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Determinants of farmers' responses on Agrochemical Usage in Ikwerre local Government Area of Rivers state, Nigeria

Unaeze, H.C.[1] and Kamalu O.J.[2]

1. Department of Agricultural economics and extension, faculty of Agriculture, University of Port Harcourt, Rivers State, Nigeria.
2. Department of Crop and Soil science, faculty of Agriculture, University of Port Harcourt, Rivers State, Nigeria.

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***Corresponding Author**
Unaeze, H.C
E-mail: *henry.unaeze@uniport.edu.ng*

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ABSTRACT

This study examined farmers' responses on agrochemical usage in Ikwerre local Government area of Rivers State, Nigeria. Multi-stage sampling techniques were used in the selection of 49 respondents. The data obtained were analyzed with percentages and probit regression model. The result obtained revealed that the mean age of farmers was 34 years and their mean farming experience was (10 years) while (77.6%) attested that the effects of agrochemical usage on their farming activities were positive. The probit regression result ascertained that years in schooling (-0.036338), income status (-7.72E-06) and household size (-0.047561) were all statistically negative to respondents probability of responding to agrochemical usage. It was only years in farming (0.023442) and farm sizes (0.831243) that were statistically positive to respondents' probability of responding to agrochemical usage. Lack of income to purchase agrochemicals coupled with minimal tillage due to soil type were their major problems. Also it was observed that the soil properties showed that the soils are inherently poor in fertility and therefore needs liberal application of fertilizers. Therefore extension agents should create awareness on the usage of fertilizers and agrochemicals input resources. Government should also assist farmers by granting credits to them.

BACKGROUND INFORMATION

The challenge for developing countries agriculture is enormous, particularly if it is not only to satisfy the growing demand/supply gap for food, but also help reduce poverty, malnutrition, and do it in an environmentally sustainable farming. Sustainable farming is the farming system that is closest to natural process, minimizes waste, does less damage to the environment and yet it's still profitable. When farming system is sustainable, the product of the farm will be nutritious, and not contaminated by substance that maybe unsafe for humans to consume. Also sustainable farming systems are set in order to maximize advantage of the existing soil nutrients, soil organisms, energy flow and water cycles, (Eap.mcgill.ca, 1989). These systems are made to be responsive to our environment and ecosystem. It is a known fact that the use of hazardous pesticides i.e. organophosphates, synthetic compound fertilizers and additive to farm animal feeds has been responsible for the prospective damage to the environment, humans and animal health. (Than, 2013). For example organophosphates is a common pesticide used and it was blamed for killing 25 children in India (Than, 2013), while in Rivers State, Nigeria due to presence of oil companies and other chemical companies, lots of waste in form of effluents are generated, polluting rivers, water bodies wetlands and environments. It is a known fact that Port Harcourt has the highest Suspended Particulate Matter (SPM) load and contaminants in the whole of the Niger-Delta, which can be associated with anthropogenic activities like oil exploration, gas flaring, construction and other industrial activities. The resultant deterioration in both the air and soil quality is big concerns to the residents due to contamination of drinking and domestic water resulting to death to the exposed population and farmers. Farming is categorized by its ecological, responses and procedure aspects.

Though farmers' behavioral and government's policy dimensions of agriculture has been rigorously analyzed in the past, while their responses and ecological dimensions are largely neglected and remains unclear despite the fact that these two factors are the pre-requisite for sustainability. Therefore farmers' responses on environmental impacts of modern agrochemical technology becomes pertinent as their views are supposed to contain goals including those achieved and those yet to be achieved and, therefore, looked upon as a guiding concept of behavior or decision-making process.(1) At this point, it becomes pertinent to state the objectives of the study as follows:

1. examine the socio-economic characteristics of farmers in the study area
2. determine farmers' responses on the effects of agro chemical usage in the study area
3. determine the effect of farmers' socio-economic characteristics on agro chemical usage in the study area.
4. assess the nutrient status of the soils and level of agrochemical usage in the study area
5. examine constraints encountered by farmers in the study area

MATERIALS AND METHODS

The study was carried out in Ikwerre Local Government Area of Rivers State. Ikwerre Local Government is one of the twenty three Local Government Areas of Rivers State. It is located North-West of Port Harcourt and lies between $4^0$58'33''North, $6^0$53'21''East and has a population of 188,930 people (National population Census 2006).The Local Government is made up of twelve communities namely; Rumuekpe, Elele Alimini, Obelle, Omudioga, Elele, Egbeda, Rukpokwu, Aluu, Igwuruta, Eneka, Isiokpko. Ikwerre Local Government Area lies on latitude 4^0 65 North and longitude 5^0 to 7^0 12 East. (National Population Census, 2006). It has it's headquarter at Isiokpo. The major language is Ikwerre language. The major occupation of the people is farming.

RESULT AND DISCUSSIONS

Socio-Economic Characteristics of Respondents in the Study Area

From table1 below, fifty-three percent (53%) of the respondents are female while 47% are male signifying that female gender dominates in the farming activities in the area. The age distribution of the respondents divulged that most respondents' fall within the age range of 25-54years with mean age of 34years which shows that the respondents are in their active age. Most of respondents are married and had spent 12 years in formal schooling. Also 71.4% of the respondents stated strongly that they have been in the farming business for a period of 1-10 years, while majority (71.4%) cultivates on 0.05-0.09ha of land, while (66.7%) had income range of ₦200,000-₦400,000.

Table 1: Distribution of respondents according to their socio-economic characteristics.

VARIABLES	FREQUENCY	MEAN	PERCENTAGE
Male	23		47.0
Female	26		53.0
Total	**49**		**100**
Age			
0-14	3		6.1
15-24	17		34.7
25-54	21		42.9
55-64	6	34 years	12.2
65 and above	2		4.1
Total	**49**		**100**
Marital Status			
Single	19		38.8
Married	20		40.8
Separated	4		8.1
Divorced	2		4.1
Widowed	4		8.1
Total	**49**		**100**
Level of Education			
0	3		6.1
6	19		38.8
12	21		42.9
16	6		12.2
Total	**49**		**100**
Years of Experience			
1-10	35		71.4
11-20	8		16.3
21-30	4	10 years	8.2
31-40	2		4.1
Total	**49**		**100**
Farm size			
0.05-0.09ha	35		71.4
0.10-0.11ha	3		6.1
>1ha	11		22.4
Total	**49**		**100**
Income Status (₦)			
200,000 – 400,000	44		66.7
500,000 – 700,000	3		5
Above 1,000,000	2		3.3
Total	**49**		**100**

Source: Field Survey Data, 2018.

Farmers' response on the effects of agro chemical usage in the study area

Looking at Table 2 below, majority (77.6%) of farmers strongly attest that the effects of agrochemical usage on their farming activities were positive. It was observed that their responses were based on the facts that majority are subsistence farmers who do not always apply agrochemical on their farming activities. So the little they apply do not have detrimental effects on their farming operations. Only 16.3% accepted that agrochemical usage has negative effects. This was based on the fact that they are commercial producers, which gave rise to continuous usage of agrochemicals on their farming operations. These farmers cultivate mainly vegetables for commercial purposes. Those farmers (6.1%) who emphasized average effects mildly apply agrochemicals on their farming activities. They are mainly peasant farmers who produce for home consumption.

Table 2: Distribution of Farmers' Responses on the Effects of Agrochemical usage in the Study Area.

Responses	Frequency	Percentage
Positive	38	77.6
Negative	8	16.3
Average	3	6.1
Total	49	100

Source: Field Survey, 2019

Effect of farmers' socio-economic characteristics on the responses of agro chemical usage in the study area.

A priori is that coefficients of x(x>0) from the probit regression results, years respondents spent in schooling (-0.036338) was found to be negatively correlated to the probability of their responding to the usage of agrochemicals. The result is not counter intuitive since most of the respondents level of education is low, making them, not to understand the consequences of agrochemical usage in their farming operations. Income status of respondents (-7.72E-06) are equally negatively correlated to the probability of respondents responses to agrochemical usage in their farming operations. This was based on the fact that farmer's level of investment to climate change adaptation and mitigation strategies was low because of inadequate income. This supports the finding of Enete and Achike (2013) that farmers are poor in adapting to climate change. But on the issues that relates to their years in farming experience (0.023442) was positively related to their probability of responding to agrochemical usage in their farming activities. This result depicts that the more the number of years farmers spent in farming with agrochemical usage, the more knowledgeable they will be in understanding their effects. Household size (-0.047561) was found to be negatively related to the probability of respondents' responses to agrochemical usage in agricultural activities. This result has shown that respondent's average household size were low and it buttresses the findings of Croppenstedt et al., (2003) who argued that households with larger pool of labor are more likely to cultivate more areas of land as well as adapt more to climate change. This has shown that households with large families are more likely to adapt to climate change and respond more to agrochemical usage. Finally, farm size (0.831243) was positively correlated with the probability of responding to agrochemical usage in their farming activities. This study has revealed that as farm size increases, the higher the probability of responding to agrochemical usage in farming activities in the study area.

Table 3: The result of probit analysis showing effects of farmers' socio-economic characteristics on the responses of agro chemical usage in the study area.

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.537080	0.932546	0.575928	0.5647
Years of schooling	-0.036338	0.068693	-0.528993	0.5968
Income status	-7.72E-06	8.96E-06	-0.861713	0.3888
Farming experience	0.023442	0.017073	1.373034	0.1697
Household size	-0.047561	0.099570	-0.477667	0.6329
Farm size	0.831243	1.086766	0.764877	0.4443

McFadden R-squared	0.067561	Mean dependent var	0.755102
S.D. dependent var	0.434483	S.E. of regression	0.442442
Akaike info criterion	1.283002	Sum squared resid	8.417458
Schwarz criterion	1.514653	Log likelihood	-25.43355
Hannan-Quinn criter.	1.370890	Deviance	50.86709
Restr. Deviance	54.55270	Restr. log likelihood	-27.27635
LR statistic	3.685609	Avg. log likelihood	-0.519052
Prob(LR statistic)	0.595507		

Obs with Dep=0	12	Total obs	49
Obs with Dep=1	37		

Dependent Variable: Y
Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)
Date: 09/18/18 Time: 10:30
Sample: 1 49
Included observations: 49
Convergence achieved after 4 iterations
Coefficient covariance computed using observed Hessian

Assess the Nutrient Status of the Soils and Level of Agrochemical Usage in the Study Area

The soils of the study area are generally referred to as acidic sands with a pH range of 5.3 – 6.6 and a predominant sandy texture. The soils have therefore been described as generally low to moderate in fertility status. In the soils nitrates ranged from 0.52 to 10.65mg/kg in the rainy season and from 1.96 – 15.60mg/kg in the dry season. Total Nitrogen levels in the area ranged from 0.06% to 0.24%. Available phosphorus, ranges from 4.17 to 24.56mg/kg. Sulphates ranged from 4.08 to 19.52mg/kg. The low values in some stations could have been caused by high nutrient mobilization. The generally low concentration has been attributed to the types of clay minerals in these soils and the dominance of oxides and hydroxides, which are known to fix phosphorus rendering it unavailable. The average available phosphorus levels are lower than the 10mg/kg reported for most 'acid soils' in south eastern Nigeria. The concentrations are also below the critical 15mg/kg required by most soils (Adepetu *et al*., 1979). The concentrations of exchangeable cations in the area as well as other members of the acid sands are low. Cation Exchange Capacity in the soils of the area ranged from 2.40 to 11.96mg/kg. Several authors have reported CEC values less than 5mg/kg for these soils, attributing the low concentration to both the predominantly sandy texture and the year round high rainfall and extreme leaching of the soils (Kamalu *et al., 2014*). The ranges of the exchangeable cations were 0.11 to 8.48mg/kg, 0.10 to 2.05mg/kg, 0.55 to 2.20mg/kg and 0.14 to 0.98mg/kg respectively for Sodium, Potassium, Calcium and Magnesium ions. The total exchangeable acidity was between 0.44 and 2.56mg/kg.

Table 4: Properties of Selected Surface Soils in Ikwerre local Government Area of Rivers State, Nigeria.

Sample Id.	pH	TOC	Total N	Avail. P	SO_4	Ca	Mg	K	Na	TEA	ECEC
			gkg^{-1}	mg/kg				$Cmolkg^{-1}$			
SS 1 (0 – 15cm)	6.0	11.0	0.45	17.1	10.2	0.34	0.27	0.71	0.78	1.16	3.26
(15 - 30 cm)	5.5	7.00	0.31	7.3	7.01	0.42	0.39	0.80	0.79	1.72	4.12
SS 2 (0 – 15cm)	5.4	11.20	0.44	10.3	17.3	0.36	0.41	0.82	0.89	0.83	3.31
(15 - 30 cm)	5.3	7.50	0.36	6.5	14.5	0.35	0.42	1.43	1.41	0.95	4.56
SS 3 (0 – 15cm)	5.4	15.00	0.39	10.3	18.1	0.37	0.40	1.40	1.32	0.99	4.48
(15 - 30 cm)	5.3	8.00	0.35	7.0	11.5	0.40	0.43	1.44	1.11	0.73	4.11
SS 4 (0 – 15cm)	5.4	17.30	0.40	14.2	21.3	0.38	0.26	0.81	1.23	2.60	5.28
(15 - 30 cm)	5.3	9.00	0.36	12.3	17.3	0.41	0.28	0.75	1.45	2.23	5.12
SS 5 (0 – 15cm)	5.4	19.00	0.39	11.5	24.5	0.34	0.35	0.79	1.35	2.29	5.12
(15 - 30 cm)	5.3	7.20	0.35	7.1	18.4	0.41	0.39	1.42	1.51	0.86	4.59
SS 6 (0 – 15cm)	5.7	11.00	0.43	17.0	19.8	0.36	0.36	1.28	1.28	2.00	5.28
(15 - 30 cm)	5.3	11.00	0.40	14.3	14.3	0.35	0.43	1.11	0.91	0.95	3.75
SS 7 (0 – 15cm)	6.4	11.10	0.45	16.3	23.5	0.38	0.29	1.36	0.78	1.72	4.53
(15 - 30 cm)	5.3	7.40	0.37	11.4	14.8	0.43	0.40	1.37	1.57	1.64	5.41
SS 8 (0 – 15cm)	6.5	11.20	0.40	10.4	21.8	0.51	0.43	1.25	1.42	1.77	5.38
(15 - 30 cm)	5.3	8.10	0.35	7.7	13.4	0.99	0.90	1.31	1.24	2.37	6.81
SS 9 (0 – 15cm)	6.0	11.40	0.42	13.9	24.2	0.80	0.89	1.40	1.51	2.11	6.71
(15 - 30 cm)	5.3	7.50	0.39	10.5	19.5	0.53	0.26	0.92	1.48	2.03	5.22
SS 10 (0 – 15cm)	5.9	11.10	0.41	15.7	17.8	0.97	0.93	1.22	1.44	2.14	6.70
(15 - 30 cm)	5.2	9.10	0.40	11.2	12.5	0.40	0.42	1.38	1.39	1.65	5.24
SS 11 (0 – 15cm)	6.6	11.50	0.44	18.1	19.9	0.63	0.38	1.28	1.47	2.35	6.11
(15 - 30 cm)	5.4	9.30	0.36	12.5	14.5	0.38	0.40	1.45	1.67	1.48	5.38
SS 12 (0 – 15cm)	5.4	11.10	0.40	10.3	18.1	0.60	0.68	0.84	1.23	1.18	4.53
(15 - 30 cm)	5.3	7.40	0.36	7.0	11.5	0.65	0.79	0.81	1.21	1.95	5.41
SS 13 (0 – 15cm)	5.7	11.20	0.39	14.2	21.3	0.68	0.71	1.63	1.49	1.14	5.65
(15 - 30 cm)	5.3	8.10	0.35	12.3	17.3	0.79	0.82	1.40	1.51	1.26	5.78
SS 14 (0 – 15cm)	6.4	11.40	0.43	11.5	24.5	0.91	0.78	1.42	1.63	2.47	7.21
(15 - 30 cm)	5.3	7.50	0.40	7.1	18.4	0.83	0.66	1.46	1.55	2.21	6.71
SS 15 (0 – 15cm)	6.5	11.10	0.45	17.0	19.8	0.65	0.58	1.25	1.51	1.24	5.23
(15 - 30 cm)	5.3	9.10	0.38	14.3	14.3	0.77	0.85	1.61	1.77	1.70	6.70

Source: Field Survey, 2019

Farming by the rural respondents in Ikwerre local government area, is extremely extractive and involves the use of very low inputs. Soil resources continuously decline with successive harvests that do not have commensurate import of nutrients into the system that are equivalent to what is removed from the soil system. This has resulted in an imbalance in soil fertility and low overall productivity of the soils. Agricultural production in the study area has been on the decline over the years. This is due to high level of insecurity and activities of oil exploration and oil spillages, which damages farm lands. Sustainable agricultural production in the area would necessitate greater input beyond the limit of organic farming, shifting cultivation and bush fallow that are practiced now. In this area, rural farmer uses fertilizers very indiscriminately. To 49 randomly selected farmers, about 45 (> 91%) just applied any fertilizer that was readily available and cheap irrespective of type and agreeability with soil properties. It is a common experience to see a farmer applying urea to an acidic soil whose pH is below 5. Scientifically, such fertilizers are counterproductive because they often enhance acidity and trigger off nutrient imbalance in the soil. This behavior was as a result of their low level of educational background, coupled with extremely low rate of application (less than 40% of conventionally recommended rates). It is important to note that under conventional background there is always an appropriate fertilizer rate for different crops under specific soil condition and inherent fertility of the soil. The common land preparation practices carried out by the respondents, for example, insistence bush burning

(inability to sustain the management of agro-based wastes).This method of land preparation also exposes the land to harsh impacts of the weather (with greater than eight months of heavy rains). Also the top soil continuously looses both organic matter and the finer particles through sheet erosion with the eventual dominance of the residual more sandy soil with adoption of minimum tillage or zero tillage. It was observed that in the study area, the most widely cultivated crop was cassava and the process of tuber formation and development in cassava requires plowed land. Though the area is situated in the acid sands that are dominantly sandy loam to loamy sand in texture and greater tuber formation are known to occur under improved tillage. It was observed that most of the respondents virtually plant cassava on the flat with minimal or near zero tillage. This actually lowers expected yield.

Constraints Encountered By the Respondents in the Study Area

Table 5 has shown that majority (33.6%) of the respondents complained that lack of income to purchase agrochemicals coupled with minimal tillage due to soil type were their major problems. These findings are in line with the findings of Enete, et al (2011) who asserted that incomes were positively and highly significantly related with the adaptation practices. They stated that technological adaptation may not only be labor intensive but also material intensive that farmers with enough money can afford. In the same vein, Enete and Achike (2008) further observed that for farmers to purchase inputs in the right quantity and adopt innovations, they should be sufficiently empowered financially. It was only 6.7% who complained of the problem of dour and choking sensation as their major constraint. Multiple responses were recorded.

Table 5: Distribution of respondents according to constraints encountered in the study area.

Constraints	Frequency	Percentage
Lack of education	18	13.4
Ignorant of the product	21	15.7
Lack of income & low farming input, minimal tillage.	45	33.6
Risk to health	**3**0	22.4
very low level(indiscriminate use of fertilizers and other agro-chemicals)	11	8.2
Problem of odour and choking sensation.	9	6.7
Total	**134**	**100**

Source: Field Survey, 2019
Multiple responses recorded.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, socio-economic factors influence the usage of agrochemical technology in the study area. Also the indiscriminate usages of the input resources are as a result of lack of awareness and poor educational background. And this has resulted to soil nutrient depletion in the study site. Therefore it is recommended that extension agents should create awareness on the usage of the input resources. Government should also assist farmers by granting credits to them.

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