generalization.This research design is considered suitable for this study considering the fact that this study's primary objective centers on risk assessment associated with pesticides application on selected agricultural farmland in Kano State.The choice of descriptive survey design is premised on its value and facility in addressing the research problem raised in the study.

The study area

Location

Kano lies between latitude 13^0N in the North and 11^0N in the South and longitude 8^0W in the West and 10^0E in the East (Figure 1).It is about 840kilometers from the edge of the Sahara Desert. Kano has a mean height of about 472.45m above sea level.Kano State is made up of the following forty-four local government areas: Ajingi, Albasu, Bagwai, Bebeji, Bichi, Bunkure, Dala, Dambatta, Dawakin Kudu, Dawakin Tofa, Doguwa, Gabasawa, Garko, Garun Mallam, Gaya, Gezawa, Gwale, Gwarzo, Kabo, Karaye, Kibiya, Kiru, Kumbotso, Kura, Kunchi, Madobi, Makoda, Minjibir, Kano Municipal, Nassarawa, Rimin Gado, Rogo, Shanono, Sumaila, Takai, Tarauni, Tsanyawa, Tudun Wada, Tofa, Warawa and Wudil.The total land area of Kano State is 20, 760sq kilometers with a population of 9, 383, 682 (2006 provisional result).[3] The temperature of Kano usually ranges between a maximum of 33^0C and a minimum of 15.8^0C although it sometimes drops to 10^0C during the harmattan.Kano has two seasonal periods, comprising four to five months of wet season and a long dry season lasting from October to April.The movement of the South West maritime air masses originating from the Atlantic Ocean, influences the wet season which starts from May and ends in September.The commencement and length of the wet season varies between northern and southern parts of Kano State.The length of the season in Riruwai, which is southern part of Kano State, is six months from early May to late September.While in northern parts it is from June to early September.[3] Average rainfall ranges from63.3mm

+ 48.2mm in May and 133.4mm + 59mm in August being the wettest months.The movement of the tropical maritime air masses from the Southwest to the North determines the weather of Kano State during the wet season.This air mass carries a lot of moisture from over the Atlantic Ocean.This moisture condenses when it is forced to rise by convection or over a barrier of highlands or an air mass; it then falls back as rain.The period of the heights occurs when the sun passes over West Africa between March and June.The dry season starts in October and lasts till about April of the following year.Temperatures are low during this period because the sun is in the Southern Hemisphere and because of movement of the desiccating continental air mass, which originates from the Sahara area and blows from the Northeast carrying along with it the harmattan dust.This is also the harvesting season.[3]

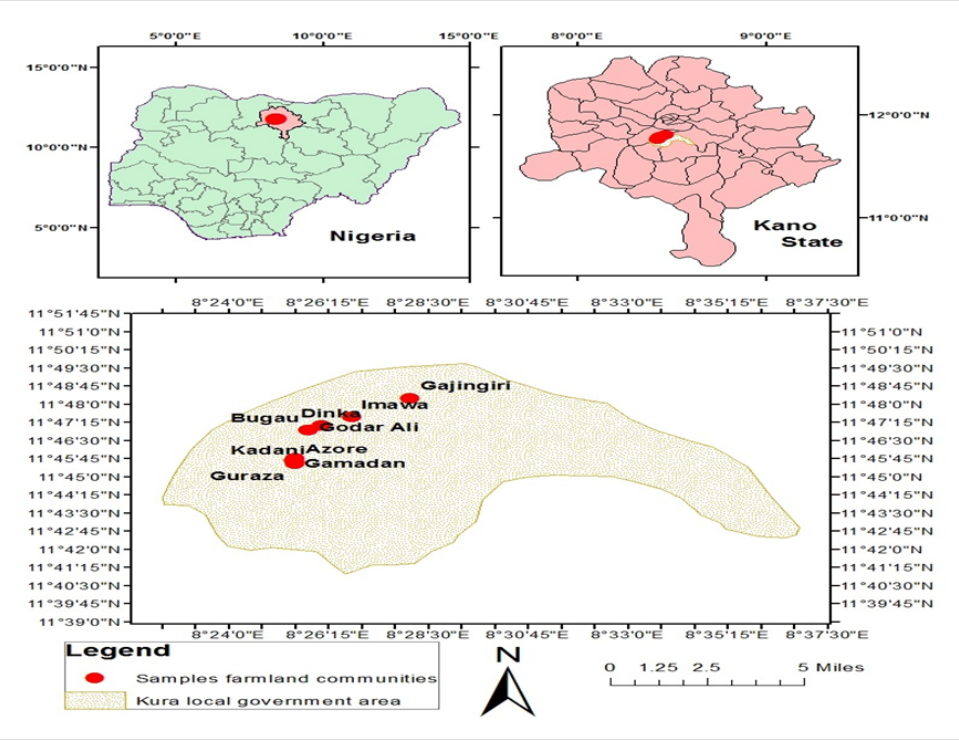


Figure 1 Map of Kano State showing the Study Area.
Adapted from Isah *et al.,* [24] DOI: 10.5281/zenodo.4008682.

Population and sample size

The population for this study comprised farmers in Kura Local Government Area of Kano State, North West, Nigeria.Based on available statistics based on 2006 Population Census showed that Kura Local Government Area has a total population of 143, 094 people with 80% of them being farmers.[13] Hence, the population of the farmers was estimated to be 114475.The population of the study was projected to 2018 using population growth rate of 2.47 percent as provided by the Nigeria population commission.[14] The projected population was obtained as follows:

$$P_t = P_0(1+r)^t$$

P_t = Projected population, P_o = population as at 2006, =114475, r = population growth rate (%) = 2.47% = 0.027, and t = number of years = 12.

$$P_t = P_0(1+r)^t = 114475\left(1+\frac{2.47}{100}\right)^{12} = 114475(1+0.0247)^{12}$$

$$= 114475(1+0.0247)^{12} = 114475(1.0247)^{12} = 114475(1.3402) = 153417$$

Hence, the projected population of 153417 farmers in Kura Local Government Area of Kano State was estimated.

Sample size

A sample size of 399farmers in Kura Local Government was estimated using Taro Yamane.[15] The sample size was estimated as follows:

$$N = \frac{N}{1+N(e)^2}$$

n = Sample size to be determined, e = Level of significance and N = Population size.

$$N = \frac{N}{1+N(e)^2},\quad N = 153417,\quad e = 0.05$$

$$N = \frac{153417}{1+153417\ (0.05)^2}$$

$$N = \frac{153417}{1+153417\ (0.0025)} = \frac{153417}{1+383.5425} = \frac{153417}{384.5425} = 398.9$$

$$n = 399$$

Sampling techniques

The study adopted a multi-stage random sampling technique in the selection of the sample.At the first stage of the sampling, the

simple random sampling was used to sample of 10villages out of the total of 26villages in Kura Local Government Area.Randomisation was done through balloting.The selected villages are Sarkin Kura, Gamadan, Azore, Kadani, Guraza, Imawa and Godar Ali.At the stage of sampling, the simple random sampling was used to select sample of farmers from each of the selected 10villages.To give each of the selected villages each number of farmers, the sample size was divided equally across the 10 selected villages and a sample of 40farmers were selected from each of the village.

Instruments for data collection

Researcher-developed a questionnaire entitled "Risk Assessment Associated with Pesticides Application Questionnaire" that was used in data collection.It comprised 25 sections which focused on the different areas of research including sex, marital status, age, educational qualification, farming experience, farm size and land ownership status, use of pesticides, common used pesticides, effect of pesticides, health problem associated with the exposure to pesticide use and the effect of the pesticide's application on the environment. The study also assesses safety practices adopted by the farmers in handling pesticides and the behaviours when using pesticides.

Validity of instrument

The research instrument was presented to experts for face-validation.Copies of the questionnaire were presented to three experts, two from Environmental Health Science, Kwara State University and one expert in research and Statistics (Statistician).These experts were required to examine the validity of the research instrument in terms of language, clarity and content in line with the purpose of the study, research questions and the hypotheses it will measure.

Method of data collection

To facilitate data collection, the researchers employed four research assistants.The two research assistants helped in the administration of the data.The research assistants were properly briefed on how to administer the instrument.The instrument was administered within a four-week period.Each of the research assistant covered two communities while the researcher also covered two communities. Out of the 400 copies of the questionnaire administered 392 copies representing 98% of the administered questionnaire were retrieved and found useable.

Methods of data analysis

Data obtained were analysed using frequencies and simple percentages.Frequency and simple percentages were used to analyse the demographics of the respondents and to answer the research questions.Also, result of the analysis of some vital results were also presented using pictorial representation like bar chart, cluster bar charts and other forms of pictorial representation.To enhance data analysis and computation of results, the Statistical Package for Social Sciences (SPSS version 20.0) was used.

Results

Demographics of the respondents

Figure 2 presents the demographics of the respondents.Result of the distribution of the respondents based on sex reveals that 54.6% of the farmers were male and 45.4% were female.

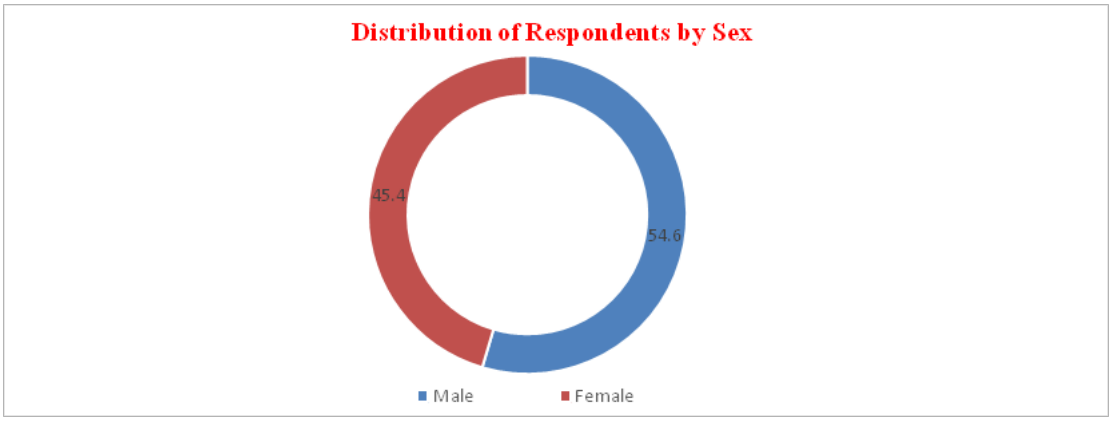
Answering of Objective Questions

Objective 1: To assess safety practices adopted by the farmers in handling pesticides in the fields by farmers in Kano State

Results summarized in Table 1 shows that 50.7% of the respondents said that they protect themselves anytime they want to use pesticides while 49.3% do not protect themselves when using pesticides.When they were asked the safety strategy they adopt, 50.0% were gloves, 43.3% wear mask, 34.8% wear boot and 48.9% said they do wear impermeable clothes.Result shows that less than half of these farmers who make use of pesticides protect themselves by wearing mask, boot or impermeable clothes.

Objective 2: To assess the farmers behaviours when using pesticides in Kano State

Result in Table 2 reveals that 72.6% of the respondents use stock in mixing pesticides, 17.7% made use of their bare hands while 9.7% use other methods.In terms of what they do after applying pesticides 70.4% wash their hands with soap and water, 25.4% claimed that they wash their hands with waters only.Also, 29.1% store pesticide in their rooms, 38.5% stored it outside house while 32.5% of the respondents stored pesticides inside house (32.5%).Result also reveals that 47.0% of the respondents dispose pesticides containers by throwing it in open field, 38.7% throw it in dustbin while 14.2% returns the containers to the seller.



Source: Field Survey, 2019

Figure 2 Distribution of Respondents by Sex.

Table 1 Safety practices adopted by the farmers in handling pesticides in the fields by farmers in Kano State

Safety practices adopted by the farmers in handling pesticides	No. of respondents	Percentage (%)
Do you protect yourself while using pesticides		
Yes	178	50.7
No	173	49.3
If yes, which of the following protective do you put on		
Wear gloves	89	50.0
Wear mask	77	43.3
Wore boot	62	34.8
Wore impermeable clothes	87	48.9

Table 2 Farmers behaviours when using pesticides in Kano State

Farmers behaviours when using pesticides	No. of respondents	Percentage (%)
How do you mix pesticides		
Use stick	255	72.6
Bare hand	62	17.7
Others	34	9.7
What do you do after applying pesticides		
Wash hands with soap and water	247	70.4
Wash hands with water only	89	25.4
Won't wash	15	4.3
Where do you store pesticides		
Store room	102	29.1
Outside house	135	38.5
Inside house	114	32.5
How do you dispose pesticides containers		
Throw in open field	165	47.0
Throw in dustbin	136	38.7
Return to seller	50	14.2

Discussion

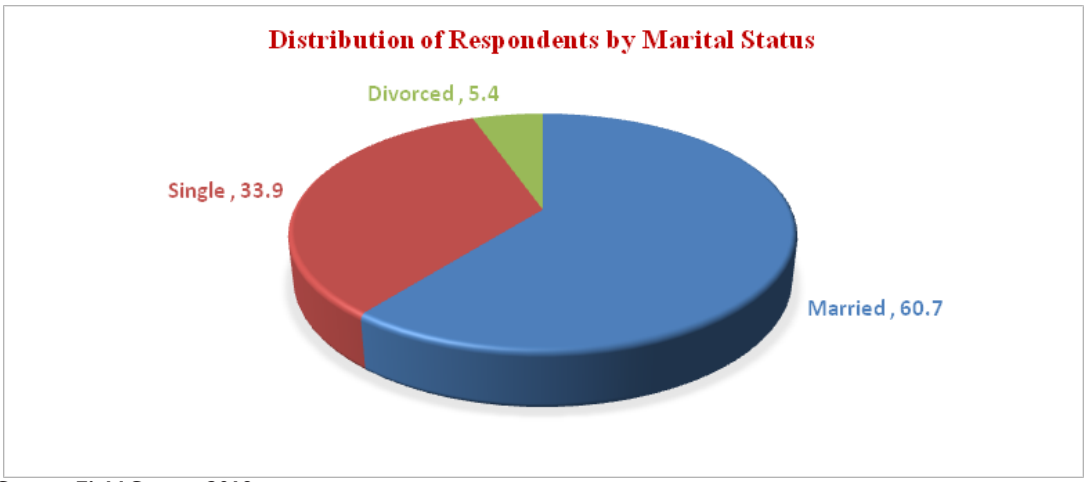
A review of the samples in question

Before the results of the statistical analyses are observed, the samples in question needs to be reviewed so as to ascertain from what specific population the results were generated.The socio-demographic characteristic, including sex, marital status, age, farm size, land ownership, educational levels and farming experience of the farmers regarding pesticide handling is shown in Figures 2–8 above.There was a significant difference observed in the distribution of gender participants in their classification.The number of male respondents was 54.6% greater than the number of female respondents.This view is also supported by Abubakar et al.[16] who found that majority, 93% of the farmers are male, while 7% are female and Bhandari *et* al[17] who reported that about 90% of the farmers interviewed were males. But is contrary to the study conducted by Kainga et al.[18] who found that male (21.7%) and female (78.3%) and Kongtip et al., [19] who state that most Thai agricultural workers in their study were women (60%) and that the characteristics of the agricultural workers in this study varied by farm type This study were different from the report of World Bank with similar number of female and male agricultural workers in Southeast Asia in 2007.[20] It was postulate that it found a higher percentage of women agricultural workers due to more recent economic drivers that push more men to move to urban areas where they are hired in manufacturing or other cash economy jobs; however, it could also be that more women than men were willing to be subjects in their study.However, as demographic shift occurred and become more industrialized, young people discover that the hard work and high cost of farming produces an uncertain income due to the dependence on weather patterns and crop prices.Interestingly, there has been a transition in the population engaged in agriculture in Kano State.Increasingly young people are leaving the rural areas and migrating to the cities to get industrial or service sector jobs. They return to help with the agricultural work on the family farm when needed.The 36-45year age groups were the largest groups in the study.However, these findings are consistent with the study done by Bhandari *et al.*[17] who found that 47% were 30 to 49years old and the remaining 23% were above 50 years old.This was as a result of the stratified sampling procedure.This was done in order

Citation: Olalekan RM, Muhammad IH, Okoronkwo UL, et al. Assessment of safety practices and farmers behaviors adopted when handling pesticides in rural Kano state, Nigeria. *Art Human Open Acc J.* 2020;4(5):191–201. DOI: 10.15406/ahoaj.2020.04.00170

to minimise the effect that small cell sizes have on skewing the frequency distributions.Similarly, this view is contrary to the study conducted by Kainga et al.[18] who found that the 46-55years (34.8%) were the largest groups in the study who engage in farming activities. The largest levels of education were SSCE or its equivalent (36.2%)as against a minority of post graduate (1.0%) who had advanced level of education.Farmers education level ranged from no formal education to a doctorate with most (36.2%) farmers having completed SSEC or its equivalent.This shows that the literacy level of participating farmers was fairly high with the majority having completed at least a secondary (36.2%) education.Meanwhile, these finding is consistent with Bhandari et al.[17] who found that about 30% of the farmers were illiterate and the rest had different levels of education such as primary (23%), lower secondary (20%), secondary (19%) and college (8.7%). Studies have shown that educated farmers are in a better position to receive and understand information about the health effects of pesticides, compared with those with little education.[21] However, this view is contrary to the study conducted by Kainga et al.[18] who found that the 48.9% of the farmer had no formal education.A significantly higher proportion of participants are married (60.7%) compared to participants who are single (33.9%).This view is supported by Kainga et al., [18] who found that 23 (25.0%) were single while 64 (69.6%) were married and 5 (5.4%) were divorced.Meaning that respondent with marital status of married are more involved than respondents from other categories, thus, the sample was a representative sample of the community composition.On farmer's experience, it shows that (46.2%) had between 1and 10 years' experience while (47.7%) had between 11and 20years' experience and (6.1%) had more than 20 years' experience.This view is contrary to the study conducted by Kainga et al.[18] who found that 67 (72.8%) had between 1and 10years' experience while 25 (27.2%) had between 11and 20years' experience.

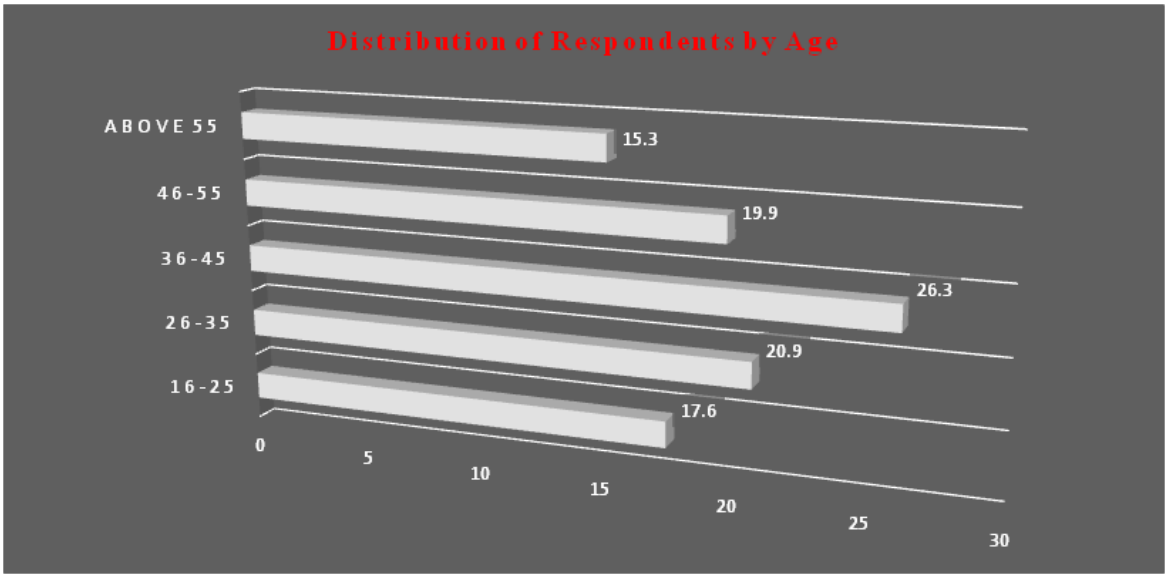
Figure 3 Distribution of Respondents by Marita Status.



Source: Field Survey, 2019

Figure 3 Distribution of Respondents by Marita Status.

Result also shows that 60.7% were married, 33.9% were single and 5.4% were divorced.

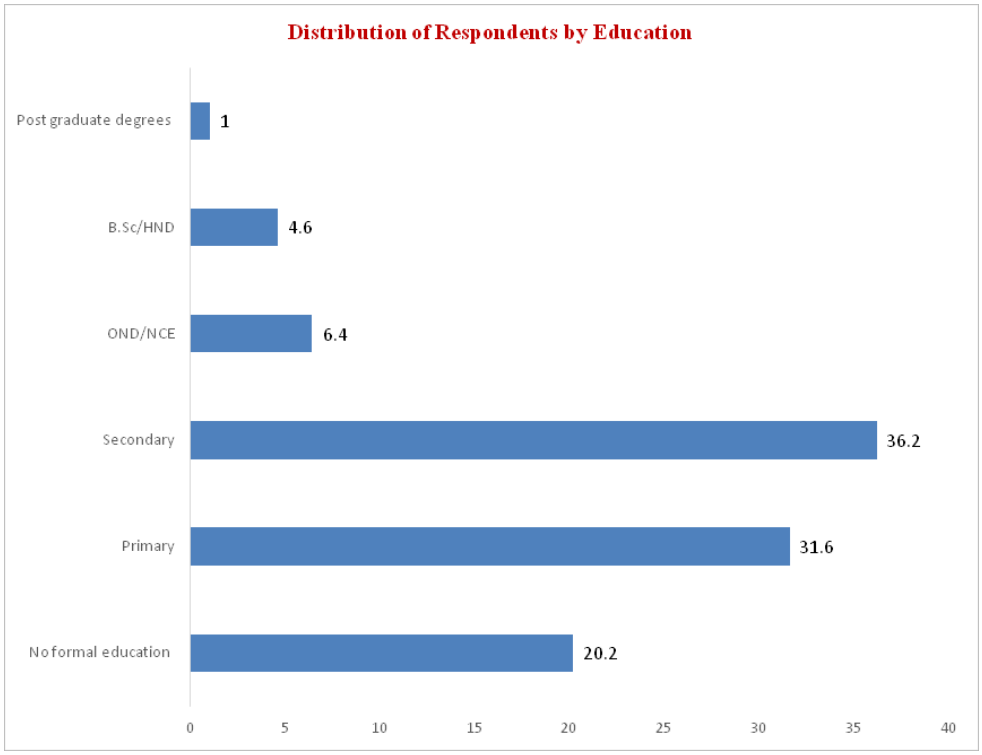


Source: Field Survey, 2019

Figure 4 Distribution of Respondents by Age (Years).

The distributions of the respondents based on age were as follows: 17.6% were between ages 16-25 years, 20.9% were between 26-35 years, 26.3% were between 36-45 years, 19.9% were between 46-55 years while the remaining 15.3% of the respondents were above 55 years.

Citation: Olalekan RM, Muhammad IH, Okoronkwo UL, et al. Assessment of safety practices and farmers behaviors adopted when handling pesticides in rural Kano state, Nigeria. *Art Human Open Acc J.* 2020;4(5):191–201. DOI: 10.15406/ahoaj.2020.04.00170

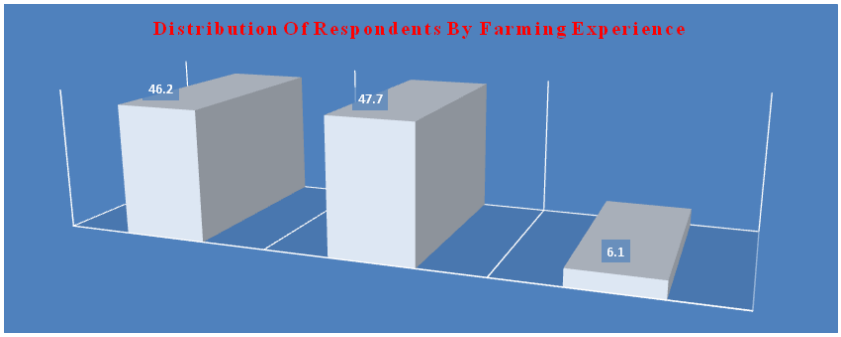


Source: Field Survey, 2019

Abbreviations: OND/NCE, ordinary national diploma/national certificate examination; SSCE, senior secondary school certificate examination; B.Sc/HND, bachelor of science/higher national diploma.

Figure 5 Distribution of Respondents by Education.

In terms of their educational qualification, 20.2% of the farmers had no formal education, 31.6% had primary education, 36.2% of the farmers had secondary education, 6.4% were OND/NCE holders, 4.6% were B.Sc/HND holders while 1.0% had postgraduate degrees.



Source: Field Survey, 2019

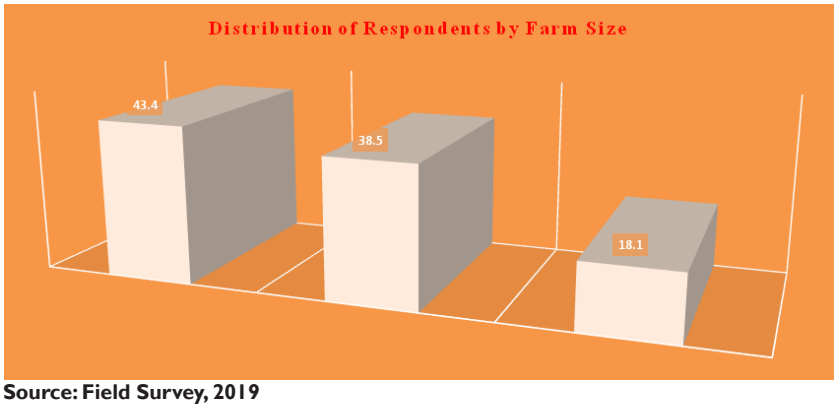
Figure 6 Distribution of Respondents by Farming Experience (years)

Result also shows that 46.2% of the respondents had 1-10years of farming experience, 47.7% had 11-20years of farming experience and 6.1% of the farmers had above 20years of farming experience.

Safety practices adopted by the farmers in handling pesticides in the fields by farmers in Kano state

Safety is a subject to which most people are quite willing to pay lip service, but which too few are willing to do something about but law must protect the health, safety and welfare of agro economy workers.Available studies suggest that farmers may actually ignore appropriate preventive measure notwithstanding an appropriate awareness of related risks, not only in emerging countries, because of factors other than knowledge of pesticide health effects.[22] For example, unavailability and/or inappropriate handling of PPE may be easily recognized and fined by work inspectors, and therefore the use of some PPE may be perceived by the worker more as a regulatory requirement rather than as a safety measure, ultimately operating the equipment without any understanding of its rationale.[22] Again, as climate scenarios project an increase in global mean temperature and in the frequency and intensity of heat waves over most areas around the world in the near future, [22] rigorous usage of PPE becomes ever more difficult, especially in an increasingly older group of workers.Finally, we cannot rule out that the use of PPE may have been perceived by participants as the "socially appropriated" behaviour (i.e.social desirability bias), with our results ultimately overstating their actual use.[22] The prevalence of symptoms potentially related to pesticide intoxication may be interpreted as an outcome of knowledge, attitudes and practices of farmers regarding pesticide

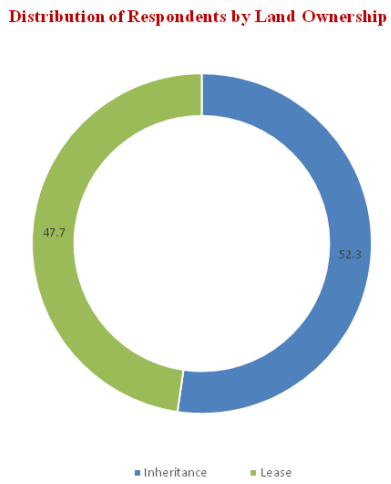
handling and personal protective measures, including both the use of PPE and personal hygiene practices.[22] Results shows that 50.7% of the respondents said that they protect themselves anytime they want to use pesticides while 49.3% do not protect themselves when using pesticides.When they were asked the safety strategy they adopt, 50.0% were gloves, 43.3% wear mask, 34.8% wear boot and 48.9% said they do wear impermeable clothes.Result shows that less than half of these farmers who make use of pesticides protect themselves by wearing mask, boot or impermeable clothes.This was contrary to the study conducted by Ricco et al., [22] who found thatFocusing on the use of personal protective equipment (PPE) during the disposal of pesticides, the majority of participants regularly wore specific gloves (92.7%), a face mask (91.2%), long sleeve clothes (84.3%), and a hat or a hood (80.8%).Similarly, a high share of respondents mentioned not drinking and/or eating (96.9%), not smoking (92.3%), and not chewing gum (96.2%).After pesticide handling, the majority of respondents reported to regularly wash the hands (94.6%), taking a shower or a water bath (86.2%), managing the face mask or the filters (88.5%), changing (84.2%) or cleaning/washing the clothes (80.8%), and replacing/cleaning the gloves (76.5%).Eventually, 76.5% of PAs reported that they did not consume food and/or drink water after the pesticide dispersal, whereas 18.5% referred to regularly smoke and 10.8% chewed gum.This is of particular interest not only for occupational health and safety, but also in broader terms, as storing pesticides at home or in inappropriate working environment can easily contaminate drinking water and food, ultimately threatening the health of other non-professionally exposed family members, whereas the disposal of the empty containers in the field or by throwing them near or into local waste containers has been reported as a major public health problem in a number of studies.[22] Unsurprisingly, not only storing pesticides at home was associated with a lower KS, but also an appropriate storage and disposal were consistently associated with better scores.Analysis of personal practices identified a more ambiguous pattern.On the one hand, available evidence suggests a general acknowledgement that the use of appropriate PPE (i.e.long-sleeved shirts, impermeable working clothes, work boots, gloves and a hat/hood) at spraying significantly decreases the probability of poisoning in pesticide handlers.[22] On the other hand, personal hygiene measures such as washing hands, changing clothes, showering, and washing work clothes fromhousehold laundry immediately after work have been also described as efficient in order to avoid poisoning after pesticide application, [22] but are more inconsistently applied, and frequently neglected.[22] In facts, several studies have found detectable levels of pesticide residues on farm workers' work boots, clothes etc., suggesting a significant household contamination from inappropriate practices of personal hygiene measures.[22]



Source: Field Survey, 2019

Figure 7 Distribution of Respondents by Farm Size (ha).

The distribution of the farmers based on farm size reveals that 43.4% of the respondents had 0.5-2.0hectares of land, 38.5% had 2.5-4.0hectares of land and only 18.1% of the farmers had above 4hectares of land.



Source: Field Survey, 2019

Figure 8 Distribution of Respondents by Land Ownership.

In terms of land ownership status, 52.3% of the farmers acquired their land through inheritance while 47.7% of the farmers acquired their lands through leasing.

Citation: Olalekan RM, Muhammad IH, Okoronkwo UL, et al. Assessment of safety practices and farmers behaviors adopted when handling pesticides in rural Kano state, Nigeria. *Art Human Open Acc J.* 2020;4(5):191–201. DOI: 10.15406/ahoaj.2020.04.00170

Farmers behaviours when using pesticides in Kano state

There is no denying the facts that the current poor pesticides safety performance in Nigeria is as a result of the defective issues surrounding it.One of the most common cause of death from pesticides is carelessness in application.Spray applicators frequently ignore recommended procedure and cover themselves with the pesticides they are using.Most of the exposure is dermal.Pray droplets are too large to be easily inhaled.Protective clothing is uncomfortable to wear, especially in warm weather, when most applications take place.Usually, frequent bathing and fresh clothes would be adequate to prevent fatal exposure since dermal absorption is not apt to be extremely fast.Moreover, prompt medical treatment also would usually be successful, but there are still cases of exposed workman who take atropine by mouth when they feel nauseated.Because this relieve the symptoms, they return to work instead of seeking medical attention.Result reveals that 72.6% of the respondents use stock in mixing pesticides, 17.7% made use of their bare hands while 9.7% use other methods.In terms of what they do after applying pesticides 70.4% wash their hands with soap and water, 25.4% claimed that they wash their hands with waters only.Also, 29.1% store pesticide in their rooms, this is in tandem with Abubakar et al., [16] who found that storage of pesticides in family bedroom is another misuse indicated by 26.6% of the farmers while the majority (96.1%) regarded improper disposal of pesticides containers as a misuse.38.5% stored it outside house while 32.5% of the respondents stored pesticides inside house (32.5%).Result also reveals that 47.0% of the respondents dispose pesticides containers by throwing it in open field, 38.7% throw it in dustbin while 14.2% returns the containers to the seller.This was contrary to the study conducted by Ricco et al., [22] who found thatthe majority of participants (90.8%) claimed that there was a special site for pesticide storage, either nearby home or in the farm, and only 26 individuals (10.0%) reported storing these products inside their house. The empty pesticide containers were returned to the specific disposal program by 93.5% of respondents, whereas 13 (5.0%) washed and reused the containers.Similarly, majority of participants disposed leftover pesticides through specific programs (81.9%), 18.8% stored them for reuse and 9.2% simply poured them on the fields.No one reported to have buried or burned the containers or leftover pesticides, but 1 participant (0.4%) declared that he preferred to not share information about the management of containers.However, this high level of knowledge about pesticides hazards which the end users of pesticides have is important for the prevention of acute poisoning.[23]

Conclusion

Personal Protective Equipment (PPE) is all about eliminating hazards no matter what method is adopted and maintaining good practices and excellent health in the workplace to a larger environment and not to endangering the lives of farmers, consumers and others. Specifically, the error of human activities on earth are responsible for many calamities across the globe because they often tend to alter the natural environment.To achieve positive results, Therefore, actions that embrace physical and practical with precision must be adopted. For example, the use of some man-made gases is responsible for the depletion of the ozone which in turn contribute to the climate change, the consequences of which is now being experienced across the globe. Therefore, human activities can be checked through compliance measures even when farmers are operating within approved standards. Creating and sustaining a culture of safety in agro economy requires *a* high level of commitment and participation by all those involved in handling the different phases of the agro economy.Like safety development and sustenance must also be an unending process.This is because, apart from the key fact that it is a preventive tool against all manner of environmental calamities, it also helps a great deal in creating opportunities for productive enquires and positive change. Therefore, with the operation of a sound safety culture in any given setting, we can be nest assumed of a long-lasting improvement in safety performance.Our growth will be propelled by prioritization of agriculture as a key contributor to development and fast paced adoption of new technologies to strengthen the sector.

Respondents have shown awareness that the use of pesticides causes adverse effects on human health.They are aware that skin irritation, dermatitis, dizziness, headache, nausea, vomiting, dyspnoea, throat itching, eye irritation and burning, and tachycardia are poisoning symptoms of pesticide use and they are aware that long term use of pesticides may cause cancer, infertility, miscarriage, birth defects and foetal death.All of them are aware that immediate actions after pesticides contact with body.Therefore, continued research on the nature of the degradation of the chemicals in various elements of the environment is necessary.It will also require adequate attention of the hazards to man and other elements of the environment during the degradation process.Also, pesticide regulations on farmers should be enforced in a way that will protect public health and those who are being exposed outside of regulations.

Recommendations

One of the first things to do to achieve these objectives is to create and sustain the culture of safety in the hearts and minds of all those involved in agro economy.As Lee (1997) states "The only way to continue to improve is to address the hearts and minds of management and workers".This is a sure step towards guaranteeing safety and integrity.Safety culture is seen as an evolvement of a safe collective way of doing things that characterized the behaviours that focuses on the identification of hazards and ensuring safety of everyone."Do it the safe way" Safety should become an integral part of the agro economy while it is possible to direct people to change their work behavior, it is quite difficult to direct people to change their values without the underlying values in place to guide the behaviours, behaviours shifts will be short-lived.Change is slow.However, it is possible to create and sustain a sound safety culture in any given setting in several ways which include;

i. Through awareness creation, role models, new entrant socialization, language clarity, attractiveness of membership and through being proactive.

ii. Government agencies should work with the private sector to help stimulate innovation for sustainable agri-food systems and produce better and safer food while preserving natural resources and biodiversity.

iii. The issues as highlighted need to be seriously addressed.The barriers must be made fit for purpose to checkmate the ever-ubiquitous risks/hazards as required.

iv. Safety standard must be enforced and professional should collaborate to reduce the probability of hazards.

v. Ensure teaching of ecological agriculture at all educational levels and in relevant research institutes and promote public awareness on safety through initiatives involving the community, policy makers, legislators, administrators and the private sector.

vi. Requires farmer's representation on all boards that are concerned with pesticides safety in agriculture and promote agriculture that preserves biodiversity and ensures safe food and other good quality products.

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vii. Control the reliance of farmers on artificial inputs including herbicides and pesticides that are harmful to the environment and promote organic and ecologically sound agricultural practices that suit the holistic nature of local agricultural practices that are not disruptive and are inclusive of economic, social, cultural and gender considerations.

viii. Agro economy workers and practitioners can key properly into the compliance strategy and be applied across board.The benefits of this exercise is not farfetched since activities could lead to loss of lives, economic wastages in terms of properties and income, increased crises among stakeholders, loss of trust, dignity, devastation of the environment and impact on the environment have been rectified, definitely, the gains both in human terms and financial are enormous.The economic relevance of this is unique since the language of business is profit making.Therefore, the exercise in its application will surely key into any activities for positive results and value of quality of life, health, safety and environment will be to the advantage of all stakeholders.

ix. Agro economy workers should inculcate as well as sustain a healthy and intelligent respect for the hazards that threaten its operation in agriculture industry.

x. Agricultural cooperative should be encouraged to have competent safety advisers through their professional association on the need to train and retrain their farmers on safety and health issues.Safety should be given a priority.

Competing interests

We declare that we have no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Consent

All authors declare that 'written informed consent was obtained from the participants.

Ethical approval

Ethical approval for the study was sought and gotten from the Institutional Review Board of the Kwara State University.Permission to carry out the research as well as written consent was also obtained from the farmers after explaining the purpose of the study to them. This was done by meeting the Kano State Farmers Association. Furthermore, the purpose of the study was again explained to participants before completing the self-administered questionnaire. Participants were assured of confidentiality and informed that their participation was voluntary.Participants were advised not to write their names on the questionnaire in order to ensure the confidentiality and anonymity of the information provided.

Appendix

Appendixes

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