AN ASSESSMENT OF FERTILIZER SUPPLY, DISTRIBUTION AND THE EFFICIENCY OF ITS UTILIZATION AMONG SMALL SCALE FARMERS IN BORGU LOCAL GOVERNMENT AREA OF NIGER STATE

* Ibrahim, G.D, **Yisa, E.S and *Nwawe, C.N

* &*** Agricultural Economics Division, Nigerian Institute for Oil Palm Research (NIFOR) Benin City
** Department of Agricultural Economics & Extension Technology, Federal University of Technology Minna, Niger State, Nigeria.

ABSTRACT

Fertilizer, apart from promoting the breakup of unproductive soil, turning it into a productive growing medium and suppressing pathogenic soil organisms, also aid in replenishing and maintaining long-term soil fertility by providing optimal conditions for soil biological activity. However prospects for sustainable food security in Nigeria will remain uncertain if strategies are not developed to increase food production through proper cultural practices by farmers. This study is designed to examine fertilizer supply, distribution as well as the efficiency of its utilization among the small scale farmers in Borgu Local Government area of Niger State. Multi stage sampling techniques were used for this study where ten village areas were selectively clustered out of the ten existing districts or wards as the primary sampling units where agricultural practices are intense. Farmers from each village were purposively selected within each cluster of the ten districts as the secondary sampling units, to whom one hundred and twelve copies of questionnaire were administered to ramdomely.The result from the findings show that, the modal age group fall within the age range of 41-50 years, which is an agriculturally active part of population and represents 33.0% with 43.0% representing full time farmers. The result of the production function analysis reveals that the estimated coefficient of X_2 (Quantity of fertilizer utilized) was statistically significant at the 0.05 level. Allocative efficiency of fertilizer utilization, using marginal analysis reveals that fertilizer is underutilized with an index number of 17.475 which is greater than 1, this is depictive of the fact that farmers in the study area are operating in Stage 1 of the classical production function which is an irrational stage of production. Farmers are advised to increase the use of the said input. Government however should ensure timely availability of fertilizer at a subsidized rate and with a good delivery system.
Keywords: Fertilizer, efficiency, Small scale farmers, cluster, **production function analysis, marginal analysis.**

INTRODUCTION

Fertilizers are materials added to the soil or applied directly to crop foliage to supply elements needed for plants nutrition, which are taken directly by plants i.e. (plants uptake) and retained within the soil i.e. (soil nutrient retention) "Tisdale et al 1993. The growth of plants is limited by the amount of nutrients available in the soil. The climax vegetation that is established depends on soil fertility which in this context is the ability of the soil to supply nutrients and water for plants growth and for maximum yield. In Nigeria, like many other parts of the tropics, soil which has been cropped for several years under traditional shifting cultivation result in relatively low production per hectare, when production pressure has enforced a more intensive practice of this system of farming, there is commonly a decline of soil fertility and yield of plants per/ha falling to very low level bearing in mind the rapidly increasing the country population and the world at large. In view of the above, growing larger yield on existing cultivated land is the surest way of producing the extra food that the Nation and the World must have in other to shown away from serious food shortage problems, this will however require both the maintenance and improvement of soil fertility through the provisions of adequate fertilizers to the small scale farmers who have little or no access to it. Akinkumi and Adegeye 2003 called for at least 4.5% per year increase in farm output to provide enough food for the population. It is therefore difficult to see how fertility of soil can be maintained or improved at a satisfactory level without some use of fertilizers. Fertilizers supplied to farmers are only one of the inputs needed to achieve maximum yield but because they remove all restriction on the supply of plant nutrients and because they go with other methods to boost agricultural production, then they are the most important. Various research works including those conducted, by Food and Agricultural Organization (FAO) In 1970 reported on the importance of fertilizer to farmers, among the various agricultural inputs fertilizers perhaps are the next to water in maximizing plants yields.FAO estimated that about 50% of the increase in agricultural production witnessed in the last decade in developing countries is attributed to fertilizer use. Proper use of

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fertilizers on soil of low natural fertility makes it possible to grow a wide variety of crops; soils with high fertility have high productivity capacities. Alan and Khan 1999 stated that fertilizer is the king pin in crop production, it is also a key to securing the food need of a country, no country has been able to increase agricultural productivity without expanding the use of chemical industry to produce adequate fertilizers for food and cash crops. It is however essential to encourage the supply of fertilizers so as to achieve the desirable consumption and utilization ratio of 4:2:1 to maintain the soil health and to sustain the plant productivity. The most important constraint to crop growth are those caused by inefficient and in balanced use of plant nutrient in form of fertilizers. The need to provide enough food and raw materials for the people of Nigeria cannot be overemphasized. These remain a major concern of the government in order to achieve its goal in self sufficiency in food production programmes so as to meet up with the demand of the growing population. Prospects for sustainable food security in Nigeria will remain uncertain if strategies are not developed to increase food production Amegbeto et al 2001. There is therefore the need to transform agriculture from the present low level of productivity through proper fertilizer use and other complimentary inputs. It has been identified from this study that, some of the principal factors that have accounted for low rate of fertilizer utilization among farmers are inadequate supply and its poor mode of distribution among the intended beneficiaries. These inefficiencies could account for fertilizer scarcity and high cost which will in turn reduce the productive capability of farmers and caused a decline in the volume of food and cash crop produced. The majority of farming population in Nigeria is small scale farmers in the rural areas. These groups of farmers represent about 75% of the farming population with farm sizes ranging from 0.5 to 5.99 hectares of land per farmer Olatunbosun et al 1997. The main objective of the rural farmer is subsistence, fertilizers hardly reach the farmers in their villages, this again according to FAO 1975 reduces the usage of fertilizers among rural farmers who could not afford the cost of buying from the distribution agency, because of its distance and its scarcity or high cost from the distribution agency or its high cost from the open market and the poor mode of distribution greatly limit its usage. Fertilizers constitute the most important scientific breakthrough in feeding the growing population so there is the need to promote the application of fertilizer in the recommended quantities and using other management practices by educating small scale farmers through extension workers. In addition, if government could harness more energy into supply of fertilizers and other inputs and make it available to farmers at the right time, if government will ease the difficulties involved in fertilizer procurement by provision of government assisted transportation means, if the government could ensure that the said inputs are appropriately distributed among farmers who actually work the land at a subsidized rate? Surely the yield of crops will increase. The level of literacy among rural farmers is very low and tends to lead to indiscriminate application of fertilizers, excess application or low dosage have negative impact on the environment, low level of farmers income could also lead to the development of cold feet to fertilizer utilization. The impact of fertilizer use on the environment is also a problem that should be given special attention to. These problems can be said to be multi- dimensional. Fertilizer application can cause pollution of the under- ground water via heavy leaching of the fertilized soil. Often it can also weaken the biological composition of the soil thereby inhibiting the biological processes that naturally adds fertility to the soil. As such it can lead to an environment not being able to sustain plant growth. This study will no doubt provide a comprehensive assessment of the existing situation in respect to fertilizer use and distribution in Borgu Local Government Area of Niger State and in Nigeria at large. The Challenge of Nigerian Agricultural system today is how to provide food security for the growing population however, fertilizers play a strategic role in agricultural development not only for its contribution to higher crop yield but because its distribution and utilization goes with other innovations such as improved seeds, pest and disease control, better husbandry and other management practices. Finally, the study shall add to the available literature on farmer's rationality from the study's output on farmer's production goal and help in formulating policy and for further planning. It is envisaged that this will assist the small scale farmers to acquire knowledge and skill on how to use fertilizers efficiently in a more profitable manner to improve the existing crop yield in the country and to improve their standard of living and quality of life.

OBJECTIVE OF THE STUDY

The broad objective of this study is focused on assessing fertilizer supply, distribution and its efficiency of utilization among small-scale farmers in Borgu Local Government Area of Niger State. The specific objectives of the study are:

1. To identify the socio- economic characteristics of the small scale farmers within the study area;
2. To examine the efficiency of fertilizer utilization by the small scale farmers and its contribution to the Yield of farm produce;
3. To identify fertilizer supplies within the locality and;

4. To proffer possible recommendation based on the research findings.

MATERIALS AND METHODS:
AREA OF STUDY
The study was carried out in Borgu Local Government Area of Niger state .The study area lies between latitude 90^0N and 11^0N, longitude 2^0E and 4^0 E Olatunde Ayeni 1989.Dry season falls between the months of November and march. Wet season has an average rain fall of 40-60 inches which rise to the peak from late July to September which is characterized by strong winds having torrential downpours and violent thunderclaps Wolf. 1999. The monthly temperature covers between 21^0 C and 32^0 C during winter and summer seasons respectively. The vegetation of the area is the northern guinea savanna type and compost of slightly thick wood vegetation. The area is endowed with fertile clay and loamy soils with particular hard stony texture of greater depths

SOURCES OF DATA
Data for the study were collected from both primary and secondary sources. Primary sources include the administration of a well structured research questionnaire, personal contact and interview was conducted with small scale farmers and the staff of Ministry of Agriculture and Agricultural Development Project (ADP) Niger State on the present status of fertilizer supplies and mode of distribution. Secondary data were collected from FAO statistical data base, text books, journals and relevant information from the internet.

SAMPLING TECHNIQUE
Multiple Sampling technique was used for this study. Ten villages where Agricultural practices are intense were selectively clustered out of the several existing village areas under the ten districts or wards as the primary sampling units. Eleven (11) farmers from a village each were randomly selected within each cluster of the ten districts as the secondary sampling units, to whom one hundred and eleven copies of the questionnaire was administered , this was based on their intensive agricultural practices.

INSTRUMENT FOR DATA COLLECTION
A total of 111 questionnaires were administered to small scale farmers and a total 100 was retrieved. Data collected include: experience in farming, problems in purchasing fertilizers, present nutrient status of farmland, status of fertilizer supply, mode of fertilizer distribution, fertilizer utilization e.t.c.

DATA ANALYSIS
In attempting to achieve the objectives of this study, simple descriptive statistics and Ordinary Least Square (OLS) multiple regression analysis were used.
(OLS) multiple regression analysis model specification:
The implicit form of production function in this study is specified as:
$Y = F(X_1, X_2, X_3, X_4, e)$ .... (i) Where
Y = Output of crop (kg)
X_1 = Farm size (ha)
X_2 = Fertilizer utilized (kg)
X_3 = Labour used (man days)
X_4 = other inputs (₦): Seeds and agrochemicals such as herbicides, pesticides and e = error term
It is believed that output of crop(y) is a function of farm size (X_1), fertilizer utilized (X_2), labour used (X_3), and other inputs (X_4).
In explicit form, the tried functional forms are specified as:
1 Linear:
$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$ .... (ii)
2 Double logarithm:
$\ln y = \ln b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + e$ .... (iii)
3 Exponential:
$\ln y = \ln b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$ .... (iv)
4 Semi log:
$Y = \ln b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + e$ .... (v)
Where: y, X_1, X_2, X_3, X_4 and e are as defined above,
b_0 = constant/ intercept
$b_1 - b_4$ = regression coefficient

However, the lead equation (equation of best fit) among the four equations above will be chosen based on:

*The explanatory power of the model (R^2)
*Significance of estimated coefficients
*Magnitude of estimated coefficients
*Conformity of signs of estimated coefficients with a priori expectation
*F statistics

Finally the efficiency of fertilizer utilization and its contribution to yield of plants was calculated using allocative efficiency index.

A resource is said to be efficiently allocated at a point when

$$MVP = MFC \quad .... \quad (vi)$$

Under Perfect Competitive Market

$$MVP = P^X \quad .... \quad (vii)$$

Where:
MVP = Marginal Value Product
MFC = Marginal Factor Cost
P^X = acquisition cost of unit of input but

$$MVP = b.py \quad .... \quad (viii)$$

$$MVP = dy /dx.py \quad .... \quad (ix)$$

Where:
$b = dy /dx$ = partial derivative of X with respect to y (estimated coefficient) and
Py = Price of unit of output.
If MVP = MFC: implies efficient allocation of resources
If MVP > MFC: implies that resources are been underutilized. Therefore the farmer should employ more of the input.
If MVP < MFC: implies that resources are being over utilized, farmer should therefore reduce the usage of the said resources.

RESULTS AND DISCUSSION

The result in table 1 describes the socio-economic characteristics of respondents, it shows that the modal age group falls within the age range 41-50 years which is an agriculturally part of population and this represents 33.0%.Youth below 20 years were not really found to be actively involved in farming activities, this however could be attributed to rural urban drift by the youth population in search of white collar jobs thereby allowing the agricultural sector to suffer neglect. The table also shows the total percentage of respondents between the age of 21-30 and 31-40 years to be 24.0%and 29.0 respectively while the smallest group and also the oldest farmers i.e. 51years and above represents 8.0% of the population. This could be attributed to old age and the weakening of the body as a result of drudgery associated with the peasant way of agricultural practices. Farming activities are mostly done with crude implements which is often more difficult when compared with mechanized system. Age is a major determinant of productivity even in farming in terms of labour efficiency younger farmers is at advantage. Farming is usually seen as a male occupation, this study however shows a sizeable proportion of females who are also engaged in farming activities in the study area. It shows the extent of participation of both genders. The total number of males involved in farming was 77 representing 80.0% of the respondents while 20.0 % represent females' involvement in land cultivation; this is low when compared with that of the males. This could be attributed to the fact that women have less access to agricultural inputs or have less access to procurement of credit to purchase inputs needed for maximum yield, this could be linked to the problems that may arise from extension workers who sometimes inappropriately direct all their efforts to men and pay little attention to women despite the fact that women play an important role in both agricultural production marketing as well as in food processing, storage and preparation. In the table, 41.0% represent the largest household size of 11-20 people, showing the fact that they are the dominant group within the respondents. The lowest is that of the household size above 21 with 5.0% of respondents. Potential labour available for farm work is not a function of 1-5 and 6-10 of the respondents represent 24.0% and 30.0% respectively. The lowest is that of the of the household size per se, but the composition and quantity of those capable of working on the farm i.e. in terms of labour efficiency, a family composed of aged people including women and children will of course need hired labour more than another family with able bodied men. All the respondents interviewed were literate to a certain level, the least number of respondents having attained tertiary and adult education with 18.0% respectively.26.0% attained up to secondary level.19.0% had attained both Islamic and primary level respectively. The extent of participation of both full time and commercial farmers in an attempt to produce

crops required for immediate use by the farm household as well as to meet consumer demands in the market. This may be linked to the availability of abundant farming land in the study area. Table 2 shows fertilizer has been captured and presented in table 1 with the highest respondents of 43.0% and 27.0% respectively. supplied to B L G A was at its peak from 1995 to 1998 where 72,000 Bags were supplied from 120 Trucks rating 3,600 000kg in four years. In 1999 fertilizer supply declined with about 50% where only 16 Trucks were supplied rating 480,000kg of fertilizers. Its supply thereafter became very low and held constant for each year where only 21 Trucks were supplied for seven years i.e. from 2000 to 2006 rating 630.000kg with only 90,000kg of fertilizers sent in each year. This could however be attributed to government's neglect of agricultural sector, putting all her efforts on crude oil. Table 3 presents regression estimates of the determination of fertilizer utilization and other inputs to crop output. The lead equation (Double Log) has adjusted R^2 value of 0.714 implies that about 71.4% of the variation in output(Y) is explained by the independent variables X_1, X_2, X_3 and X_4 included in the model while the remaining 28.6% is as a result of errors in estimation. The F-statistic was significant at the 0.01 level which implies that the independent variables adequately explain the dependent variable. All the variables $X_1 X_2 X_3$ and X_4 were found to be statistically significant variables explaining fertilizer utilization in crop production in the study area. The estimated coefficient of X_2 (quantity of fertilizer utilized) was found to be 0.191 and was statistically significant at the 0.05 level. This implies that if fertilizer is increased by 5% holding other variables constant, the output of crops will also increase by 0.191 which indicates that the relationship between output and fertilizer utilized is positive. Table4 presents the result of marginal analysis to determine the efficiency of fertilizer usage and other inputs, from the result, the resources were found to be inefficiently utilized. The result revealed that fertilizer was underutilized since its allocative efficiency index value which is 17.475 is greater than 1 .Profit is maximized only where ratio of MFC to MVP is equal to 1 or unitary i.e.MVP=MFC .Under utilization of a resource is depictive of the fact that farmers in the study area are operating in stage 1 of the classical production function which is an irrational stage of production, consequently the farmer should increase level of utilization of the said input for maximum yield and profit.

Table 1: Percentage distribution of Socio-economic characteristics of small scale farmers

Variables	Frequency	percentage
Age(years)		
Below 20	6	6.0
21-30	24	24.0
31-40	29	29.0
41-50	33	33.0
Above 50	8	8.0
Gender		
Males	77	77.0
Females	23	23.0
Household size		
1-5	24	24.0
6-10	30	30.0
11-20	41	41.0
Above 21	5	5.0
Level of education		
Primary	19	19.0
Secondary	26	13
13.0		
Personal business	15	15.0
Student	26.0	
Tertiary	18	
Adult education	18	18.0
Qur-anic education	19	18.0
		19.0
Occupation		

Full time farming	43	43.0
Commercial farming	27	2
2.0 27.0		
Civil servant		

Source: Field survey Data, 2006.

Table 2: Estimates of Fertilizer supplied from 1995-2006

Year	No of Truck	No of Bag	(kg)	Collection Centre
1995	30	18,000	900,000	Ministry of Agric
1996	30	18,000	900,000	Ministry of Agric
1997	30	18,000	900,000	-
1998	30	18,000	900,000	-
1999	16	9,600	480,000	-
2000	3	1800	90,000	-
2001	3	1800	90,000	-
2002	3	1800	90,000	-
2003	3	1800	90,000	-
2004	3	1800	90,000	-
2005	3	1800	90,000	-
2006	3	1800	90,000	-
Total	157	180,600	4,710 000	

Source: Ministry of Agric and the Department of Agric BLG Secretariat New Bussa, Niger State.

Table 3: Regression estimates of the determinants of fertilizer utilization and other factors affecting crop output in Borgu Local Government Area of Niger State, 2006.

FUNCTIONAL FORMS				
Variables	Linear	Semi-Log	Double-Log	Exponential
Intercept	-158.848 (-5.273)(-4.928)*	-710.786	0.483 (0.483)	3.163 (19.595) ***
Farm sizeX_1 (ha)	149.798206.820 (9.446)*	1.173 (6.091) ***	0.858 (7.927) ***	(10.122) *** 1.497E-04 (0.543)
Qnty of fertilizer utilizedX_2(kg/ha)	0.175 (3.399) ***	55.738 (3.200) ***	0.191 (2.519) **	1.123E-04 (0.543)
Labour X_3 (Manday)	3.216E-01 (4.259)***	33.374 (2.167) **	0.233 (2.519) **	
Other inputsX_4	1.565E-03 (2.047)**	36.403 (2.693) **	0.163 (2.768) **	5.935E-06 (1.449)
R^2	0.701	0.640	0.725	0.256
Adjusted R^2	0.689	0.625	0.714	0.256
F.ratio	55.796***	42.164***	62.698***	45.297***

Sources: Computed from field survey Data, 2006.

NOTE;*** Implies significance at 0.01 level i.e. (1%)
     ** Implies significance at 0.05 level i.e. (5%) and
      * Implies significance at 10% level.
Figures in parentheses are the respective t-ratio.

Table 4: Allocative efficiency of fertilizer and other inputs used in improved crop production

Variables	MFCi (N)	bi	Py (N)	MVP= bi.Py	Ki= MVP/MFCi	% derivation from optimality (1-Ki) x100
Quantity Of fertilizer Utilized-40 (Kg/ha)	0.233	300	699	17.475	-1647.5	
Farm size (ha)	1	1.173	300	3519	3519	-351800
Labour (Mandays)	500	0.191	300	573	1.146	-14.6
Other Inputs	1	0.163	300	489	489	-48800

Source: Field survey Data, 2006.

CONCLUSION

The most important constraint to crop growth are those caused by inefficient and in balanced use of plant nutrient in form of fertilizers. The need to provide enough food and raw materials for the people of Nigeria cannot be overemphasized. These remain a major concern to the government in order to achieve its goal in self sufficiency in food production programmes so as to meet up with the demand of the growing population. Prospects for sustainable food security in Nigeria will remain uncertain if strategies are not developed to increase food product Amegbeto et al (2001). There is therefore the need to transform agriculture from the present low level of productivity through proper fertilizer use and other complimentary inputs. It has been identified from this study that, some of the principal factors that have accounted for low rate of fertilizer utilization among farmers are inadequate supply and its poor mode of distribution among the intended beneficiaries. These inefficiencies could account for fertilizer scarcity and high cost which will in turn reduce the productive capability of farmers and caused a decline in the volume of food and cash crop produced.

RECOMMENDATIONS

Fertilizers constitute the most important scientific breakthrough in feeding the growing population so there is the need to promote the application of fertilizer in the recommended quantities and using other management practices by educating small scale farmers through extension workers. In addition, if government could harness more energy into supply of fertilizers and other inputs and make it available to farmers at the right time, if government will ease the difficulties involved in fertilizer procurement by provision of government assisted transportation means, if the government could ensure that the said inputs are appropriately distributed among farmers who actually work the land at a subsidized rate? Surely the yield of crops will increase.

REFERENCES

Amegbeto, N.K. V.M Mantoung, O. Coulibaly and R.Asiedu, 2001 "Factors affecting the adoption Of Agricultural Technologies."

Akinkumi, S.O and Adegeye, W.C. 2003 "Producing response to Phosphate application for sort Of southern, eastern Nigeria soil science" Vol.183 pp 111-116.

Chikwendu, D.O and Gwa R. I 1992 "Government policies on fertilizer procurement and Distribution impact on Agricultural production Nigerian journal of Agricultural Extension" Vol. 1 and 2.

Chikwendu, D.O and Gwa R. I 1992 "Government policies on fertilizer procurement and Distribution impact on Agricultural production Nigerian journal of Agricultural Extension" Vol. 1 and 2.

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Khan, M. A. and Alam S.M. 1999 "Proper use of fertilizer on soils of low natural fertility a Seminal presented" on Mar. 01-07-1999.

Olatunbosun, K.L, and Olunfowora, O. 1997 "Fertilizer Policy in Nigeria paper presented at NAFCON" and FDPP fertilizer seminar Feb.1997.

Salako,E.A 1994 "Fertilizer use and recommendation for Rice, Maize, Sorghum and Wheat"Vol.45pp 156-189.

Tisdale, B, Abolu, G.O and J.Y Yayock, 1992 "Adoption of improved form of technology in Northern Niger" (Quarterly Journal of international Agric vol. 19(pp3)