



PERCEPTION OF RICE FARMERS' ON THE EFFECTS OF AGROCHEMICALS ON HEALTH AND ENVIRONMENT IN BAUCHI STATE, NIGERIA

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ABSTRACT

The study examined the factors influencing agrochemical usage among rice farmers in Bauchi State, Nigeria. A multi-stage sampling procedure was used in selecting 271 rice farmers. Data were collected using questionnaire and analysed using descriptive statistics. The findings reveal that majority (87.1%) of the respondents perceived that agrochemical have effects on human health. The results also show that 88.95% farmers were aware that agrochemicals are hazardous in nature. The results further indicated that, majority (71.6%) rate agrochemicals as very harmful while 23.6% and 4.8% of the total respondents rates it as moderately harmful and not harmful respectively. The major adverse effects to health include skin irritation (1st), eye irritation (2nd) and vomiting (3rd) among others. The results of the perception of respondents on the effects of agrochemical on the environment include harmful to non-target organism (44.3%), pollute river and stream (41.0%) and contamination of food (39.5%). The major constraints to the use of agrochemicals include; High cost (1st), lack of support from government (2nd) and unpleasant odour (3rd) to mention few. Based on the finding of the study, it was concluded that, farmers agreed that agrochemicals have effects on human health and the environment. Based on the constraints highlighted the study recommended that, there should be alternatives to some agrochemicals which is the biological methods, government should subsidize agricultural input and farmers should wear protective clothing to reduce the effects of unpleasant odour of the agrochemicals.

Keywords: Agrochemical, Environment, Farmers, Health and Rice

INTRODUCTION

In Nigeria, agrochemicals are used for various agricultural services such as weed control, pest control, and improvement in farm produce. These are usually applied by farmers who have little or no knowledge regarding some of the environmental health implications of these chemicals (Ndaghu, 2017). Profitability in smallholder farms is mostly contingent on the use of agrochemicals with intensity variation depending on the production type (Nyambo *et al.*, 2019). In many parts of the world, production increases during the last 50 years were strongly associated with a more intensive use of agrochemicals (Christiaensen, 2017; Meemken and Qaim, 2018). According to Danielou (2014), half the food we eat today is produced mostly with the use of fertilizers. Farmers would resort to applying quantities of agrochemicals to lessen the insurgence of the pests and diseases on crops (Kwofi, 2017). While chemical fertilizers, herbicides and pesticides help to increase crop yields, their misuse can lead to soil, water, and air pollution causing serious problems for the environment and human health (Elahi *et al.*, 2019; Li *et al.*, 2019; Sheahan *et al.*, 2017). Appropriate public policies can reduce negative environmental and health externalities. Agriculture and the environment have always been closely inter-linked to the extent that farmers depend upon the environment, on the resources of land, water, sunlight and biological organisms for agricultural production. The



environment provides opportunities for agriculture, but it is most often being hampered by several environmental activities. The environment of the world is slowly degrading due to industrial and agricultural emissions and the people are very anxious about the degradation or pollution as this may cause serious damage to lives on the earth (Brodt *et al.*, 2011).

The unsafe handling and use of agrochemicals can lead to excessive exposures and accumulation of hazardous chemicals in the body. This accumulation can lead to adverse effects on health and different symptoms associated with these effects have been reported by agrochemical users (Ojo, 2016). Today, it is an established fact that agriculture sector beside industry is another major polluter of environment on a local, regional and global basis (Muhammad and Ruslan, 2012).

According to the World Health Organization [WHO], (2018), agrochemical use is widespread and can have negative consequences for public health. Exposures to other organisms during their application, including humans, is poorly controlled (Damalas and Koutroubas, 2018). The use of agrochemicals has significantly increased the concentration of toxic materials in food and the environment, with negative effects on plant and animal health (Tago *et al.*, 2014). The application of agrochemicals is often imprecise with unintended worker exposures. Comprehensive effects assessments related to the use of agrochemicals and their impact on human health and environment were lacking and also the strategies to curtail its effects on humans and environments. Specific to the Bauchi State region, studies have not been conducted on risk related to the use of agrochemical. This research intends to address the gap in the literature by providing information on the effects of agrochemical on human health and environment in Bauchi State, Nigeria. The study attempted to;

- i. examine the agro-chemical handling practices of rice farmers;
- ii. ascertain rice farmers' perception on the effects of agrochemical use on human health and
- iii. access rice farmers' perception on the effects of agrochemical use on the environment.

MATERIALS AND METHODS

The Study area

Bauchi State was created in 1976 and was divided into three (3) Agricultural zone. The state is located between Latitudes 9°30' and 12°30' North of the Equator, and between Longitudes 8°45' and 11°0' East of the Green Which Meridian. It is bounded in a clockwise direction by Yobe, Gombe, Taraba, Plateau, Kaduna, Kano and Jigawa states. There are 20 Local Government Areas (LGAs) in the State. Bauchi State has a land mass of 49,259 Km² with a population of 4,653,066 according to National Population Commission (NPC, 2006) which is estimated to be 7,057,045 people in 2018 at 3.2% annual increase rate and estimated to be 9,000,0000 people in 2022 at 3.86% annual increase rate. The State is heterogeneous, with predominant tribes like Hausa, Fulani, Jarawa, Sayawa among others (Bauchi State Economic Empowerment and Development strategies [BSEEDS], 2016). The State is one of the States in the north east of Nigeria that span two distinctive vegetation zones, namely, the Sudan savannah and the Sahel savannah. The Sudan savannah type of vegetation covers the southern part of the State. The vegetation types as described above are conditioned by the climatic factors, which in turn determine the amount of rainfall received in the area. For instance, the rainfall in Bauchi state ranges between 1,300 millimetres per annum in the south and only 700 millimetres per annum in the extreme north. Consequently, rains start earlier in the southern part of the State, where rain is heaviest and lasts longer. Here the rains start in April with the highest record amount of 1,300 millimetres per annum. In contrast, the northern part of the state receives the rain late, usually around June or July and records the highest amount of 700 millimetres per annum. In the same vein, the weather experienced in the south and the north varies considerably.



The major economic activities of the Bauchi State were agriculture, which include both crop and livestock production. The major crop production activities include production of rice, maize, sorghum and soybean in western zone, while for central and northern is millet, sorghum, cowpea and sesame. The livestock production includes rearing of cattle, sheep, goat and poultry (BSEEDS, 2016).

Sampling Technique and Sampling size

A multi-stage sampling procedure was used to select the respondents from the study area. In the first stage, all Bauchi State Agricultural Development Programme (BSADP) zones (Western, Central and Northern zones) were selected for the study using stratified sampling technique. In the second stage, nine (9) LGAs were proportionately (40%) and purposively selected. In the third stage, two (2) communities from each of the selected LGAs were purposively selected. The purposive sampling was used based on comparative advantage for rice production making a total of 18 communities. In the final stage, 271 rice farmers were proportionately (0.5%) and randomly selected for the study. A sample frame of the study was a list of rice farmers in the state obtained from BSADP (Table 1).

Table 1: Sample Frame and Sample Size Selection Plan

Agricultural zone	LGAs	Communities	Sampling frame	Sample size (0.5%)
Western Zone	Bauchi	1. Liman	2,788	14
		Katagum	6,896	34
	Dass	2. Bauchi		
		1. Wandi	1,265	06
	Alkaleri	2. Bundot	2,491	12
		1. Duguri	1,027	05
		2. Kwala	1,622	08
	Sub-total		16,089	79
Central Zone	Ningi	1. Gadar	2,398	12
		Maiwa	5,988	30
	Warji	2. Dingis		
		1. Dagu	3,915	20
		2. Gabanga	3,421	17
	Sub-total		15,722	79
Northern Zone	Shira	1. Zigau	3,745	19
		2. Faggo	2,604	13
	Jama'are	1. Dako-	1,894	09
		Dako	2,762	14
	Itas	2. Yola		
		1. Gadau	2,847	14
	gadau	2. Buzawa	1,795	09
		Zaki	1. Katagum	2,573
	2. Sakwa		4,425	22
	Sub-total		22,645	113
Total	9	18	54,456	271

Source: BSADP, 2020.



Data Collection and Analysis

The study used primary data mainly collected with the use of structured questionnaire administered by trained field enumerators to the respondents. The data collected were analysed using inferential and descriptive statistics. Logit regression as the inferential statistics employed to achieve objective ii while descriptive statistics was used to achieve object i and iii

RESULTS AND DISCUSSION

Rice Farmers' Perception on the Effects of Agrochemicals on Human Health

The results in Table 2 show that, majority (87.1%) of the respondents perceived that agrochemical had effects on human health while 3.7% perceived that, it has no effect and 9.2% had no knowledge on whether it has effect or not. This finding is in line with that of Matanmi *et al.* (2015) on awareness of rice farmers when handling agrochemical who reported that farmers agreed that agrochemicals are hazardous in nature. The results also show that, majority (71.6%) rate agrochemicals as very harmful while 23.6% and 4.8% of the total respondents rates it as moderately harmful and not harmful respectively. Similar finding was reported by Gitahi (2014), that, less than half of his respondents considered them moderately harmful.

Table 2: Distribution of Respondents Based on Their Perception and How They Rate the Effects of Agrochemicals on Human Health of Agrochemical on Human Health

Perception (n=271)	Frequency	Percentage
Yes	236	87.1
No	10	3.7
Not to my knowledge	25	9.2
Variable		
Not harmful	13	4.8
Moderately harmful	64	23.6
Very harmful	194	71.6

Source: Field Survey, 2021

Adverse Effects Associated with Agrochemicals in the Study Area.

The results in table 3 reveals the adverse effects associated with agrochemicals in the study area were skin irritation due to agrochemicals usage which was ranked 1st with a percentage of (58.7%) followed by eye irritation (51.7%) which was ranked 2nd and vomiting was ranked 3rd with 33.6%. effects such as diarrhoea, shortness of breath, stomach upset, coughing/catarrh and headache/fever constituted 30.6%, 27.7%, 26.2% 19.6% and 18.5%, ranked 4th, 5th, 6th, 7th and 8th respectively. Other adverse effects which were ranked, 9th, 10th, 11th and 12th were muscle pain, excessive sweating, death and blindness constituting 9.2%, 7.7%, 0.7% and 0.4% of the respondents respectively. The results agreed with Matanmi *et al.* (2015), who posited that, pain and difficulty in breathing were the most severe health symptoms respondents faced as a result of not adhering to agrochemical safety knowledge. Similarly, according to the report of Matanmi *et al.* (2015) rank on effects of agrochemicals on human health eye problem and sneezing were ranked 2nd and 3rd respectively. Furthermore, skin irritation was also severing among the respondents. The occurrence of these health symptoms could probably be to the fact that most maize farmers do not use the recommended personal protective equipment when handling agrochemical. The result is in line with that of Adesuyi *et al.* (2018) who reported that headache, itchy eyes, fatigue, skin irritation, dizziness and coughing as some of the health symptoms respondent face in the study area. Lekei and



Ngowi (2016) corroborated this result by reporting that unsafe handling of agrochemical tends to increase the risk of pesticide exposure, which might lead to serious health challenges. Also Adamu *et al.* (2014), find out in their research that, about 4% of respondent farmers facing stomach upset.

Symptoms which may include skin, eye, stomach and respiratory irritation and neurological problems. Occupational contamination or poisoning has been identified as the most serious problem associated with the use of agricultural pesticides (Monosson, 2007). According to Laary (2012), some farmers who do not usually protect themselves are unaware of the dangers of exposure during handling, formulation, and application of Agrochemicals. However, Users need to wear additional protective equipment as recommended by the label of a chemical such as chemical-resistant gloves, goggles, and/or face shield and an approved respirator (CFSPH, 2010). Similar results were documented by Jibrin *et al.* (2021), in their research titled “factors affecting awareness of maize farmer on health risk of agrochemical usage in Niger state, Nigeria” reported that, shows that pain and difficulty in the breathing where the most sever health symptoms respondents faced as a result of not adhering to agrochemical safety knowledge were eye problem and sneezing.

Table 3: Distribution of Respondents Based on Adverse Effects Associated with Agrochemicals

Adverse effects (n=271)	Frequency	Percentage*	Ranking
Skin irritation	159	58.7	1 st
Eye Irritation	140	51.7	2 nd
Vomiting	91	33.6	3 rd
Diarrhoea	83	30.6	4 th
Shortness of breath	75	27.7	5 th
Stomach upset	71	26.2	6 th
Coughing/catarrh	53	19.6	7 th
Headache/fever	50	18.5	8 th
Muscle pain	25	9.2	9 th
Excessive sweating/heating	21	7.7	10 th
Death	2	0.7	11 th
Blindness	1	0.4	12 th

Source: Field Survey, 2021

*Multiple response

Respondents Perception on Agrochemicals' Effects on Environment

The result in Table 4 indicates that, more than half (52.4%) of the respondents perceived that agrochemicals has effect on the environment while 17.0%, 17.0% and 13.7% perceived that it has effects sometimes, cannot tell and has no any effect on the environment respectively.

Table 4: Distribution of Respondents Based on their Perception on the Effects of Agrochemicals on environment

Variable(n=271)	Frequency	Percentage
Yes	142	52.4
No	37	13.7
Can't tell	46	17.0
Yes sometimes	46	17.0

Source: Field Survey, 2021



Severity of Agrochemicals Effects on the Environment

The results from Table 5 further depicts that, agrochemicals are slightly harmful (36.2%), moderately harmful (29.9%), and extremely harmful (16.2%) while 17.7% of the respondent's rate agrochemicals as a non-harmful chemical substance to the environment in the study area. The world health organization classified agrochemicals according to the potential hazard to human and animal health as extremely hazardous, highly hazardous, moderately hazardous, and slightly hazardous (WHO, 2016). The classifications were based on the findings of studies that were conducted by the IARC and review of other studies (FAO, 2016; and WHO, 2016).

Table 5: Distribution of Respondents Based on their Perception on their Perception on Severity of the Potential Adverse Effects of Agrochemical on Beneficial Organisms on the Environment

Severity of the effects (n=271)	Frequency	Percentage
Not harmful	48	17.7
Slightly harmful	98	36.2
Moderately harmful	81	29.9
Extremely harmful	44	16.2

Source: Field Survey, 2021

Perception of the respondents on the effects of agrochemicals on the environment

The result in Table 6, shows the respondents' perception on the effects of agrochemicals to the environment. The results depict that less than half (44.3%) of the respondents perceived agro-chemicals had effects on non-target organism while 41.1%, 39.5% and 36.2% perceived it to be source of contamination of food, contribute to air pollution and destruction of the ozone layer respectively. The result from the Table 6 further reveal that, the respondents in the study area perceived that agrochemicals destroy beneficial soil organisms and decrease in biodiversity constituting 22.5% and 8.1%, respectively. Excessive use of fertilizers, for example, can lead to the contamination of groundwater with nitrate, rendering it unfit for consumption by humans or livestock (Singh *et al.*, 2004). Consequential health-related problems Farmers' may be exposed to include redness and tearing of the eye, body itching, cough, body pains, and headache (Ogunjimi and Farinde, 2012).

According to Laary (2012), some farmers who do not usually protect themselves are unaware of the dangers of exposure during handling, formulation, and application of Agrochemicals. However, Users need to wear additional protective equipment as recommended by the label of a chemical such as chemical-resistant gloves, goggles, and/or face shield and an approved respirator (CFSPH, 2010). Matanmi *et al.* (2015), also reported that, 65.0% of the farmers experience crop injuries as the major effect of the use of agro chemicals, 13.33% indicated that agrochemicals cause environmental pollution, while 12.50% and 9.17% opined that skin irritation and soil degradation respectively emanates from the use of agrochemicals. The effective use of herbicides depends to a great extent on how they are applied. More so, much of the equipment used in developing countries is poor and some designs have proved unsuitable for use (Peter, 2012). Ogunjimi and Farinde (2012) also reported that, 13.33% of the respondents reveal that agrochemicals causes environmental pollution, while 12.50% and 9.17% opined that skin soil degradation emanates from the use of agrochemicals



Table 6: Distribution of Respondents Based on their Perception on the Effects of Agrochemicals to the Environment

Variable (n=271)	Frequency	Percentage*
Destroy soil organisms	45	16.6
Decrease biodiversity	22	8.1
Contribute to air pollution	98	36.2
Pollute river and stream	111	41.0
Harmful to non-target organism	120	44.3
Destroy ozone layer	61	22.5
Contamination of food	107	39.5

Source: Field Survey, 2021

*Multiple response

Constraints to the Use of Agrochemicals by the Respondents

Table 7 revealed the respondents' constraints to effective use of agrochemicals in the study area. The results reveal that majority (86.3%) of the respondents were distracted with the high cost of the agrochemicals followed by 70.1% and 53.5% lack of support from government unpleasant odour of the agrochemicals which were ranked 1st 2nd and 3rd respectively. The results also show inadequate extension contacts (46.9%), inadequate training on agrochemicals usage (46.1%), lack of technical knowledge (42.4%), and inadequate knowledge of the effects of the agro-chemicals (40.2%) were ranked 4th, 5th, 6th and 7th respectively. The findings agreed with that of Issa *et al.* (2015), they reported that there is widespread recognition that farmers misuse agrochemicals while protecting crops from incidences of pests, diseases, and weeds. This could be because many crop farmers are inadequately informed about the potential short and long-term risks, and the necessary precautions in the correct application of such toxic chemicals. In addition, other constraints to utilization of agrochemicals were inadequate access to capital (35.8%), health hazard associated with the agrochemicals (29.5%) and irritation from agrochemicals spills (28.8%) while spraying which were ranked 8th, 9th and 10th respectively. This finding is similar to the report of Sosan and Akingbohunge (2009) that in some situation, exposure to pesticides can occur from accidental spills of chemicals, leakages or faulty spraying equipment). Similarly, according to Sani *et al.* (2011), farmers that use agrochemicals were faced with problem of high cost of agrochemicals, sales of expired agrochemicals, not giving the right information and those without any problem.

Other respondents conceived misinformation from agrochemicals dealers (27.7%), poor timing of application (22.5%), complexity of application equipment (13.3%), scarcity of some selected agrochemicals (7.7%) and adulteration (0.4%) which were ranked 11th, 12th, 13th, 14th and 15th, respectively. This is in line with the report of Habib (2019), who reported that, the constraint faced by the farmers in using agrochemicals, 44.2% of the respondents had inadequate access to capital in purchasing agrochemicals. 20.83% indicated inadequate technical knowhow, 18.33% admits lack of safety measure as a constraint, and 12.50% claimed agrochemicals are not always available while 4.17% complained of poor extension services

Furthermore, Nwakile *et al.* (2020) in a research titled "farmers' perception on the use of agrochemicals in crop production in Nsukka, Enugu State" uses mean ratings and standard deviation to measure item statement of the constraints of responses of respondents on the constraint to effective utilization of agrochemicals in crop production such as high cost of pesticide, cost of procuring agrochemical spraying implement such as knapsack sprayer, complexity of user's manual, misguiding information from agrochemical dealers, health hazards associated with misuse of agrochemicals, irritation from agrochemical spills, unpleasant odour of most agrochemicals, complexity of application equipment, misconception



on the efficacy of agrochemicals. Most agrochemicals in the markets are expired and Unavailability of instrument for measuring the quantity of agrochemicals to be utilized.

Table 7: Distribution of Respondents Based on their Constraints to the use of Agrochemicals

Constraints (n=271)	Frequency	Percentage*	Ranking
High cost of agrochemicals	234	86.3	1 st
Lack of support from government	190	70.1	2 nd
Unpleasant odour of agrochemicals	145	53.5	3 rd
Inadequate extension contacts	127	46.9	4 th
Inadequate training	125	46.1	5 th
Lack of technical knowledge	115	42.4	6 th
Lack of awareness on the effects of agrochemicals	109	40.2	7 th
Inadequate access to capital	97	35.8	8 th
Health hazard associated with agrochemicals	80	29.5	9 th
Irritation from agrochemical spills	78	28.8	10 th
Misinformation from agrochemical dealers	75	27.7	11 th
Poor timing of application	61	22.5	12 th
Complexity of application equipment	36	13.3	13 th
Scarcity of some agrochemicals	21	7.7	14 th
Adulteration	1	0.4	15 th

Source: Field Survey, 2021

*Multiple response

CONCLUSION AND RECOMMENDATIONS

Based on the finding of the study, it was concluded that, farmers in the study area perceived that agrochemicals have effects on human health and the environment. It is therefore recommended that, Research institutes and extension agencies should provide information on research-based Recommended Agrochemical Practices to the farmers, dealers of agrochemicals should give the right information about agrochemicals which will help educate farmers on the benefits associated with the right use of agrochemicals on rice production, stakeholders such as agro-industries, growers, dealers of agrochemicals and policy makers to sensitize the rural farmers and equipped them with the right information on agrochemicals, farmers must get acquainted with the correct application of registered agrochemicals for use and ensure that all safety measures are strictly adhered to, farmers should be encouraged to form cooperative in order to pool resources together to solve the problems high cost of agrochemicals, training on agrochemicals usage should be enforced on all farmers so as to curb the its hazardous effects on health and environment, farmers should use agrochemicals, especially pesticides should be used as per the instructions on the label, extension agents should provide information to the rice farmers on the different types of agrochemicals available for rice production through the use of mass media and farm visits, government and other financial institutions should provide credit facilities to crop farmers at low interest rate which could be in form of loans, government should ensure that agrochemical sellers sell only original products that have not expired by inspecting the imported agrochemicals regularly and finally government should make agricultural input available and affordable to the farmers through subsidy.



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