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DETERMINANTS OF EXPENDITURE ON FERTILIZER AMONG ARABLE CROP FARMERS IN OSUN STATE, NIGERIA

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ABSTRACT

This study investigated fertilizer use among arable crop farmers in Osogbo Agricultural Development Programme (ADP) zone of Osun State, Nigeria. Specifically, it identified and quantified the determinants of fertilizer use among arable crop farmers, in Osun State, Nigeria. Multi stage sampling technique was used to select 120 arable crop farmers while structured questionnaire was used to obtain information on their socio-economic characteristics, types and quantity of fertilizer used, farm characteristics, and expenditure on fertilizer. The results showed that 76.65%, 4.35% and 6.09% farmers respectively had expenditure on solely inorganic, organic and combination of inorganic and organic fertilizers, while 13.91% were non-fertilizer users. The multiple linear regressions revealed that sex of farmer, farming experience, level of education, fertilizer type, extension visits, land tenure status and quantity of fertilizer used, positively influenced expenditure on fertilizer while farm income had a negative relationship. The result indicated a positive response to fertilizer use by farmers and the need for national policy on fertilizer to effectively address the problem of physical and economic access of fertilizer to farmers in good time.

Keywords: Fertilizer use, farm expenditure, arable crop farmers.

INTRODUCTION

Declining soil fertility has been identified as one of the major reasons for slow growth rate in food production in Nigeria (Ogunmola, 2007). The use of soil amendment materials of both inorganic and organic have shown promises in addressing this. While the former seems more popular, its abysmal low usage of 10kg/ha in Nigeria is grossly inadequate to meet the increasing need of the growing population, while soil nutrients from the latter is also inadequate to address the problem (Okoloko, 2006).

Up till date a plethora of policies has been championed by the Federal and State governments of Nigeria to make fertilizer available to farmers. In the extreme cases government operated a monopoly and was solely involved in the procurement, distribution, and

also subsidized fertilizer. The fertilizer subsidy regimes fluctuated between 75 and 25 percent for over two decades, at different periods between 1976 and 1999. Some other policies during the period were the institution of price controls at the fertilizer retail market, provision of credit to farmers for the purchase of fertilizer, institution of import tariffs (Crawford *et al.*, 2005). This period witnessed another extreme which was the era of liberalization from 1986 to 1997 and government was to decentralize fertilizer procurement and distribution thereby deregulating the market. The two extremes witnessed massive policy failure which manifested in the form of untimely fertilizer distribution to farmers, fertilizer adulteration, fertilizer loss in transit, arbitrage, undue rent seeking by other stakeholder in the fertilizer

supply chain and deliberate effort on the part of government officials to frustrate the era of liberalized market.

There is no gainsaying that, poor access to fertilizer has been the bane of food production in Nigeria. Table 1 shows that fertilizer use by farmers in Nigeria is still very low despite its capacity to tremendously increase crop productivity. Nigeria fertilizer consumption of 2.1kg/ha ranks higher than 1.0kg/ha of Togo and far below 49.2kg/ha, 239kg/ha and 503.9kg/ha of South Africa, United Kingdom and China. This observation also finds reflection in the estimated cereal yield among the selected countries.

Suffice it to say, agricultural lands in Nigeria over the years have suffered severe nutrient

depletion due to short fallow periods, overgrazing, low investment in soil management practices among others. The study area is a case in point and the present government of Osun State is making effort to make massive investment in soil fertility improvement in conjunction with the German government.

Consequent upon the aforementioned it is obvious that fertilizer is an important missing ingredient in Nigeria's agriculture and most policies before now have failed to make timely availability to farmers in quantity and quality. Thus this study therefore investigated factors that influence farmer's expenditure on fertilizer. This approach will address farmers' effective demand for fertilizer and will provide the farmer's own way of solving the problem of fertilizer accessibility.

Table 1: Fertilizer consumption (Kg/ha) and Cereal Yield (Kg/ha) in selected countries in 2009

| Country | Fertilizer consumption (Kg/ha) | Cereal yield (Kg/ha) |
|----------------|--------------------------------|----------------------|
| Canada | 60.5 | 3298 |
| Cameroon | 6.7 | 1765 |
| China | 503.9 | 5450 |
| Cote d'Ivoire | 15.9 | 1712 |
| France | 148.3 | 7496 |
| Germany | 181.4 | 7199 |
| Ghana | 20.3 | 1660 |
| Nigeria | 2.1 | 1530 |
| South Africa | 49.2 | 4413 |
| Togo | 1.0 | 1243 |
| United Kingdom | 239.9 | 7031 |
| United States | 109.4 | 7236 |
| India | 167.2 | 2581 |

Source: Compiled from the World Bank website

MATERIALS AND METHODS

Study area

The study area is Osogbo Agricultural Development Programme (ADP) Zone of Osun State, Nigeria. This is an agrarian community and falls within the rain forest agroecological zone.

Sampling techniques

One hundred and fifteen (120) arable crop farmers were selected through multi stage sampling technique. The first stage involved a

purposive selection of Osogbo ADP zone from the three available zones in the state. The second stage involved a random selection of 3 local government areas (LGAs) out of the 12 LGAs present in this zone. Furthermore, 4 communities were randomly selected from each LGAs, while 30 farmers were thereafter selected from each community to make a total of 120 farmers. Data were collected by the researchers and enumerators from the Agricultural Development Programme of Osun state between February and March, 2013 using questionnaire

as well as interview guide. Data were collected on farmers' socioeconomic characteristics, farm production inputs, farm cost and returns. The data was analyzed using descriptive statistics and multiple regression analysis. Of the 120 questionnaires, 115 were correctly completed and were used for data analyses.

Analytical technique

The data was fitted to the linear, semi logarithm, double logarithm and exponential models to determine which best describe the relationship amongst the study data. However, using statistical, economic and econometric criteria, the linear multiple regression was used to estimate the determinants of fertilizer use among the arable crop farmers in the study area. The explicit model is stated as;

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12}$$

Where; Y is expenditure on fertilizer in Nigerian naira, X_1 is sex (score of 1 for male and 0 for female farmers), X_2 is age in years, X_3 is household size (number of persons), X_4 is farm size (hectare); X_5 is years of formal education; X_6 is length of farming experience in years, X_7 is fertilizer type (score of 1,2 and 3 for farmers that use, organic, both types and inorganic fertilizers respectively, X_8 is fertilizer quantity in Kg, X_9 is frequency of extension visits, X_{10} is land tenure status (score of 0 for farmers that are not land owners and 1 for land owners), X_{11} is access to credit (score of 1 for farmers that needed and obtained loans and 0 otherwise, X_{12} is annual farm income.

RESULTS

Table 2 shows that 83.5% of the respondents were male, 36.6% fall between the age of 21 – 40 years; 34.8% had secondary education; 27% had between 11 -20 years farming experience; 57.3% had household size of between 6 – 12 people; 63.5% are members of cooperative societies; 94.1% had farm size of less than 1 hectare while 73.9% own their land. Table 3 shows that the most common crop enterprise combinations were maize/cassava; maize/cassava/okra and sole maize representing 42.3%, 13.9% and 10.4%, respectively. Table 4 reveals that the most important sources of fertilizer for farmers were the open input market followed by ADP/government. Furthermore, Table 5 indicates that respondents spends an average of ₦16,275, ₦1,560 and ₦7,500 on inorganic fertilizer, organic fertilizer and both, respectively. The Duncan Test for significant difference in fertilizer expenditure, net farm returns, and quantity of fertilizers used among users of inorganic, organic fertilizer and both showed that inorganic fertilizer users incurred the most expenditure on fertilizer followed by those who use both types and organic fertilizer, respectively. Also users of organic fertilizers have the highest returns, while no significant difference ($p>0.05$) existed between the quantity of fertilizer used by users of organic and inorganic fertilizers (Table 6). Finally, the multiple linear regression result shows that sex, level of education, farming experience, fertilizer type, fertilizer quantity, extension visits, tenure, were significant and positively related to farmers' expenditure on fertilizer. However, annual farm income was significant and negatively related (Table 7).

Table 2: Socioeconomic and farm characteristics of respondents

| Variable | Frequency | Percentage (%) |
|------------------------------------------|------------------|-----------------------|
| Sex | | |
| Male | 96 | 83.5 |
| Female | 19 | 16.5 |
| Total | 115 | 100 |
| Age | | |
| 21 – 40 years | 42 | 36.6 |
| 41 – 60 years | 23 | 28.6 |
| > 61 | 28 | 24.5 |
| Total | 115 | 100 |
| Mean 52.9 years | | |
| Educational status | | |
| No formal education | 30 | 26.1 |
| Primary education | 35 | 30.4 |
| Secondary education | 40 | 34.8 |
| Tertiary education | 10 | 8.7 |
| Total | 115 | 100 |
| Farming experience (years) | | |
| 1 – 10 | 23 | 20.0 |
| 11 – 20 | 31 | 27.0 |
| 21 – 30 | 26 | 22.5 |
| 31 – 40 | 21 | 18.2 |
| 41 – 50 | 10 | 8.7 |
| 51 – 60 | 4 | 3.5 |
| Total | 115 | 100 |
| Mean = 24 years | | |
| Household size | | |
| 1 – 5 people | 49 | 42.6 |
| 6 – 12 people | 63 | 57.3 |
| Total | 115 | 100 |
| Membership of cooperative society | | |
| Member | 73 | 63.5 |
| Non member | 42 | 36.5 |
| Total | 115 | 100 |
| Farm size (Hectares) | | |
| < 1 | 108 | 94.1 |
| 1 – 2 | 2 | 1.8 |
| 3 – 5 | 5 | 4.4 |
| Total | 115 | 100 |
| Land Tenure status | | |
| Own farm land | 85 | 73.9 |
| Do not own farm land | 30 | 26.1 |
| Total | 115 | 100 |

Table 3: Crop Enterprise combination

| S/n | Crop combination | Frequency | Percentage |
|-----|----------------------------------------|------------|------------|
| 1. | Sole maize | 12 | 10.4 |
| 2. | Sole cassava | 5 | 4.3 |
| 3. | Maize + cassava | 49 | 42.3 |
| 4. | Maize + yam + cassava | 4 | 3.5 |
| 5. | Maize + cassava + okra | 16 | 13.9 |
| 6. | Maize + cassava + tomatoes | 2 | 1.7 |
| 7. | Maize + cassava + cocoa | 1 | 0.9 |
| 8. | Maize + yam | 3 | 2.6 |
| 9. | Maize + cassava + rice | 1 | 0.9 |
| 10. | Maize + cassava + pineapple + Oil palm | 1 | 0.9 |
| 11. | Maize + okra | 5 | 4.3 |
| 12. | Water melon + cucumber | 3 | 2.6 |
| 13. | Tomatoes + pepper | 4 | 3.5 |
| 14. | Cassava + tomatoes | 2 | 1.7 |
| 15. | Yam + okra | 2 | 1.7 |
| 16. | Leafy vegetable + pepper + Tomatoes | 5 | 4.4 |
| | Total | 115 | 100 |

Table 4: Respondents source of fertilizer

| Source | Frequency | Percentage (%) |
|-------------------------|------------|----------------|
| ADP/Government | 41 | 35.7 |
| Market | 49 | 42.6 |
| Poultry farm | 12 | 10.4 |
| Market and poultry farm | 13 | 11.3 |
| Total | 115 | 100 |

Table 5: Respondents expenditure on fertilizer

| Source | Frequency | Percentage (%) |
|------------------------------------------------------------|------------------|-----------------------|
| Expenditure on Inorganic fertilizer (₦) | Frequency | Percentage (%) |
| < 10,000 | 30 | 34.5 |
| 10,001 – 20,000 | 35 | 40.2 |
| 20,001 – 30,000 | 15 | 17.2 |
| 30,001 – 40,000 | 6 | 6.9 |
| 40,001 – 50,000 | 1 | 1.5 |
| Total | 87 | 100 |
| Mean = ₦ 16,275 | | |
| Expenditure on organic fertilizer (₦) | Frequency | Percentage (%) |
| 1,300 – 1500 | 4 | 80 |
| > 1500 | 1 | 20 |
| Total | 5 | 100 |
| Mean = ₦ 1,560 | | |
| Expenditure on organic and inorganic fertilizer (₦) | Frequency | Percentage (%) |
| < 6000 | 1 | 14.3 |
| 6,001 – 10,000 | 5 | 71.4 |

| | | |
|-----------------------|----------|------------|
| 10,001 – 15,000 | 1 | 14.3 |
| Total | 7 | 100 |
| Mean = ₦ 7,500 | | |

Table 6: Duncan Test for Significant Difference in the Fertilizer Expenditure, Net Farm Returns, and Quantity of Fertilizers among users of Inorganic, Organic Fertilizer and Both

| Fertilizer Type | Expenditure | Net Farm Returns | Quantity of fertilizer |
|------------------------------|--------------------|---------------------|------------------------|
| Organic | 1550 ^c | 368000 ^a | 556.26 ^a |
| Inorganic | 14000 ^a | 218000 ^b | 462.50 ^a |
| Both (Organic and Inorganic) | 11000 ^b | 218000 ^b | 300.00 ^b |

The alphabets along the column indicate statistically significant difference in mean quantities of the different column titles for the fertilizer categories at P < 0.05.

Table 7: Multiple linear regression to estimate the determinants of fertilizer use by respondents

| Variable | Coefficient | Standard error | Z value |
|-------------------------|-------------|----------------|-----------|
| Constant | -10775.657 | 4865.600 | -2.215** |
| Sex | 3939.886 | 1795.580 | 2.194** |
| Age | -84.052 | 65.501 | -1.283 |
| Household size | 340.538 | 296.178 | 1.150 |
| Farm size | -38.974 | 702.089 | - 0.056 |
| Formal education | 441.431 | 129.787 | 3.401*** |
| Farming experience | 159.888 | 54.635 | 2.927*** |
| Fertilizer type | 2794.987 | 1430.260 | 1.954* |
| Fertilizer quantity | 11.290 | 3.777 | 2.989*** |
| Extension visit | 309.197 | 178.020 | 1.737* |
| Land tenure status | 5130.716 | 1817.360 | 2.823*** |
| Credit access | 1463.233 | 1169.551 | 1.251 |
| Farm Income | -0.010 | 0.003 | -3.300*** |
| R ² | 0.528 | | |
| Adjusted R ² | 0.467 | | |
| F | 8.670*** | | |

***Significant at 1%, **Significant at 5%, *Significant at 10%

DISCUSSION

Farming in the study area was male dominated and the farmers were in their economic active age. They had an appreciable level of formal education and could be regarded as enlightened farmers. Their average farming experience was 24 years, household size of between 6 – 12 years and majority were members of a cooperative

society. Furthermore, majority cultivate small holding of less than 1hectare of farm land and owned these farm land. This land tenure status is a likely incentive for farmers to invest in soil fertility improvement activities such as the use of fertilizers and other soil conservation measures.

The respondents practice mixed cropping as shown in Table 3. The crop mix shows great diversity in the arable crop resources in the study area. There were two sole cropping scenarios and about fourteen multiple cropping scenario. Maize featured prominently in the crop combination and would require massive fertilizer use to increase its yield. These crops helped to sustain the household of respondents while the marketable surpluses were sold and the cash income were used to meet other household needs.

Table 4 shows that farmers procure most of the fertilizer through the open input market. This applied mainly to inorganic fertilizers. The main organic fertilizer was poultry droppings and was purchased from poultry farms. Furthermore inorganic fertilizers were still the most widely used and incur the highest expenditure by farmer while sole organic fertilizer is the least common and incur the least expenditure (Table 5). Farmers using inorganic fertilizer had the highest expenditure and this was significantly different from those that used both, while those who used organic fertilizer had the least cost. These costs were significantly different from one another. In terms of net farm returns, organic fertilizer users had the most promising value ($P \leq 0.05$) while the returns of those that use inorganic fertilizer and both were not significantly different from one another (Table 6). However, no significant difference existed in the quantity of organic and inorganic fertilizer used but existed for those who used both. The absence of a difference in quantity of organic and inorganic fertilizer used may be due to the bulkiness of organic fertilizer but the difference in expenditure clearly indicates a relative preference for inorganic compared to organic fertilizer.

Result of the multiple linear regression shows that sex, level of education, farming experience, fertilizer type, fertilizer quantity, extension visits, and tenure, are significant and positively related to farmers' expenditure on fertilizer. However, annual farm income was significant and negatively related. The results implied that there was male dominance in fertilizer use and suggest the need to make gender consideration a

priority in fertilizer procurement, more importantly in the present era where women's relevance is increasing in agriculture. Level of formal education has been shown to positively influence fertilizer use in several studies (Olwande *et al.*, 2009, Amanze *et al.*, 2010, and Otunaiya *et al.*, 2012). Formal education puts the farmer in a position to take advantage of information that can assure him access to fertilizer and because of his education he is positive influenced to expend money on fertilizer. Years of farming experience also has similar influence as level of formal education. More experienced farmers are more influenced to expend more on fertilizer due to the positive and significant contribution of fertilizer to their crop output over the years. The result shows a strong marginal relationship between expenditure on fertilizer and quantity and type of fertilizer used. Both variables have strong positive increasing effects on expenditure on fertilizer by farmers and suggest that a substantial proportion of farm expenditure will be on this input. It also confirms the need to make both organic and inorganic fertilizers available in good quantity. Results also shows positive increasing relationship between expenditure on fertilizer and frequency of extension visits similar to the result obtained by Akpan and Aya (2009) in the study of the determinants of fertilizer demand. This result show the importance of extension visit which among other things will provide farmers with information on access to fertilizer, specific fertilizer requirements based on individual soil need and the knowledge on fertilizer application. In the case of land tenure, the positive relationship is probably influenced by the fact that majority of the farmers own their farmland or have permanent title to the land. This condition provided a necessary security that encourages farmers to invest on soil improving materials. This will help to reverse the slow growth rate of food production which Ogunmola (2007) attributed to declining soil fertility. Government at all levels may need to introduce policies to improve agricultural land security to increase fertilizer use by farmers and consequently increasing crop productivity.

Furthermore, the negative relationship showed between annual farm income and annual expenditure on fertilizer is difficult to explain. The rationale for this may be that big farms may show some reluctance to invest too much on fertilizer because of the huge proportion fertilizer will represent in the total farm expenditure. For this category of farmers, access to timely credit or subsidized fertilizer might be away to address this challenge. Finally, the adjusted R^2 shows that 46.7 percent of the variation in fertilizer expenditure was jointly explained by the explanatory variables while the significant F value indicates that the regression line had a good fit.

CONCLUSION

The study showed that both farm and non-farm factors influence expenditure on fertilizer by farmers in Osun State. Sex, level of education, farming experience, fertilizer type, fertilizer quantity, extension visits, tenure, were significant and positively related to farmers' expenditure on fertilizer while age and annual farm income were significant and negatively related. Also the less bulky nature of inorganic fertilizer gave it more preference over organic fertilizer and the use of both, when expenditure on them was considered.

Based on the findings of the study it is recommended that any fertilizer support programme from government should be designed across gender line so that farmer of both sexes will have equitable access to fertilizer. There is need for government to acquire agricultural land and lease out on long term to farmers thereby increasing land security. It is important that some level of subsidy on fertilizer is still maintained to make it more affordable with farmers with large farms.

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