

Demand for Fertilizer Technology by Smallholder Crop Farmers for Sustainable Agricultural Development in Akwa Ibom State, Nigeria

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ABSTRACT

This study was undertaken to examine the demand for fertilizer technology by the smallholder crop farmers for sustainable agricultural development in Akwa Ibom State, Nigeria. Using a linear regression analysis the result indicated farm size, price of fertilizer, price of manure (a substitute) and farmers education to be important variables that significantly affected the demand for fertilizer in the State. Constraints to fertilizer procurement and utilization have also been identified, while appropriate recommendations have been made based on the findings of the study.

Key Words: Demand; Fertilizer; Smallholder crop farmers; Sustainable agriculture; Akwa Ibom State Nigeria

INTRODUCTION

There has been a great need to apply mineral fertilizer to improve the soil in view of the continuous cropping of the fragmented farmland available to the smallholder farmers in the State. The importance of fertilizer technology in crop nutrition justifies government policy on fertilizer pricing and subsidy in the last few years.

Between 1976 and 1979, fertilizer attracted a 75% subsidy wholly borne by the federal government. In the period between 1980 and 1985, federal government share was reduced to 50%, while States were required to absorb the 25%. However, in 1997 - 1999, the federal government withdrew all subsidies on fertilizer and later re-introduced a 25% subsidy on mineral fertilizer in June 1999 (Evbuomwan, 1991; CBN, 1999; Tanko & Mbanasor, 2000).

The gradual removal of subsidy on fertilizer and the commercialization of existing plants, which are parts of the portfolio of the pricing and subsidy policy, implemented in recent years was to remove the bottleneck on fertilizer distribution and ensure availability in line with the agronomic recommendations and to reduce the fertilizer cost.

Several studies and reports point to the huge capital expended over the years as budgetary cost on fertilizer subsidy, (Hussain, 1987; Nnodi, 1987; NAFCON, 1995; Ayodele & Barau, 1997). Farmers were therefore expected to consume more of this input to boost their production and to justify government's involvement in the input subsidy. However, the experience in the State is that there is a greater awareness and adoption of fertilizer technology to boost productivity per Naira invested but the supply is becoming erratic. This irregular supply of fertilizer to farmers results

in the price increase and a reduction in the level of fertilizer consumption. The resultant effect at the farm level on farmers' output and income calls for an investigation bearing in mind that small holder farmers produce the bulk of the food consumed in the State.

This study was undertaken with the objectives to,

*Determine the factors that affect the demand for mineral fertilizer in the study area,

*Identify the constraints to fertilizer demand by the farmers and to proffer policy recommendations based on the findings.

METHODOLOGY

Theoretical framework. Demand is defined as the quantity of a commodity that buyers are willing and able to buy at a specified price in a given market and at a particular time. This demand is termed "effective" as it is backed by the ability to pay for such goods. Therefore individuals (consumers) are prepared to pay for goods and services, because of their values (Tanko & Mbanasor, 2000).

The quantity of a commodity demanded is a function of factors referred to as determinants of demand. The demand function in its implicit form can be presented as:

$$Q_d = f(P, T, P_r, Y, F)$$

Where

Q_d = quantity of product demanded by a consumer

P = product price

T = taste and preference of consumers

P_r = price of related products

Y = consumers' income

F = family (household) size.

On the basis of *ceteris paribus*, other variables

(determinants) can be held constant to observe the effect that a particular variable exert on demand. Price is a major determinant of effective demand. The information conveyed by the demand curve to the farmer is what the law of demand expresses. The law of demand states that the higher the price of any commodity the smaller the quantity of such commodity that is purchased and the lower the price, the larger the quantity purchased (Koutsoyanis, 1988; Igben & Eyo, 2002). Price will adjust to that level, which equates demand and supply in a pure competitive market at which point the market is cleared.

Study area. The study was conducted in Akwa Ibom State, Nigeria. Four Local Government Areas (LGAs) namely Ukanafun, Essien Udim, Ikono and Ini, were purposively selected out of the 31 LGAs in the state, because of their significant involvement in agriculture. The area lies between latitude 4° 32 'and 5° 31' N and longitude 7° 35 'and 8° 25' E, occupying a land mass of 8, 421 square kilometers (Udofia & Inyang, 1987). The population is one of the highest in the country with 2, 359, 736 people (NPC/CBN, 1992). The predominant occupation in the study area is farming, where the major land use pattern is rain fed tree and food crop cultivation.

Data and analysis. The primary data meant for this study was collected from a total of 80 smallholder farmers, which were randomly sampled using structured questionnaires administered to the respondents. The data collected were subjected to both descriptive statistics and multiple regression analysis. Multiple regression analysis was used specifically to estimate the relationship between fertilizer consumption and some set variables that determine its demand.

The empirical model. In implicit form, the postulated relationship between the fertilizer demand and its determinants is expressed using the model:

$$Q_f = f(P_y, F_s, P_f, P_m, E_d, C_d)$$

Where

Q_f = quantity of fertilizer demanded in time, t (no. of 50 kg bag)

P_y = persona income of the farmer (₦)

F_s = farm size (ha)

P_f = price of fertilizer (₦/50 kg bag)

P_m = price of manure (₦/50 kg bag)

E_d = farmer's Educational level (years)

C_d = availability of credit facilities (₦).

Four functional forms were tried based on their previous performance on short run demand (Olayide & Oni, 1969), which in explicit form the models are expressed as follows:

Linear: $Q_f = b_0 + b_1 P_y + b_2 F_s + b_3 P_f + \dots + b_6 C_d + e$

Semi log: $\ln Q_f = b_0 + b_1 P_y + b_2 F_s + b_3 P_f + \dots + b_6 C_d + e$

Double log: $\ln Q_f = \ln b_0 + b_1 \ln P_y + b_2 \ln F_s + b_3 \ln$

$$P_f + \dots + b_6 \ln C_d + e$$

Exponential: $Q_f = \ln b_0 + b_1 \ln P_y + b_2 \ln F_s + b_3 \ln$

$$P_f + \dots + b_6 \ln C_d + e$$

Where, Variables are as defined earlier

b_0 = Constant parameter

b_1 to b_6 = regression coefficients

e = error term.

RESULTS AND DISCUSSION

Regression estimates on fertilizer demand. The parameters and related statistical test results of the independent variables obtained from the regression analysis are provided in Table I. The linear functional form was chosen as the lead equation for this analysis. The choice was informed by its value of R-squared for the degrees of freedom, F-ratio for the overall test of significance as well as conformity with a priori expectation of signs and magnitudes of the estimated coefficients. The lead equation had more statistically variables and the highest value of F-ratio. The regression estimates of the determinants of fertilizer demand in Akwa Ibom State during the 2003 cropping season is shown on Table I.

The F-ratio test for the significance of the regression result suggests that the explanatory variables best fit the model, while about 87% of the total variation in fertilizer demand is explained by variables included in the model.

The estimated fertilizer demand function for crop farmers in Akwa Ibom State in its linear form for the 2003 production season is expressed as follows:

$$Q_f = 0.514 + 7.408 E - 08 P_y + 0.103 F_s - 2.857 E - 04 P_f + 5.111 E - 05 P_m - 3.030 E - 02 E_d + 5.225 E - 06 C_d$$

(4.054)*** (0.118) (2.453)** (- 16. 226)***
(3.617)*** (- 3.288)*** (1.657).

The results of the regression analysis have implications on the fertilizer, which could positively or negatively affect the needed boost in food crop production in the State.

Farmer's personal income was not statistically significant at any percentage level but positively related to the quantity of fertilizer demanded by them. The insignificance of the income variable could be attributed to the low income of the farmers, which is a reflection of their low level of output.

The coefficient of the farm size variable is estimated to be positive, conforming to a priori expectation and highly significant at 1% level. This result shows that farm size is an important factor determining the quantity of fertilizer demanded by the farmers and indicates that fertilizer demand increases with increase in the hectares of farm cultivated with food crops. This result is consistent with the earlier findings of (Tanko & Mbanasor, 2000; Onu *et al.*, 2000; Ebong, 2002).

The price of fertilizer an important factor explaining the demand for fertilizer was highly significant at 1% level

and also negatively related. This result is in consonance with a-priori expectations and suggests that fertilizer is a significant factor of production by increasing crop yield per hectare. This also conforms to the law of demand that as the price of fertilizer increases the demand for it decreases. However, this result differs from the findings of Tanko and Mbanasor (2000) and Onu *et al.* (2000), whose result showed a positive relationship between price and quantity demanded of fertilizer and cotton, respectively in Northern Nigeria.

The coefficient of the price of manure (a substitute) was positive as expected and statistically significant at 1% level. The reason is obvious, because the high price of fertilizer resulted in the increase in the demand for manure to improve farmland, which is a limiting factor in the study area. The excess of demand over the supply of manure automatically increases its price resulting in more of the fertilizer being demanded. This result is in agreement with Igben and Eyo (2002), who opined that if two farm inputs can be substituted one for the other, an increase in the price of one would cause and increase in the demand for the other.

The coefficient of education variable was statistically significant at 1%, indicating the variable to be an important determinant of fertilizer demand but with the sign unexpected. The implication of this result is that most of the farmers in the study area had low level education of which greatly affected their rate of adoption of fertilizer technology to improve their crop yields.

The volume of credit acquired by the farmers was not significant at any percentage level indicating that the credit facilities made available to the farmers to acquire the much needed fertilizer was low. This may either be due to the fact that the farmers did not have collateral to present as security for such credit facilities or lack awareness for the existence of such loans. However, the credit variable had a positive relationship to the quantity of fertilizer demanded. This conforms to a -priori expectation that the quantity demanded of fertilizer increases as the volume of credit increases.

The distribution of farmers based on their constraints to fertilizer procurement and utilizations presented in Table II. The result shows that 27.31% of the respondents attributed their low demand for fertilizer to high cost of it and 21.15% of them to inadequate supply of fertilizer, while 14.54% of the farmers blamed their inability to purchase enough fertilizer to lack of credit facilities and 12.33% of them to hoarding by intermediary agents, whose activities assisted in hiking the fertilizer price. Only 6.61% of the respondents had a problem of having to buy inappropriate type of fertilizer for their crops. This result agrees with the earlier findings of CBN (1991) and Ayodele and Barau (1997) and that supplies were inadequate and the much available were distributed by fertilizer dealers at very exorbitant prices. The implication of this result is that with the farmers faced with these problems, their productivity is bound to be low with the attendance effect of food

Table I. Determinants of the demand for fertilizer

Variables	Linear	Semi – log	Double log	Exponential
Constant	0.514 (4.054)***	-2.643 (-2.052)*	-2.515 (-3.577)***	-0.437 (-4.544)***
Personal income	7.408E-08 (0.118)	0.150 (2.410)**	9.842E-02 (1.552)	1.715 E-07 (0.360)
Farm size	0.103 (2.453)**	0.529 (3.546)***	0.386 (4.742)***	0.116 (3.642)***
Price of fertilizer	-2.857E-04 (-16.226)***	-0.105 (-4.175)***	-5.706E-02 (-4.141)***	-1.468E-04 (-10.991)***
Price of manure	5.111E-05 (3.617)***	0.208 (1.989)*	0.149 (2.602)**	2.889E-05 (2.696)***
Farmer's Education	-3.030E-02 (-3.228)***	-0.134 (-1.374)	-6.840 E-02 (-1.282)	-9.040E-03 (-1.272)
Credit facilities	5.225 E-06 (1.657)	1.211E-02 (0.534)	-9.030 E-04 (-1.073)	3.994E-07 (0.167)
R ²	0.869	0.577	0.554	0.776
F – ratio	80.775***	12.006***	15.133***	42.178***

Source: computed from field survey data, 2004.

*** = Significant at 1%; ** = significant at 5%; * = significant at 10%.

The figures in parenthesis are the respective t – ratios.

Table II. Constraints to fertilizer demand

Constraints	Frequency	Percentage
Untimely supply of fertilizer	18	7.93
Supply of undesired type	15	6.61
High cost of fertilizer	62	27.31
Inadequate supply of fertilizer	48	21.15
Lack of credit facilities	33	14.54
Hoarding of fertilizer by agents	28	12.33
High cost of transportation	23	10.13
	227*	100.00

Source: Field Survey data 2004

*Indicates multiple responses by farmers.

insecurity for the teaming population in the State.

CONCLUSION AND RECOMMENDATIONS

The study examined the effect of demand determinants on fertilizer consumption in Akwa Ibom State. The variables that significantly affected fertilizer demand were farm size, price of fertilizer, price of manure (a substitute) and farmers' education. The major factors limiting fertilizer input, lack of credit facilities, hoarding of fertilizer by dealers, inadequate supply, sometime caused by the overzealous politicians, who use fertilizer as a vote catching weapon and fuelling supply to the black market outlets and the untimely supply of the fertilizer to meet the production season.

Based on the findings the following recommendations are deemed appropriate;

- Since the price of fertilizer was found to be a highly significant factor explaining demand policy, which removes subsidy on fertilizer should be followed by another policy that re-finances the farmers to meet the challenging cost of the input.
- The Agricultural Credit and Guarantee Scheme of the Central bank of Nigeria should be revitalized and sustained in view of the crucial role of credit in explaining agricultural output.

- Fertilizer pricing should be allowed to be determined by the free interplay of the force of demand and supply and not super imposed by the government agencies.
- The necessary conditions for agricultural loans should be relaxed especially for the smallholder farmers in respect of collateral, which the farmers cannot afford.
- Poor transportation network induces cost and loss of agricultural output. Therefore good access roads should be constructed in the rural areas for easy transportation of the commodity and the needed production inputs like fertilizer.
- An agricultural extension service is one of the most outstanding institutions created to serve the felt needs of the farmers. Thus a policy, which provides adequate, trained and well-equipped extension workers has the potential of raising the demand for fertilizer for increased production.
- More ago-service centres should be opened within the state to provide fertilizer distribution services.

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