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Factors Influencing Fertilizer Use Intensity among Small Holder Crop Farmers in Abak Agricultural Zone in Akwa Ibom State, Nigeria

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Abstract

This study analyzes factors that influenced fertilizer use intensity among arable crop farmers in Abak agricultural zone in Akwa Ibom state, Nigeria. Primary data were obtained from 150 arable crop farmers in the zone. Descriptive statistics and multivariate regression analysis were used to analyze data collected. The result reveals that majority of farmers were getting old and there is low social capital accumulation among arable crop farmers. Also, age, gender, household size, farm size, perceived price of fertilizer, value of farm output, extension agent visit, number of goats and sheep own by farmers, and decision to own poultry by farmers as well as the distance to fertilizer selling point are significant factors affecting fertilizer use intensity among arable crop farmers in Abak agricultural zone in Akwa Ibom state. The study recommends that Akwa Ibom state government should further subsidize the price of fertilizer to make fertilizer more affordable to small holder farmers. In addition, arable crop farming households in the state should be sensitized on the current method of family planning as this would help to reduce non-farm cost and help increase fertilizer procurement. Furthermore, the extension unit of the state ministry of Agriculture should be strengthened to educate arable crop farmers more on fertilizer usage.

Keywords: Fertilizer, Crop, arable, farmer, production, Akwa Ibom

1. Introduction

Agricultural sector in Sub Saharan Africa has continued to be an essential instrument for sustainable development, rural poverty reduction and a reliable source of self food sufficiency for the region (World Bank, 2008 and Olwande *et al.*, 2009). However, agricultural productivity in the region has continued to decline over the last decades and poverty levels have increase (Olwande *et al.*, 2009). Currently, agricultural productivity growth in Sub-Saharan Africa lags behind that of other regions in the world, and is well below that required to achieve food security and poverty goals. Many farmers in the region are facing

declining crop yields, which have adverse effects on the region's economic growth (Hassan, 1998). A prominent constraint to higher productivity among farmers in the region is "soil infertility" related mainly to low nutrient status of the soils and continuous cultivation without planned replenishment of depleted soil nutrients (Wanyama *et al.*, 2009). Increasing agricultural productivity in the Sub Saharan Africa especially in Nigeria is an urgent necessity; and one of the fundamental ways of improving agricultural productivity is through introduction and optimal use of improved agricultural technologies.

In Nigeria, agricultural production like in most developing countries is dominated by small scale farm producers (Oladeebo, 2004). Smallholder farmers constitute about 80% of the farming population in Nigeria (Awoke and Okorji, 2004). One major problem faced by farmers in Nigeria especially in the erosion prone region of South-South is "land fragmentation"; imposed by increasing population density and urbanization. This has resulted in increasing land use intensification leading to the collapse of the traditional fallow system of cropping, increase soil depletion and low crop yield among farmers (Azagaku and Anzaku, 2002). Food and Agricultural Organization (FAO) reports on fertilizer use intensity among Nigerian farmers reveal an increasing fertilizer use rate from 1970 to 1993. The intensity however drops from 11.8Kg/ha in 1995 to 8.90Kg/ha, 9.0Kg/ha and later increased to 13.0Kg/ha in 1996, 2003 and 2009 respectively. The reports further reveal that the fertilizer use rate among farmers in the country was far below the 200 kg/ha recommended by FAO for the sub Sahara African countries.

Akwa Ibom State like other parts of Nigeria have suffered gross soil nutrient mining due to continuous cropping, coupled with low soil nutrient levels and poor nutrient conservation practices accentuated by mounting population growth and land scarcity (Ministry of Agriculture Akwa Ibom state, MAAKS, 2010). In the state, intensive cropping is gradually replacing the traditional shifting cultivation that is associated with long period of land fallowing. The undulating pattern in food production due to reduce length of fallow on land have prompted farmers in the state to amend the soil with different materials (organic and inorganic) in order to enhance plant growth and increase crop yield (Reijnties et al., 1992; Adepetu, 1997). However, adding nutrients to the soil is crucial in sustainable agriculture; as this would compensate for depletion of nutrients through harvested crops. But evidence provided by the Akwa Ibom state Ministry of Agriculture in 2010 shows that most farmers in the state are not adequately compensating for soil nutrients loss caused by intensive cultivation practices. Hence, declining soil fertility has been highlighted as one of the major reasons for slow growth rate in food production in Nigeria (Ogunmola, 2007).

In spite of the early adoption of fertilizer technology by arable crop farmers in Akwa Ibom state, arable crop outputs have not shown encouraging growth rate (CBN, 2003 and SMA, 2011). Large proportion of arable crop outputs like cassava and its derivatives, maize, yam, vegetables like cucumber, garden egg and water melon are brought in from the neighboring states to complement local production. On the other hand, the past efforts of the state government in ensuring the availability of fertilizer and at a subsidized rate to farmers in the state has not yielded the intended objective, given the present low productivity among crop farmers in the state (CBN, 2010 and MAAKS, 2011). Therefore, following the current situations of low growth rate of arable crop outputs, rapid population growth and unintended objective from the highly publicized fertilizer subsidy programme in the state; there is need to uncover factors which could hinder

optimum used of fertilizer among food crop farmers in Akwa Ibom state. Hence the study specifically examines the socioeconomic characteristics of arable crop farmers in Abak agricultural zone in Akwa Ibom state and determines factors that affect fertilizer use intensity among them.

2. Literature Review

Past studies have documented some factors that influenced the fertilizer use intensity among arable crop farmers in developing countries. Studies by Croppenstedt *et al.*, (1996) in Ethiopia and Naseem *et al.*, (1995) in sub-Saharan Africa identified plot size, previous experience with fertilizer, supply of fertilizer, farm size, amount of rainfall, household size, and the ratio of price of main crop to cost of fertilizer as well as accessed to credit as factors constraining fertilizer demand among arable crop farmers. Minot *et al.*, (2000) study demand of fertilizer among farmers in Benin Republic and Malawi. They discovered in Benin Republic that education of household head, size of farm plot, household head expenditure, farm size, maize plot, rice plot, and number of cattle owned has significant effect on fertilizer demand. In Malawi, they inferred that household size, education of household head, ethnicity, price of maize, farm size, number of pigs owned, household head expenditure, club membership, and vegetable plot affect fertilizer demand. Staal *et al.*, (2003), identify education, extension service, number of adults per acre, cash crop plot, pasture plot, idea or prediction of rainfall pattern by farmers, population density and soil textures (clay, loamy and sand) as important determinants of fertilizer demand decision in Kenya. Chianu and Tsujii (2004) in Nigeria found that the probability of adoption of fertilizer increases with increase targeting of farmers from guinea savanna zone, younger farmers, better educated farmers and farmers who diversified into many crops. Kelly (2006) study factors that affect demand of fertilizer in sub Saharan Africa and discovered that price of fertilizer, output price of crops, and prices of other inputs that substitute for fertilizer are factors that affect fertilizer demand in the region. Fufu *et al.*, (2006) on their empirical research on determinants of fertilizer use on maize farms in eastern Ethiopia found that age, farmer's perception of price change, and rainfall expectation are significant factors that affect fertilizer use among maize farmers. Olwande *et al.*, (2009) in Kenya also confirm that age, education, credit, presence of a cash crop, distance to fertilizer market and agro ecological potential significantly influenced the use of fertilizer by smallholder farmers. Akpan and Aya (2009) in Nigeria showed that household size, household consumption expenditure, number of poultry birds kept by farmers, number of goats owned and perceived price of fertilizer have negative effect on fertilizer demand. Education of farmers, farm size, extension agent contact, farm income, ability to predict rainfall, modern communication facilities, output of maize and mixed cropping combination with maize have positive influence on fertilizer demand. Olayide *et al.*, (2009) in Nigeria established that the intensity of fertilizer use increases with the family labour and physical access to the fertilizer, but declines with the farm size and farm size distance from the homestead. Amanze *et al.*, (2010) in Nigeria also proved that output of crop, level of education, farm size and price of fertilizer were important factors influencing farmers' use of fertilizer in arable crop production while gender, age and household size were not. Wanyama *et al.*, (2009) in Kenya showed that change agent (extension) visit to farmers, proportion of land under maize production, sex of household head, and agricultural training significantly affected likelihood of farmers adopting fertilizer in maize production while, employment type of household head, fertilizer price and proportion of area allocated for maize cultivation significantly influenced the intensity of fertilizer

application.

3. Research Methodology

3.1 ***Study Area*****:** The study was conducted in Abak agricultural zone in Akwa Ibom State, Nigeria. The zone consists of five local government areas; these are Abak, Oruk Anam, Etim Ekpo, Ukanafun and Ika local government areas. Akwa Ibom state is one of the states in the South-South region of Nigeria. It is one of the Niger delta states rich in crude oil deposit. The state is in the rain forest belt and is prone to oil spillage, acid rain and increasing ocean encroachment. Some of the common food crops grown in the area are; cassava, plantain, waterleaf, fluted pumpkin, white yam, cocoyam, maize and banana.

3.2 Sampling Procedure and Sampling size

Multi-stage random sampling procedure was used to select respondents (solely arable crop farming household heads). First, three local government areas were randomly selected from Abak agricultural zone. In the second stage, 5 villages were randomly sample from each of the selected local government area in the zone. In the third stage, 10 arable crop farmers were randomly sample from the 15 villages randomly selected. A total of 150 arable crop farmers were used for data collection in the study. Arable crop farmers in the study was defined as those farmers that cultivate the following crops either as sole cropping or mixed cropping; cassava, maize, fluted pumpkin, okra, waterleaf, pepper, green *(Amaranthus spp*) and yams.

3.3 Source of Data and Instrument for Data Collection

Primary data were used in the analyses and these consisted of socio-economic data and production data. Structured questionnaires were administered to respondent and complemented by personal interviewed to ensure the consistency and accuracy of data collected.

3.4 Method of Data Analysis

Fertilizer use intensity (FUI) as defined by Maiangwa *et al.*, (2007) and Olayide *et al.*, (2009) was described as follows:

$$\textbf{FUI} = \frac{\text{Quantity of fertilizer used by } i_{th} \text{ farmer measured in Kg}}{\text{Area of land cultivated by } i_{th} \text{ farmer measured in hectare}} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

A multivariate linear regression model based on the ordinary least squares estimation was specify and used to determine factors influencing fertilizer use intensity among food crop farmers in the study area. This was described as follows:

$$FUI = \beta_0 + \beta_1 AGE + \beta_2 GEN + \beta_3 EDU + \beta_4 HHS + \beta_5 CRE + \beta_6 LANS + \beta_7 CRP + \beta_8 PRI + \beta_9 EXP + \beta_{10} OUT + \beta_{11} EXTEN + \beta_{12} DANI + \beta_{13} PANI + \beta_{14} LAOW + \beta_{15} DIS + U$$

Other variables in the model are as define below;

AGE = age of a farmer (years)
GEN = gender of a farmer (1=Male, 0 = female)
EDU = years of formal education of farmers (years)
HHS = household size of farmer (number)
CRE = access to farm credit by farmers (1=accessed and 0 otherwise)
LANS = land size cultivated by farmers (hectare)
CRP = purpose of crop grown by farmer (1= commercial crop, 0 = otherwise)
PRI = perceived price of fertilizer by farmers (1= high price and 0= low price)
EXP = farmers farming experience (years)
OUT = value of farm output of farmers in naira (₦)
EXTEN = extension agent contact (number of times)
DANI= number of domestic animals (i.e. Goats and Sheep)
PANI = Poultry ownership (1 = own poultry enterprise, 0 otherwise)
LAOW = Land ownership (1= inheritance, 0 otherwise)
DIS = distance to fertilizer selling point (1 = far, 0= otherwise)
U = stochastic error term.

4. Results and Discussion

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4.1 The Socioeconomic Characteristic of Small holder Farmers in Abak Agricultural Zone in Akwa Ibom state.

Table 1 reveals that, majority (74.67%) of arable crop farmers in the region are males. About 50.67% of the total respondents were relatively young compared to 49.33% aged category. With the mean age of 49.03 years, the arable crop farmer population in Abak agricultural zone is tilting to aged population in the near future. The findings call for an urgent policy that will encourage youth involvement into agricultural production in the area. The result also indicates that majority (about 89.33%) of arable crop farmers sample in the zone were married. This means that arable crop production in the zone is mostly practiced by married people who perhaps used the proceeds from the farming to augment family income and complement family food supply. The result further shows that majority (42.67% of the total respondents) of arable crop farmers in the zone have 5-6 member household size. About 25.33% of respondents had family size range of 5-8 members. A mean family size of 6 members was obtained among the sample respondents. This implies that family size of arable crop farmers in the region could be one of the necessary conditions for engaging in crop production; as large family size could ease the labour constraint. In addition, about 88.00% of the respondents sample had formal education with an average of 9 years. The finding indicates that most respondents were learned and this means that there is high tendency of adopting and assimilating of agricultural innovations or technologies among arable crop farmers in Abak agricultural zone in Akwa Ibom state. The mean annual farm income of ₦87 146.67 was also obtained among respondents. About 92.00% of the total respondents belong to 0-5 year's category of membership of farming associations in the

study area. Also only 2 respondents representing 1.33% of the total respondent fell in the category of 11-15 and 16-20 years respectively. The result further reveals that no respondent attended above 20 year membership of farming association in the study area. The average year of membership of association among farmers was around 1.08 years. The result implies that arable crop farmers in Abak local government area have less social interaction and as such social capital accumulation among farming households was low. The mean non-farm income of ₦31 854.07 per year among arable crop farmers in the zone revealed that most arable crop farmers in the area are low income earners. Also the mean farm size of 0.9 hectare was obtain among respondents; the result implies that arable crop production in Abak agricultural zone is basically a subsistence farming characterized by small land holdings.

4.2 Factors that affect fertilizer use intensity among small holder crop farmers in Abak Agricultural Zone in Akwa Ibom State

Table 2 reports the results of the multivariate linear regressions analysis for determinants of fertilizer use intensity among arable crop farmers in Abak Agricultural zone of Akwa Ibom state, Nigeria. The diagnostic tests show that the Chi-Square is significant at 1% probability level and this attests to the normality of the regression error term and also confirm the relevance of the Ordinary Least Squares technique. The R^2 of 0.65 is fairly high and indicates that about 65% of variability in the index of fertilizer use intensity in Akwa Ibom state is caused by the specify explanatory variables. The log likelihood value and the information criteria as well as the RESET test for the model are significant thus confirming the fitness of the models and implies that the specify independent variables are important explanatory factors of the variations in the indices of fertilizer use intensity among food crop farmers in Abak agricultural zone of Akwa Ibom state.

The result reveals that (AGE) and education (EDU) of small holder arable crop farmers in Abak agricultural zone are positive determinant of fertilizer use intensity. This implies that fertilizer use intensity increases with the age and education of farmers. The result satisfies *apriori* expectation because increase in age and education would tend to enhance agricultural innovation adoption. The result corroborates the finding of Chianu and Tsujii (2004) in Nigeria; Fufu *et al.*, (2006) in Ethiopia and Olwande *et al.*, (2009) in Kenya.

The coefficient of gender (GEN) is significant and positively related to fertilizer use intensity in the zone. The result indicates that the male farmers are more likely to increase fertilizer use intensity compared to their female folks. The result could be linked to the cultural barriers existing in the study area which give male folks more accessed to resource ownership through inheritance than the female folks. Wanyama *et al.*, (2010) in Kenya obtains similar result among arable crop farmers.

The result also reveals that the slope coefficient of family size (HHS) and Land size (LANS) are negative determinants of fertilizer use intensity among arable crop farmers in Abak agricultural zone in Akwa Ibom state. The results denote that increase in farmer's farm size and family size decrease the fertilizer use intensity in the study area. The result could be explained by the fact that in developing countries; the costs of farm production usually increase with family expenditure and farm size. This is associated with the cost of farm inputs and price uncertainty. The result agree with the findings reported by Coppenstedt (1996) in

Ethiopia; Minot *et al.,* (2000) in Benin Republic and Malawi; Staal *et al.,* (2003) in Kenya; Chianu and Tsujii (2004); Akpan and Aya (2009) and Amanze *et al.,* (2010) in Nigeria.

Perceived price of fertilizer (PRI), number of goats and sheep kept (DANI), decision to own poultry (PANI), and distance to fertilizer selling point (LAOW) have adverse influences on fertilizer use intensity among arable crop farmers in Abak agricultural zone in Akwa Ibom state. Increase in these variables reduces the intensity of fertilizer use in the zone. A unit increase in these variables would result in 9.78Kg/ha; 0.07Kg/ha; 6.67Kg/ha; 41.89Kg/ha and 37.52Kg/ha reduction in fertilizer use intensity respectively in the zone. Similar results have been reported by Coppenstedt (1996) in Ethiopia and Naseem *et al.,* (1999) in sub-Saharan Africa for farm size and perceived price of fertilizer; Minot *et al.,* (2000) for farm size; Kelly (2006) and Fufu *et al.,* (2006) for perceived price of fertilizer; Akpan and Aya (2009) for farm size, number of goats and sheep kept and decision to own poultry; Olayide *et al.,* (2009) and Amanze *et al.,* (2010) for farm size and distance from the point of sale.

5. Conclusion

The study assessed the socio-economic characteristics and analyzes factors that influenced fertilizer use intensity among small holder arable crop farmers in Abak agricultural zone in Akwa Ibom state. The descriptive analysis of the socio economic characteristic of respondents reveals that the population of arable crop farmers in Abak agricultural zone was getting old; as such there is an urgent need to encourage youth into arable crop production in the zone. There is also need to encourage social capital accumulation among arable crop farmers through formulation of viable social groups; this will encourage innovation adoption. Also, based on the result from the multivariate regression analysis of factors influencing fertilizer use intensity among small holder farmers in Abak agricultural zone in Akwa Ibom, the study recommended that government of Akwa Ibom state should further subsidize the price of fertilizer to make fertilizer more affordable to poor small holder farmers in the state. In addition, arable crop farm households in the state should be sensitized on the current method of family planning as this would help to reduce non -farm cost and help increase fertilizer procurement. Furthermore, the extension unit of the state ministry of Agriculture should be strengthened to educate arable crop farmers more on fertilizer usage. The study also recommended that fertilizer selling points should be located in the strategy rural areas in Akwa Ibom state so as to reduce the cost of purchase.

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Table 1A: The socio-economic characteristic of arable crop farmers in Abak Agricultural zone in Akwa Ibom state

Variables	**Freq.**	**%**		**Variables**	**Freq.**	**%**
Gender				**Education (yrs)**		
Male	112	74.67		No schooling	18	12.00
Female	38	25.33		Primary school	48	32.00
Total	**150**	**100.00**		Junior Sec. school	10	6.67
				Senior Sec. school	50	33.33
				Tertiary institution	24	16.00
				Total	**150**	**100.00**
				Mean (9 years)		
Age (yrs)				**Marital Status**		
20-29	16	10.67		Single	12	8.00
30-39	30	20.00		married	134	89.33
40-49	30	20.00		divorced	0	0.00
>50	74	49.33		widowed	4	2.67
Total	**150**	**100.00**		**Total**	**150**	**100.00**
Mean (49.03years)						
Family Size (No.)				**Secondary Occupation**		
1-4	40	26.67		Trading	98	65.33
5-8	64	42.67		Grafting	8	5.19
9-12	38	25.33		Fishing	2	1.33
>12	8	5.33		Civil servant	32	20.77
Total	**150**	**100.00**		other	14	9.09
Mean (6.0 members)				**Total**	**154**	**100.00**

Source: *Field Survey, 2011; Note there was multiple counts for secondary occupation.*

Table 1B: The socio-economic characteristic of arable crop farmers in Abak Agricultural zone in Akwa Ibom state

Variables	Freq.	%	Variables	Freq.	%
Farm Income (₦/Yr)			**Farming experience**		
10 000	6	4.00	1-9	42	28.00
10 001– 50 000	62	41.33	10-19	36	24.00
50 001– 100 000	42	28.00	20-29	34	22.67
100 001– 150 000	24	16.00	30-39	24	16.00
>150 000	16	10.67	> 40	14	9.33
Total	**150**	**100.00**	**Total**	**150**	**100.00**
Mean (₦87 146.67)			Mean (18 years)		
Non- Farm Income (₦/Yr)			**Farm Size (9ha)**		
< 10 000	4	2.94	0.101-0.40	52	34.67
10 001– 50 000	90	66.18	0.401-0.80	60	40.00
50 001– 100 000	30	22.06	0.801-1.00	28	18.67
100 001–150 000	10	7.35	>1.00	10	6.67
>150 000	2	1.47	**Total**	**150**	**100.00**
Total	**150**	**100.00**	Mean (0.91hectare)		
Mean (₦31 854.07)					
Membership of Social Group (year)					
0-5	138	92.00			
6-10	8	5.33			
11-15	2	1.33			
16-20	2	1.33			
>20	0	0.00			
Total	**150**	**100.00**			
Mean (1.08 years)					

Source: *Field Survey, 2011.*

Table 2: OLS estimates of the fertilizer use intensity equation in Abak Agricultural Zone in Akwa Ibom State.

Variable	Coefficient	Standard Error	t-value
Constant	27.16	43.44	0.63
AGE	1.61	0.93	1.74*
GEN	44.29	22.35	1.98**
EDU	4.82	2.01	2.40**
HHS	-11.41	3.15	-3.62***
CRE	-24.43	24.83	-0.98
LANS	-9.78	2.96	-3.31***
CRP	21.60	19.61	1.10
PRI	-0.07	0.007	-9.09***
OUT	0.0003	9.73e-05	3.11***
EXTEN	131.04	37.79	3.47***
DANI	-6.67	1.62	-4.11***
PANI	-41.89	17.49	-2.39**
LAOW	-24.42	18.75	-1.30
DIS	-37.52	17.79	-2.11**
Mean Dependent var.	121.37	Schwarz Criterion	1836.79
R-Square	0.65	Akaike Criterion	1788.84
F-cal	16.04***	Hannan-Quinn	1808.32
Log-likelihood	-878.42	Normality test	34.91 (0.000)***
Adjusted R-Square	0.61	Hetero-test	3.34 (0.000)***
RESET test	59.78 (0.000)***		

Note: *, ** and *** represent 10%, 5% and 1% significant levels respectively. Variables are as defined in equation 1.