MEDWELL PUBLISHING
The Social Sciences 4 (1): 53-58, 2009
ISSN: 1818-5800

Effect of Fertilizer Policy on Crop Production in Nigeria

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Abstract: This study examined the effect of fertilizer policy on crop production. The trends in fertilizer policy reform were explored. It explores the fertilizer policy in 2 specific policy periods; the pre-liberalization period and the liberalization period. The pre-liberalization period is between 1990 and 1996 and the liberalization period is between 1996 and 2005. Secondary data on the fertilizer distribution and usage rate as well as the National crop yield and some selected crops (cereal) yield data were used in this research. The descriptive analysis, t-test and the regression model were used to analyze the data. It was discovered that the distribution of fertilizer in Nigeria is dwindling. More so, the recommended fertilizer usage rate in Nigeria might have reached the point of diminishing returns. However, there was increase in crop yield in the second era over the first era. The fertilizer usage rate, the quantity of fertilizer distributed, the price of fertilizer and the policy period as policy variables were found to have significant effect on to crop production. The quantity of fertilizer distributed and the price of fertilizer were found as policy variables that positively affect crop production, the usage rate and the policy period has a negative effect. For fertilizer policy to affect crop production positively in Nigeria; the distribution of fertilizer to farmers has to be improved. Government should also ensure farmers are educated on fertilizer usage rate. The price of fertilizer should also be checked appropriately because farmers are found to use fertilizer judiciously when they spend an appreciable sum of money to purchase it.

Key words: Fertilizer, policy, crop production, Nigeria

INTRODUCTION

Agriculture is the economic heart of most countries and most likely source of significant economic growth (DFID, 2003). It has been observed as the major and certain path to economic growth and sustainability. In spite of the dominant role of the petroleum sector as the major foreign exchange earner, agriculture remains the mainstay of the economy (NEEDS, 2004). Apart from contributing the largest share of GDP, it is the largest non-oil export earner; the largest employer of labour and a key contributor to wealth and poverty alleviation, as a large percentage of the population derive their income from agriculture and related activities.

DFIS (2001) paper series report also shows that the economic of most developing countries are built on agriculture. There is strong relationship between agricultural productivity growth and reduction of poverty. Irz *et al.* (2001) confirms that recent research shows that a 1% increase in agricultural yields, especially from crop yield reduces the percentage of people living on less than $1 per day between 0.6 and 1.2%, no other economic activity generate the same benefit for the poor. Agriculture has been and of course still remains an important and vital sector of the economy in Nigeria. It is expected that the agricultural sector must be called upon in the future to supply more food to a growing and more prosperous population and to be a foreign exchange earner (Nagay and Edun, 2002). In order to generate more food for the growing population, the potential of agriculture has to be found. Nigeria has a great potential in food and cash crop production, to expand out, increase productivity, become a net exporter and enhance food security (Dickson, 2004). In order to increase productivity, Nigeria agriculture needs to embrace science-based technology and the use of fertilizer, improved seed and crop protection products. Since, land expansion is limited, without science-based agricultural inputs, agricultural production will decline and fall.

African leaders and International policy makers and agricultural experts all at the African Fertilizer Summit on the 19th of June 2006 have highlighted both the significant challenges that African farmers face as a result of declining soil fertility and the potential productivity

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gain from the modest fertilizer use. They also reported that, soil which are depleted of nutrients and organic matter are unable to effectively retain and use water (Batino, 2006), at the summit concluded that depleted soil must first be restored through the use of mineral and organic fertilizer, to make full use of the low and erratic rain that falls across the nation. Dr. Pedro Sanchez, Director of Tropical Agriculture at the Earths Institute at Columbia University in United States reported that the use of fertilizer, improved seed and other practices by 1000 farmers in Sauri, Kenya resulted in more than tripled their last maize harvest. Sanchez presented evidence on farm productivity in 'millennium villages' in Kenya, Ethiopia and Malawi. These villages, which are part of the United Nations millennium project, combine community participation and the best of science to end poverty and hunger. In Sauri, the average yield rose from 1.5 tons ha^{-1} to 4.9 tons and farmers returned 10% of their surpluses to school feeding program. Grain production from maize, sorghum and barley increased nine times in Kararo, Ethiopia (Pedro, 2004).

Bum (2002) in his research illustrates the Malawi's experience. Malawi's heavy dependence on tobacco for export has been a cause for concern. The government is promoting increased fertilizer use to make food crops and other exports crops more profitable. Training for fertilizer demonstrations, according to him was the key to success.

Visualizing the subject matter, with Africa as a continent in view, fertilizer use in sub-Sahara Africa is the lowest of any region in the world. Only about 8 kg ha^{-1} yearly and per capita food production has remained stable about 1 ton ha^{-1}, for the past three decades. In contrast, food purchasing has increased dramatically in the Green Revolution countries of Asia, where fertilizer use ranges from 100 to >200 kg ha^{-1} (Roy, 2006).

Dickson (2004) describes the fertilizer supply in Nigeria as still inadequate. This accounts to some extent for its low usage. One major impetus to fertilizer usage is an improvement of the fertilizer market. Olomola (2005) stated that there is need to improve the agribusiness market structure and performance. Many agribusiness firms and farmers are unable to ascertain before hand where to buy or sell commodities in order to maximize profit and reduce risk associated with marketing. This has created a class of market agent, who have capitalized in this non-transport market situation and lack of information to rip off both farmers and agribusiness firms in Nigeria thereby reducing and discouraging acquisition and usage of such inputs.

On 11th June 2006 at the Africa fertilizer summit, Nobel Peace Prize Laurel. Norman Borlaug best known for saving millions of people in Asia and latin America from hunger through the scientific and technological innovation known as the Green Revolution, urged African agriculture ministers, politicians and others to find the political will to start an Africa Green Revolution by replenishing the continent's severely depleted soil. Some three quarters of Africa's land south of the Sahara are severely depleted.

Borlaug submitted in the summit that the knowledge currently exists to set an African Green Revolution What is missing according to him is the appropriate political will and economic policies. Noting African's vast natural resources and given the data which shows that even minimum amount of fertilizer can have dramatic effects in crop yields. Borlaug urged African leaders to implement policies which will facilitate an appropriate level of fertilizer use (Norman, 2006).

If the fertilizer market system would experience any development at all, impetus must be drawn from the research of Thomas Thompson *et al.* (2004). This research reveals that an efficient fertilizer market system are needed to provide producers with competitively priced fertilizer products that meets the need of local farming systems. Demand at the farm level for fertilizer must be induced ultimately to profitable production technologies and attractive process for agricultural products at the farm gate. Government policy, laws regulations and services should reflect a commitment to an expanded role for the private sector. From experience, he affirms that government subsidies can distort demand and hinder the development of a sustainable fertilizer marketing system.

Grace *et al.* (2003) considering agricultural development policy and sustainability in crop production gave the following submission: The Nigeria's agricultural policy over the year has been informed by the belief that the development of agriculture is a sub qua non for the overall growth and development of the economy. It involves among others and the production of exportable cash crops to boost the nation's non-oil foreign exchange earning capacity.

Grace *et al.* (2003) identifies the problem of low yield as the inefficient use of fertilizer as an input thus affirming the fact that soil fertility is really a prerequisite for sustainable crop production. They expressed it thus: Despite the laudable efforts of the nation to improve crop production, Nigeria's agricultural sector is still characterized by low yields attributed to the use of crude implements, a low level of input and limited area under cultivation among others. Hence, Nigeria has to adopt policies that will encourage an agricultural sector that has a high investment growth rate. A key element of this strategy is an efficient and well functioning policy on

agriculture inputs market, making use of the following complements among which are; fertilizer, improved seed variety and crop protection product. Thompson *et al.* (2004) saw the need to invest in policy and regulatory reforms in the fertilizer sector as well as establishment of government and regulatory capacity.

Nigeria's agricultural policy frame work has gone through a number of evolutionary process and fundamental changes that reflected, in a historical perspective, the changing character of agricultural development problems and the roles which different segment of the society were expected to play in tackling these problems. But in the main, the form and direction of agricultural policy vis-à-vis fertilizer policy at a point in time were dictated by the philosophical stance of government on the content of agricultural development and the role of government in the development process.

There have been inconsistencies in fertilizer policy in Nigeria over the years. Making retrospectical review of the Nigerian fertilizer policy reveals an inconsistency of government fertilizer policy over the years. Many policies have been formulated right from the pre-1970 period, the pre-structural adjustment period (1970-1985) the Structural Adjustment Period (SAP) in 1986 and the post structural adjustment period. Up till 1996 the federal government has free monopoly on the distribution of fertilizer in Nigeria. But with effect from 1997, trade in fertilizer has been liberalized and private importers are now free to import and sell fertilizer in the open market: This form the liberalization period.

Despite the various policy reforms and campaign by the federal government to encourage the use of fertilizer, farmers are yet to adopt the optimum fertilizer use rate. Fertilizer use in Nigeria averages 10-15 kg ha^{-1}. If all our production stays in Nigeria, we can raise fertilizer use rate to 100 kg ha^{-1}, says Okoloko (2006) in his speech. If this is required when Nigeria does not want to export food or cash crop at all, then an higher rate should be expected if we are to consider exporting products, in order to meet up with the NEEDS agricultural crop production target. With the current application rate, Nigeria is still far from achieving this. Has our previous fertilizer policy any effectiveness?

Despite the application of fertilizer, crop yield at the average has not met up with food demand. Can Nigeria crop production output keep pace with the future demand? Nigeria food import bill for 2000 was N 164 billion (2001 constant naira) or 13.3% of total value of imports and 173 billion in 2005 (CBN, 1999). This implies that, there should be a campaign for a better fertilizer use via policy that must meet up with the food demand.

From the foregoing, an efficient fertilizer policy is urgently needed. But how can a better and efficient fertilizer policy are formulated if a critical look is not done to the past policy and their influence on crop production. Therefore, a need to examine the effect of the past Nigerian fertilizer policy. There should be juxtaposition, critique and a better policy framed out to meet the present need of improved crop production in Nigeria. Therefore, this research attempts to answer the following question: Does the distribution of fertilizer in 1997-2006 any better of to the distribution in 1990-1995/6? Do farmers' usage rate of fertilizer in the second policy (1997-2006) better than in the first policy era (1990-1995/6)? Has the use of fertilizer in the second policy era (1997-2006) any improvement on crop yield over the first policy era (1990-1995/6) upon which the new fertilizer policy was formulated, especially cereal crops that depend on fertilizer so much? What has been the effect of the past fertilizer policy on crop production? The main objective of this study is to examine the effect of fertilizer policy on crop production. The specific objectives include to: Identify and compare the distribution of fertilizer for the 2 policy period (1990-1995/6) compare the usage rate of fertilizer for the two policy periods; compare the yield of some fertilizer dependent crops over these policy periods especially cereal crops, (such as maize, rice, sorghum and millet) and determine the impact of fertilizer policy on crop production.

MATERIALS AND METHODS

The study area is Nigeria. Nigeria is the most populous country in West Africa. It occupies a land area of 923, 768 km^2 and lies between longitudes 3 and 14° east of the Greenish Meridian and Latitude 4 and 14 North of the equator. Her population based on the 2006 population and housing census is 140, 003, 542 comprising of 71, 709, 859 males and 68, 293, 683 females. It also shows an annual growth rate of 3.2% (Federal Republic of Nigeria Official Gazethe, 2007).

Period of study: This study looks at the policy period from 1990 to date. From 1990-1995/96 is seen as a policy era. This was the pre-liberation period. Also, at this time, an import duty on fertilizer was yet to be reduced to 5%. The second policy era of this study is the 1995/96-2006. This period is when there is full liberalization on fertilizer in which the private investments have free entrance into fertilizer market system and reduction of the import duties to as low as 5%.

Secondary data were used in this research work. These data were obtained from: Central Bank of Nigeria

(CBN, 2004) Financial and Economic Review, Statistic Bulletin from Federal Office of Statistics, Ministry of Agriculture, ADP [Agricultural Development Project], IFDC (International Fertilizer Development Centre, 2000) and PCu/Farm management survey and advisory services.

The methods of data analysis include descriptive analysis, t-test and regression analysis.

The t-test was used to check if there is any significant difference between the fertilizer distribution rate and usage rate for the 2 policy periods. It was also used to determine the significant difference between the yield of some selected cereal crops (maize, rice, sorghum and millet) for the 2 policy era.

The regression analysis was employed to examine the impact of fertilizer policy on crop production. The usage rate, the quantity of fertilizer distributed the price of fertilizer for the various years, the fertilizer subsidy cost and the policy periods were used as proxy for fertilizer policy. The implicit function for the regression analysis is stated thus:

$$Y = f(X_1, X_2, X_3, X_4, X_5, U)$$

Where:

Y = Total crops yield in tonnes.
X_1 = Usage rate of fertilizer.
X_2 = Quantity of fertilizer distributed.
X_3 = Price of fertilizer (₦).
X_4 = Subsidy cost of fertilizer (₦).
X_5 = The i dummy variable, where pre-liberalization period is 1 and the liberalization period is 0.
U = Error term with zero mean and constant variance.

RESULTS AND DISCUSSION

Distribution of fertilizer between 1990-1996 and 1997-2005: The means of the amount of fertilizer distributed in the first period and the second period are significant difference (Table 1). It was discovered that the first period has a mean fertilizer distribution of 1, 148, 741 and the second period has a mean fertilizer distribution of 124, 283.3. This shows clearly that the first period may be said to have a better mean fertilizer distribution. This may also be interpreted that the first period is really better than the second period in term of fertilizer distribution.

The usage rate of fertilizer between 1990-1996 and 1997-2005: The means of the usage rate of fertilizer in the first era and the second era are significant difference (Table 2). It was discovered that the first period has a mean of fertilizer userage rate of 9.637 and the second period has a mean fertilizer distribution of 4.1336. This shows clearly that the mean of the first era is times-two (2x) the mean of the second era. This shows clearly that the first era may be said to have a better mean fertilizer usage rate. This may also be interpreted that the first period is really better than the second period in term of fertilizer usage rate.

Table 1: Result of students't- test of fertilizer distribution

			Mean of the periods	
	t-value	Sig.	Era1	Era2
Fertilizer distributed	7.43400	0.001	1,148,741	124,288.3

Table 2: Result of students't-test of fertilizer usage rate

			Mean of the periods	
	t-value	Sig.	Era1	Era2
Fertilizer usage rate	5.558	0.000	1,148,741	124,288.3

Table 3: Result of students' t- test of crop output

			Mean of the periods	
Crops	t-value	Sig.	Era1	Era2
Maize output	-2.725	0.000	6251.429	7888.944
Rice output	-3.351	0.000	2973.2857	3511.222
Millet output	-5.641	0.000	4924.4286	6480.0778
Sorghum output	-6.065	0.000	6301.4	8977.7

The yield of selected fertilizer dependent crops over the two policy eras: From data analysis, there is significant difference between the maize yield in the first era and the second era. The mean of the maize crop output for the 2 periods revealed that the mean of the output in period 1997-2005 is greater than that of the first period (1990-1996).

There is also significant difference between the rice yield in the first era and the second era. The means of rice crop output for the two periods revealed the mean of the second era is more than that of the first era (Table 3).

Furthermore, there is significant difference between the millet and rice yield in the first era and the second era. Their means showed that the mean of the output in the second period is greater than that of the first period (Table 3).

Impact of fertilizer policy on crop production: Of all the 4 functional forms of the regression analysis of Table 4 above, the lead equation is semi-log. Thus:

$$Y = -733.519 - 42.022\log X_1 + 144.580 \log X_2 + 93.082\log X_3 + 14.052\log X_4 - 86.785\log X_5 + U$$

The value of the coefficient of determination (R^2) of the result is 0.968. This implies that about 97% of the crop yield is explained by the explanatory variables included in the model. The F-test indicates that the overall model is statistically significant at 10% level. All variable are significant except the subsidy cost. It is,

Table 4: Represent the data analysis for each of the functional forms

Functional form		Usage rate of fertilizer X_1	Quantity of fertilizer distributed X_2	Price of fertilizerX_3	Fertilizer subsidy cost X_4	Dummy X_5	.....Constant	R^2	F
Linear function	Coefficient	-8.835	0.0001039*	0.0757	0.006672*	-85.415	232.888	0.860	19.399
	S.E	(5.027)	(0.000)	(0.062)	(0.002)	(87.751)	(98.068)		
	t-value	-1.758	3.421	1.225	2.934	-0.973	2.375		
Double	Coefficient	-0.03267	0.208*	0.161*	0.04013	-0.131	-830	0.959	57.189
log function	S.E	(0.036)	(0.041)	(0.04)	(0.047)	(0.081)	(0.250)		
	t-value	-0.911	5.105	4.048	0.849	-1.621	3.312		
Semi	Coefficient	-42.022*	144.580*	93.082*	14.052	-86.785*	-733.519	0.968	74.485
log function	S.E	(19.918)	(22.593)	(22.075)	(26.270)	(44.847)	(139.127)		
	t-value	-2.110	6.399	4.217	0.535	-1.935	-5.272	0.850	18.059
Exponential	Coefficient	-	0.0000001365	0.0001317	0.00001278	-0.139	2.329		
Function	S.E	-0.008470	(0.000)	(000)	(0.00)	(0.144)	(0.160)		
	t-value	(0.008)	2.746	1.302	3.434	-0.970	14.513		
		-1.030							

Computer print out 2007; Note * = t-value significant at 10%

however alarming that usage rate of fertilizer is negatively significant contrary to aprior knowledge. The reasons may not be far fetched. The more the application of fertilizer the more the crop yield, however, this is when diminishing returns has not set in. When, the application of fertilizer according to the recommended rate is greater than what an effective crop yield can bear, definitely the law of diminishing returns might set in. From the result of the regression analysis in Table 4, the negative influence of fertilizer to crop yield probably might be as a result of diminishing returns effect of fertilizer application. Quantity distributed and price was seen as policy factors that contributed much to crop yield. From the dummy result the policy in the first era might have been negatively influencing the crop yield, this is because the first era was given 1, while the second era was given 0. This was to specifically determine the impact of fertilizer usage rate on crop yield. The result has shown further that from the data analyzed, fertilizer usage rate in Nigeria is inversely proportional to crop yield.

CONCLUSION AND RECOMMENDATIONS

Based on this research, the distribution of fertilizer in Nigeria is dwindling. More so, the recommended quantity of fertilizer usage in Nigeria might have reached the point of diminishing returns, may be that is why the fertilizer usage rate has been affecting national crop yield negatively and the recommended quantity of fertilizer use per hectare may not be the best for Nigeria soil. This research has also revealed that there has been only a little increase in crop yield in the second policy period over the fist and of course these crops are fertilizer dependent crops.

For fertilizer policy to affect crop production positively in Nigeria; the distribution of fertilizer to farmers has to be improved. This research has identified quantity of fertilizer distributed as a major factor that i mproves crop production. Thus, government should monitor the various agents distributing fertilizer to farmers and ensure that this necessary input gets to farmers at the right time. Government should also ensure farmers are educated on fertilizer usage rate. The price of fertilizer should also be checked appropriately since farmers are found to use fertilizer judiciously when they spend an appreciable sum of money to purchase it.

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