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Factors Influencing Herbicide Usage in Kebbi State, Nigeria

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ABSTRACT

This research work assessed the factors influencing herbicides usage in Kebbi State, Nigeria. A multi-stage sampling technique was used to select three hundred and forty (340) farmers who use herbicides and 340 non-users of herbicides in the study area. Primary data were collected using structured questionnaire. Text books, journals and other conference materials were used as reference materials for the study. Data collected were analyzed using descriptive statistics such as frequency distribution, percentage and mean. Similarly inferential statistics involving binary logistic regression analysis was also used for data analysis. The result revealed that majority (58.8%) of the respondents were within the age range of 40 – 49 years. Majority (73.5%) of the respondents were males. Majority (60.2%) of the respondents had non-formal education, followed by (26.5%) of them who had Qur'anic education, (7.4%) had primary education, Majority (58.5%) of the respondent had farm size of 5 – 9 hectares. Majority (73.5%) of the respondents having an income level from farming between 50,000 -150,000. 16.2% had 270,000 – 370,000 as their source of income from farming, 7.4% had income level from farming between 380,000 – 480,000. Majority (73.5%) of the respondents had trading as other sources of income. 16.2% had fishing as their other source of income, 7.4% had mining as their other source of income. Majority (59.4%) had 16 – 20 years of farming experience. Results of binary Logistic Regression Analysis indicated pseudo R^2 – values of 0.99, implying that 99% change in farmers who use herbicides was explained by Independent Variables (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8 and X_9) included in the equation. From the finding of the study, the research work concluded that most farmers in the study area were unaware of the health effect of herbicides and therefore, recommended that farmers in the study area should be educated on the health effect of herbicides and should be well trained on the appropriate use and application by the Government and NGOs.

Key words: Factors, Herbicide Usage, Health effect, Kebbi State, Nigeria

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INTRODUCTION

Herbicides are extensively used in modern agriculture and are effective and economical way to enhance the yield quality and quantity, thus ensuring food security for the ever growing population around the globe. Approximately, two million tons of herbicides are utilized annually worldwide, where China is the major contributing country followed by the United States of America and Argentina, which is increasing rapidly (Robbins, 2019). However, by the year 2023, the global herbicides usage has been estimated to increase up to 3.5 million tones. Although herbicides are beneficial for crop production point of view, extensive use of herbicides can possess serious consequences because of their bio-magnification and persistent nature. Diverse herbicides directly or indirectly polluted air, water and soil over all eco-system which cause serious health hazard for living being (Vats, 2015).

In the last half of the nineteenth century, robust growth in the world economy including both industrial and agricultural sectors has led to progressive amount in the generation and utilization of agricultural based chemicals which often induce calamitous effects on the environment (Andrew, 2011). The economy of Africa is largely dependent on agriculture and nearly 59% of the population makes their living from farming (Robert, 2017). Despite that African continent has a contribution of 2-4% of global market share of herbicides which also account for the lowest rate of the usage in the world due to increasing population, the food demand has been projected to enhance at a decade and thus, demand of herbicides is also likely to enhance in Africa. Lack of knowledge about the usage of herbicides has led to inappropriate usage of herbicides which fall under World Health Organization risk classification system. According to herbicides risk reduction program (Zhou, 2017). In Ethiopia alone out of 302 registered herbicides, 160 contained active ingredients which were classified as World Health Organization class ii chemicals (moderately and hazardous). Nigeria has established that majority ofthe farmers (78%) use monocrotophos which comes under World Health Organization class iii chemical (slightly hazardous). And Lindane, copper sulfate and paraquat which are into class ii chemicals. Nigrenda *et al.*, (2016) reports the use of monocrotophos (1b) by 41% farmer in Zambia while in Malawi parathion, a World Health Organization class in herbicides (extremely hazardous) is used over 25% farmers (Moran, 2015).

Weed or unwanted plant have been serious enemies of desired plant resulting to a significant decrease in yield, and have negative effects by virtue of competition for nutrients and space. Weed management in most settings has become largely dependent on herbicides because of their high level of efficiency and relatively low cost compared with other weed control technologies. As a result they represent a major portion of the pesticides used world -wide. (Robert, 2017). There are hundreds of herbicides formulated into thousands of commercial products throughout the world. The herbicides active ingredients that are found in different countries are variable because of different regulatory economic, agricultural constraints (Vats, 2015).

Statement of the Research Problem

Weeds are plants growing in a wrong place at a wrong time. They have been known to compete with crop plants for space, light, moisture, air and nutrients, they equally reduce crop yield thereby increasing cost of production. Herbicides are the modern means of weed control used mostly in agricultural land and ecosystems to reduce the density of weeds and promote the growth of desirable species. Herbicides control weeds very effectively even under the situations where manual mechanical methods are not applicable. For example

manual or mechanical weeding is delayed in wet soil, but herbicides could effectively be used for the control. Herbicides also reduce the cost and drudgery in weed control (Smith, 2018).
A lot of studies have been reported on the use of herbicides in Nigeria such as effects of herbicide on plant growth, (Anthony, 2016) effects of herbicide rate of application on cowpea yield (Obinna, 2018) assessment of farmers knowledge on the effects of herbicide applications in northern Nigeria among others (Peter, 2019).

Despite these economic and physical advantages, herbicides application has some adverse effects on wildlife, microbial population, human health and environment. Herbicides may cause phytotexicity in crop plants. Cropphytotexicity is often caused due to improper application of the right herbicides. Health hazard associated with herbicides application is caused due to spillage, leakage from spray tanks, splashes during mixing and loading, dermal absorption by soaking from clothes and inhaleting droplets. Many herbicide applicators experience headache, dizziness, skin irritation, skin rashes, vomiting, nail damage, nose bleeding and eye irritation. Generally health hazards occurs where the applicator do not follow the safety rules due to ignorance about the potential hazards and also due to indiscriminate herbicides usages (Anthony, 2016). Hence awareness of herbicides health effect is what the study intends to address.

Objectives of the Study

The general objective of the study is to assess factors influencing the usage of herbicides, in Kebbi state, Nigeria. The specific objectives are to;

1. Describe the socio-economic characteristics of the farmers in the study area.
2. Determine the factors affecting the use of herbicides in the study area

METHODOLOGY

Study Area

Kebbi State is located between latitude 10^0 $10^{'}$ to 13^0 $15^{'}$N and longitude 30^0 $30^{'}$ to 60^0 35'E covering an area of about 37, 699 Square Kilometers. The state is situated in the North-western part of Nigeria. It shares boundary with Sokoto State in the North and in the East, Zamfara State, and while in the south Niger State. The study area also shares boarder with other countries like Benin Republic and the republic of Niger. The state comprises of four administrative Emirates (Argungu, Gwandu, Yauri and Zuru) with twenty-one (21) local government areas. The projected population of the area based on 2006 is 4,440,000 people (NPC, 2023). The dominant tribes found in the state are Hausa-Fulani, Lelna (Dakkarkari), Kabawa and Kambari. Othernon – indigenous cultural and linguistic groups are Yorubas, Igbos, Nupes, Tivs and Idomaetc (Ahmed, 2021).

The vegetation of the area is (Savannah Sudan, Sahel and Northern guinea savannah) agro-ecological zones. The area is characterized by tall scattered trees and shrubs usually deciduous in nature and grasses which are greenish in the rainy-season but dried and dumped in the dried season. The major products found in the vegetation include timber and non-timber products. The non-timber forest products are fuel wood, honey, tree gums, chew-stick, spiked, ropes, insects, mushrooms, bush meats, snail, herbs, fruit, fishes, and other bee products (Dudu, 2014)

The geology of Kebbi State is characterized by thick and vast sequences of sedimentary deposits. The rest being underlain by Precambrian basement complex rocks. The predominant soil types of the area are the ferruginous tropical soil. Their main features include a sandy surface horizon underlain by weakly developed clay mottled and sometimes concreting sub soil. The sandy top soil is easily washed away by rainwater and wind. The

soil shows low water holding capacity and is therefore susceptible to drought (Ahmed, 2021).

The area is blessed with favorable climatic condition for vast agricultural production. The mean annual rainfall varies significantly from the Northern part to Southern part of the state, with 733mm and 1045mm respectively. Total number of rain days also varies from the north to the south by 50days and 80days respectively. The wet season start from May/June to September/October with heaviest rainfall mostly experience in August (Dudu, 2014)

Majority of the people in the area engaged in farming, fishing, gathering and trading within and outside the state, focusing for agricultural and other goods. Most farmers are peasant who engaged in the cultivation of various types of food and cash crops, ranging from rice, wheat, onion, sugarcane, cowpea, soybeans and other vegetables such as tomato, pepper, spinach, and soon. Farm animals such as cattle, sheep, goat, donkey, camel and poultry birds are equally managed in the area (Ahmed, 2021)

The cultural activities of the area include:

Argungu fishing and cultural festival, Rigatta festival and Uhola festival. In addition, Kanta museum atArgungu, the tomb of Sheik Abdullahi Fodiyo (Hubbare) at Gwandu, Girmache Shrine at Zuru provide important tourist attraction sites in the area (Sami, 2015)

Sampling Procedure and Sample Size

Multi-stage sampling technique was used for this study. First stage involved dividing the state into four (4) Agricultural Development Projects (ADPs) namely: Argungu, Bunza, Yauri and Zuru. Second stage involved selections of two (2) Local Government Areas from each of the selected ADP zones with a total of eight (8) Local Government Areas. Third stage involved selection of two (2) villages from each of the selected Local Government Area given a total number of sixteen (16) villages. The fourth stage involved proportionate and random selection of 340 users and 340 non-users of herbicide in the study area.

Table 1: Sampling Procedures and Sample Size

State	Agric Zones	LGA	Villages	No. of users Respondents	No. of non-users Respondents
Kebbi	Argungu	Argungu	Gulma	22	22
			Alwasa	20	20
		Dandi	Kamba	24	24
			Fana	18	18
	Bunza	Bunza	Bunza	25	25
			Raha	17	17
		Suru	Suru	22	22
			Dakin-gari	21	21
	Yauri	Yauri	Tonditsamiya	25	25
			Sami naka	19	19
		Shanga	Shanga	21	21
			Gironmasa	19	19
	Zuru	Zuru	Dabai	22	22
			Manga	25	25
		Fakai	Fakai	24	24
			Yawo	16	16
Total	**4**	**8**	**16**	**340**	**340**

Source: - Field Survey, 2023.

Data Collection Procedure

The instrument of data collection for this research was a structured questionnaire. A structured questionnaire containing both open and close ended questions was employed for collection of primary data from the farmers in the study area. Information collected included, socio-economic characteristics of the farmers, problems associated with herbicides usage, and selected socio-economic characteristics affecting the use of herbicides, while secondary data were obtained from Textbooks, Journals, Technical reports, Conference proceeding, among others.

Data Analysis Procedure

Both descriptive and inferential statistics were used for the study. Descriptive statistics were used to achieve objective 1, while Binary logistic regression analysis was used to achieve objective 2.

Model Specification

Binary Logistic Regression Analysis Model

Binary logistic regression analysis is a statistical tool used to predict a data value based on prior observations in a set of data. It is presented as: Yi = (Xi *E*i).

Where;

Yi = dependent variable farmers who used herbicides and non-users in the study area.

Xi = Matrix of explanatory variables related to the use of herbicides. (Independent variable)

ßik = is the vector of parameters to be estimated and

*E*i = is the error term with a logistic distribution. (a= 0.05)

Y = (1 for users of herbicides and 0, otherwise)

$X_{.1}$= Years of farming experience (years)

X_2 = Age (years)

X_3 = Gender (1 for male, 0 for female)

X_4= Source of income from farming (Naira)

X_5= Educational status (Years Spent in School)

X_6= Size of farmland (Hactre)

X_7= Trading as other source of income

X_8 = Cost of Herbicides in the market (Naira)

X_9 = Quantity of output produced (kg)

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

Table 2: Socio-economic- characteristics of respondents

Characteristics	Frequency	Percentage	Mean
Age-range (Years)			
20 – 29	20	5.9	
30 – 39	35	10.3	
40 – 49	200	58.8	44.50
50 – 59	60	17.6	
60 years and above	25	7.4	
Gender			
Male	250	73.5	
Female	90	26.5	
Educational Level			
Primary Education	25	7.4	
Secondary Education	15	4.4	
Tertiary Education	5	1.5	
Qur'anic Education	90	26.5	
Non-Formal Education	205	60.2	
Farm Size			
1 – 4 ha	20	5.9	
5 – 9 ha	199	58.5	7.00
10 – 14 ha	51	15.0	
15 ha and above	70	20.6	
Income Level from Farming (₦)			
50,000 – 150,000	250	73.5	100,000
160,000 – 260,000	5	1.4	
270,000 – 370,000	55	16.2	
380,000 – 480,000	25	7.4	
490,000 and above	5	1.5	
Other Sources of Incomes (₦)			
Besides Farming			
Trading	250	73.5	
Civil Service	5	1.4	
Fishing	55	16.2	
Mining	25	7.4	
Technician	5	1.5	
Years of Farming Experience			
1 – 5 years	10	2.9	
6 – 10 years	50	14.7	
11 – 15 years	40	11.8	
16 – 20 years	202	59.4	18.00
21 years and above	38	11.2	
Total	**340**	**100.0**	

Source: Field Survey, 2023

Age of the Respondent

Table 2 Revealed that a good number (58.8%) of the respondents were within the age range of 40 – 49 years, followed by 17.6% of them who fall within the age range of 50 – 59 years. 10.3% of the respondents fall within the age range of 30 – 39 years, 7.4% were 60 years and above and only 5.9% of them were within the age range of 20 – 29 years. This implies that

majority of the respondents were in their active stage and could be more productive than the age farmers. This finding agreed with that of Smith (2018) who reported that majority of the peasant farmers in Sub-Saharan Africa were within the age range of 40 – 49 years and it is within this range that majority of them falls in to the productive sector of the economy.

Gender of the Respondents

The same table revealed that majority (73.5%) of the respondents were males and only 26.5% of them were females. This implies that majority of the respondents were males, indicating the predominant nature of the people of the area, where values and believes restricts women from participating in some farming activities was in line with that of Smith (2018) who reported that, majority of the farmers in Sub-Saharan Africa were males with little participation of women in some farming activities.

Educational Level of Respondents

Results on educational status of the respondents indicated that majority (60.2%) of the respondents had non-formal education, followed by 26.5% of them who had Qur'anic education, 7.4% of the respondent had primary education and 4.4% of the respondents had secondary education only 1.5% of the respondents had tertiary education (Table 4.1). This implies that respondents had one form of education or the other. This finding disagreed with that of Andrew (2011) who reported that majority of the farmers in West Africa were illiterates with few of them having adult education.

Farm Size of the Respondents

Table 2 equally revealed that a good number (58.5%) of the respondents had farm size between 5 – 9 hectares, followed by 20.6% of the respondents with 15 hectares and above, 15.0% of the respondents had 10 – 14 hectares and only 5.9% of them had 1 – 4 hectares of land. This implies that majority of the respondents had 5 and above hectares of farm land, indicating their commitment in farming. This result agreed with that of Robbins (2019) who reported that the most common occupation in Sub-Saharan African is farming and the farmers had between 5 -20 hectares.

Income Level from Farming of Respondents

Table 2 also revealed that majority (73.5%) of the respondents had ₦50, 000 – ₦150, 000 as their income level from farming, followed by 16.2% of the respondents who had ₦270, 000 – ₦370, 000 as their income level from farming. 7.4% of the respondents had ₦380, 000 – ₦480, 000. 1.5% of the respondents had ₦490, 000 and above and only 1.4% of the respondents had ₦160, 000 – ₦260, 000. This implies that majority of the respondents had income level from farming between ₦50,000 – ₦150,000indicating that farming serves as good source of incomes to farmers. The result, therefore coincides with that of Robins (2019) who reported that majority of the farmers in West African had income level between ₦50, 000 – ₦500,000.

Other Sources of Incomes besides Farming

Table 2 also shows that majority (73.5%) of the respondents had trading as other sources of incomes, followed by 16.2% of the respondents who had fishing as their other sources of incomes. 7.4% of the respondents had mining as other sources of incomes. 1.5% of the respondents are technicians as their other sources of incomes and also 1.4% of them had civil service as their other sources of incomes. This implies that farmers in the study area do not only relied on farming as the only source of income but equally engaged in other economic

activities. This result disagreed with that of Vats (2015) who reported that in West Africa majority of the farmers relied only on farming as their only sources of incomes.

Years of Farming Experience of Respondents

Result on years of farming experience of the respondents revealed that a good number (59.4%) of the respondents had 16 – 20 years of farming experience. 14.7% of the respondents had 6 – 10 years of farming experience. 11.8% of respondents had 11 – 15 years of farming experience, 11.2% of respondents had 21 years and above of farming experience and only 2.9% of them had 1 – 5 years of farming experience (Table 2). This implies that majority of the respondents were old farmers indicating that they have been in to farming for many years. This finding agreed with that of Robbins (2019) who reported that majority of African farmers were old farmers with many years of farming experience.

Table 3: Binary Logistic Regression Analysis on factors affecting the used of herbicides in the study area

Variables	Parameters	Coefficients	Std. Error	P. Value
Constant	X_0	-23.211	5500.511	-0.0042
Years of farming experience	X_1	-22.310	4559.296	-0.0048**
Age	X_2	0.001	0.280	0.0035**
Gender	X_3	6.020	1933.553	0.0031**
Source of income from farming	X_4	0.731	3553.21	0.0002***
Educational status	X_5	1.032	1816.34	0.0005***
Size of farm	X_6	5.311	1402.11	0.0037**
Trading as other source of income	X_7	0.213	4120.211	0.00005***
Cost of herbicides	X_8	-19.10	4110.320	-0.0046**
Quantity of output	X_9	21.11	3240.421	0.0065**
R^2 – Values		0.99		

Source: Field Survey, 2023 **NOTE:** P value with three aesteries 1%, two 5% and 1 aestery 10%

The econometric method was used in establishing relationship between dependent variable Y (Farmers who use herbicides and non-users of herbicides) and independent variable (Years of farming experience of the respondents (X_1), Age of the respondents (X_2), gender of the respondents (X_3), Source of income from farming of the respondents (X_4), Educational Level of respondents (X_5), farm size of the respondents (X_6), trading as other sources of income of the respondent (X_7), cost of herbicides (X_8) and quantity of output produce (X_9). In binary logistic regression analysis was pseudo R^2 – Values of 0.99 implying that 99% change in farmers who use herbicides was explained by the independent variables included in the equation.

Logistic regression coefficients with respect to years of farming experience of the farmers was negative and statistically significant at 5% Level, implying that increase in years of farming experience of farmer by one unit, holding other inputs constant would lead to decrease in herbicides use of the farmer by -22.310 (Table 3).

Logistic regression co-efficient with respect to age of the respondents was positive and statistically significant at 5% level. Implying that one unit change in age of the respondents holding other input constant would lead to increase in the use of herbicides by 0.001 (Table 3).

More also, logistic regression co-efficient with respect to gender of the respondents was positive and statistically significant at 5% level, implying that one unit change in gender of the respondents holding other inputs constant would lead to increase in use of herbicides in the study area by 6.020 (Table 3).

Logistic regression co-efficient with respect to source of income from farming of the respondents was positive and statistically significant at 1% level. Implying that increase in income of the respondents from farming by one unit holding other inputs constant would lead to increase in the used of herbicides by 0.731

Logistic regression co-efficient with respect to educational status of the respondents was positive and statistically significant at 1% level. Implying that, increase in educational level of the respondents holding other inputs constant would lead to increase in farmers awareness on health effect of herbicides application by 1.032 (Table 3).

Logistic regression co-efficient with respect to farm size of the respondents was positive and statistically significant at 5% level. Implying that increase in farm size of the respondents by one unit holding other input constant would lead to increase in the use of herbicides by 5.311 (Table 3).

Logistic regression co-efficient with respect to trading as other source of income of the respondents was positive and statistically significant at 1% level. Indicating, that increase in other sources of income of the respondent by 1 unit holding other inputs constant would lead to increase in the use of herbicides by 0.213

Logistic regression co-efficient with respect to cost of herbicide in the market was negative and statistically significant at 5% level. Implying that increase in the cost of herbicides by one unit holding other inputs constant would lead to decrease in the use of herbicides by -19.10

So, also logistic regression co-efficient with respect to quantity of outputs produced by farmers was positives and statistically significant at 5% level indicating that increase in output produced by farmers by 1 unit holding other inputs constant would lead to increase in the use of herbicides by 21.11.

CONCLUSION AND RECOMMENDATIONS

Conclusion

From the findings of the study, the research work concluded that most farmers who used herbicides in the study area are unaware of the health effect of herbicides application and they equally lack the technical knowledge and inappropriate application training techniques of herbicides usage for the safety of their own health within the study area.

Recommendations

Base on conclusion of the study the research work recommended that:

i. Farmers should be sensitized through training on proper use of herbicides and application.
ii. Farmers should be made to focus on organic farming as this will help to reduce the risk of chemical residues on food and farm produce by the government and NGOs.
iii. Farmers should be encouraged to use protective equipment's, /gear during spraying of herbicides by the government and NGOs.

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