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Determinants of participation in fertilizer subsidy programme among rice farmers in Ogun State, Nigeria

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Nigerian farmers, including rice farmers, still record very low levels of fertilizer use thereby limiting productivity. Subsidies have been known to encourage fertilizer use among farmers. This paper examined the factors influencing rice farmer participation in the government's fertilizer subsidy programme. Data was collected through the aid of a well-structured questionnaire from 263 rice farmers. Descriptive and Logistic regression analyses were used to analyze the data. Statistical mean differences were found in age, household size, years of farming experience, farm size, output and total annual income between participants and non-participants. Also, participation was significantly and positively influenced by marital status, household headship, membership of farmer association/groups, motorcycle ownership, mobile phone ownership, access to credit and total farm size. The paper concludes that efforts should be geared towards encouraging membership of farmer groups, availability and timely distribution of subsidized fertilizer and the establishment of more redemption centres.

Key words: Fertilizer, growth enhancement scheme (GES), participation, rice, subsidy.

INTRODUCTION

Increased fertilizer use played a significant role in the success of the green revolution in Latin America and Asia. It helped raise agricultural productivity and farm incomes, thus laying the foundation for broader economic growth. As much as 50% of yield growth in these regions could be attributed to increased fertilizer use (Toenniessenn et al., 2008). Despite the growing evidence that fertilizers can substantially increase yields in Sub-Saharan Africa (SSA) as well as slow down soil degradation, farmers in SSA still lag far behind other developing countries in fertilizer use. The average fertilizer use in Sub-Saharan Africa (SSA) is estimated at 16 kg/ha; much lower than other parts of the world with 90 kg/ha in Middle East and North Africa, 126.6 kg/ha in North America, 127.9 kg/ha in Latin America and Caribbean, 158.5 kg/ha in South Asia and 344.3 kg/ha in East Asia and Pacific. In Nigeria, the fertilizer use was estimated at 4.5 kg/ha in 2002 and 10.9kg/ha in 2014, below the average for SSA (World Bank, 2014).

Furthermore, the results of a Food and Agricultural Organization (FAO) study spanning 1983-2000 along with some other studies (FAO and ITPS 2015, Sheldrick and Lingard, 2004; Lesschen et al., 2003; Stoorvogel and Smaling, 1990) which assessed soil nutrients (Nitrogen,

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Phosphorus and Potassium-NPK) balances by land use systems revealed a general depletion in Africa characterized by annual negative nutrient balances. For Nigeria, the nutrient balances were -34 kg/ha in 1983 and -37 kg/ha in 2000 for N; -4 kg/ha in 1983 and -4 kg/ha in 2000 for P; and -24 kg/ha in 1983 and -31 kg/ha in 2000 for K. These figures are indicative of unrelenting nutrient mining over time (Bationo et al., 2012). The gap in fertilizer use in SSA and Nigeria relative to the rest of the world is given as one reason for the failure of the region to achieve its green revolution objectives. This failure raises the question of what types of policies and programme are needed for the region to realize the potential benefits from fertilizer usage (Kelly, 2006).

In 2006, African leaders in the context of the Comprehensive Africa Agriculture Development Programme (CAADP) through the Abuja Declaration resolved to improve the use of fertilizer as a means to achieving the region's green revolution objectives. As a follow up, the Federal Government of Nigeria (FGN) decided to disengage from direct procurement of fertilizer in favor of promoting private sector participation. This was done via the Growth Enhancement Support (GES) Programme; a fertilizer subsidy programme under the Agricultural Transformation Agenda (ATA) which set ambitious goals of increasing fertilizer use from the year 2010 level of approximately 13 to 50 kg/ha (FMARD, 2011). The GES was different from previous subsidy schemes in that it targeted beneficiaries through vouchers and the handing over of subsidized fertilizer distribution from the government to private dealers. This contrasts with previous subsidy schemes in which the government directly participated in the procurement and distribution of subsidized fertilizer through the agricultural development project (ADP) and other agencies (IFPRI, 2012).

In 2011, the Nigerian government made an effort to find a long-lasting solution to the problem of food insecurity by raising agricultural productivity and boosting food production. In order to achieve this objective, the Agricultural Transformation Agenda was launched in the same year. This was anchored on the philosophy of treating agriculture as a business rather than a development programme. The goal was to add 20 million metric tonnes (MT) of food to domestic food supply and create 3.5 million jobs by year 2015.

The GES Programme was designed as a component of the Agricultural Transformation Agenda of the Federal Government (ATA). The Federal Government of Nigeria introduced the GES which was designed to deliver government subsidized farm inputs directly to farmers via mobile phones. The GES scheme was powered by e-Wallet, an electronic distribution channel which provided an efficient and transparent system for the purchase and distribution of agricultural inputs based on a voucher system. The scheme guarantees registered farmers e-Wallet vouchers with which they could redeem fertilizers, seeds and other agricultural inputs from agro-dealers at half the cost, the other half being borne by the federal government and state government in equal proportions (FMARD, 2011). Individual farmers were registered in a national database. Each farmer was entitled to a 50% subsidy on the price of two 20 kg bags of fertilizer. This intervention became necessary as a result of the crisis that riddled the agricultural sector in the past, given its critical role for food security and economic diversification.

On inception, the aims of the GES was to migrate smallholder farmers from subsistence farming to commercialized systems over a 4 to 10 year period in order to facilitate trade and competitiveness. According to Takeshima and Liverpool-Tasi (2013), the potential in the fertilizer subsidy reform under the ATA include improved targeting through voucher and crowding-in of the commercial fertilizer sector. By June 2014, agricultural productivity and food production had increased by 17 million MT and was expected to reach 21 million MT by the end of the year and exceed the 20 million MT target set for 2015. However, challenges remain in farmer access to redemption facilities, entitlement risk (mobile phone), fertilizer quality regulation and the speed at which the private sector respond. Generally, fertilizer demand still depends on broader agricultural policies, factor endowments and farming systems.

The Federal Government under the current administration has decided to build on the achievements of the ATA by launching a new strategy known as the Agricultural Promotion Policy (APA). The plan is to solve the problems associated with the previous attempt at ensuring an efficient fertilizer distribution system. Therefore, the current policy objective is to increase productivity by ensuring timely access to high quality and price competitive inputs (FMARD, 2016). Thus, encouraging more farmer participation in the program is key to the policy success.

This study seeks to contribute to existing literature on the factors responsible for participation in the fertilizer subsidy programme. In order to achieve this, answers were provided to the following questions:

1. What differences exist in rice farmers' characteristics by their level of participation in the fertilizer subsidy programme?
2. What factors influences the participation of farmers in the fertilizer subsidy programme in the study area?

MATERIALS AND METHODS

Descriptive statistics

Descriptive statistics include the use of frequencies, percentages, means and standard deviation to analyze the socio-economic characteristics of respondents. It was also used to describe the reasons for the non-receipt of subsidized fertilizer.

Empirical estimation

The decision whether or not to participate in the fertilizer subsidy

programme can be explained as a discrete binary variable, 1 for participants and 0 for non-participants. The simplest possible binary regression model is the linear probability model (LPM) in which the binary response variable is regressed on the relevant explanatory variables by using the standard Ordinary Least Square (OLS) methodology. However, it suffers from several estimation problems; one of which is that it can produce predicted probabilities outside the (0; 1) bounds (Gujarati, 2004). Other appropriate models that can be used are logit and probit. Logit and probit models usually yield similar results. Hence; the choice is not too critical, even though the logit distribution has more density mass in the bounds. Estimating participation is to define an adequate measurable indicator that will distinguish between participants and non-participants.

A binary variable indicates whether or not the farmer participates in the programme. When one is interested only in comparing outcomes for those participating (T = 1) with those not participating (T = 0), this estimate can be constructed from a probit or logit model. In this study, a participant is defined as a rice farmer that has received subsidized fertilizer in the last rice production season. The sample of participants and nonparticipants was pooled, and then participation T was estimated on all the observed covariates X in the data that are likely to determine participation. Traditional instruments used in the literature include the distance between the farm and the fertilizer selling points, or social capital proxied by how long the farmer has lived in the community (Seck, 2015). The vector of explanatory variables includes farm characteristics that may influence the probability of getting subsidized fertilizer such as farm size, access to credit, mobile phone ownership, and ownership of a means of transportation and affiliation to farmers' union.

In this analysis, participation (Z) is defined as the dependent variable which takes the value of 1, if a rice farmer participates in the fertilizer subsidy programme and 0, otherwise, that is, $Z = 1$, if a rice farmer participates in the fertilizer subsidy programme and $Z = 0$, otherwise. The logistic model postulates the probability (P_i) that participation is a function of an index $(Z_i)$where:

(Z_i) is an inverse of the standard logistic cumulative function of P_i that is, $P_i(y) = f(Z_i)$; (Z_i) is also an inverse of the standard logistic cumulative function of P_i:

$$P_i\ (y = 1) = f\ (Z_i)$$

The probability of participation is given by:

$$P_i\ (y = 1) = \left(\frac{1}{1+e}\right) - Z_i \quad (1)$$

e represents the base of natural logarithms (2.718).

The probability of no participation is given by:

$$Q_i = (y = 0) = 1 - P_i\ (y = 1)$$

Since, $1 - P_i\ (y = 1) = 1 - \frac{1}{1+e^{-Z_i}}$; $1 - P_i\ (y = 1) = \frac{1+e^{-Z_i}}{1+e^{-Z_i}} - 1\ and\ \ 1 - P_i\ (y = 1) = \frac{e^{-Z_i}}{1+e^{-Z_i}}$

But,

$$\frac{1}{P_i\ (y=1)} = 1 + e^{-Z_i} \quad (2)$$

Thus: $\frac{P_i(y=1)}{1-P_i(y=1)} = \frac{1}{e^{-Z_i}}$ and

$$\frac{P_i(y=1)}{1-P_i(y=1)} = e^{Z_i} \quad (3)$$

We take as comparison category, farmers who did not participate in the fertilizer subsidy programme. This means that the changes in relative risk will represent the improvement of a non-participating rice farmer given the impact of a specific variable.

The explanatory and dependent variables that were used in the econometric model (logit) are defined as follows:

$$\ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_m X_m + \varepsilon \quad (4)$$

Where, Z_i = Participation (1 = participants, 0 = non-participants); X_1 = Age in years; X_2 = Marital status (1 = single, 2 = married, 3 = divorced, 4 = widowed); X_3 = Household headship (0=female, 1=male); X_4 = Farming experience in years; X_5 = Years of education; X_6 = Ownership of a means of mobility (motorcycle) (1=Yes, 0=No); X_7 = Ownership of a mobile phone (1 = Yes, 0 = No); X_8 = Access to credit (1 = Yes, No = 0); X_9 = Membership of farmers' association/group (1 = Yes, 0 = No); X_{10} = Total farm size (in hectares); X_{11} = Ownership of land (1 = Personal, 0 = otherwise) and ε = Error term.

Data collection

This study was carried out in Ogun State in the South-Western geo-political zone of Nigeria. The state has 21 Local Government Areas (LGAs) and a projected population of 4,424,066 (NPC, 2011). The state is located in the moderately hot, humid tropical climate zone of Southwestern Nigeria and it favours the production of food crops such as maize, cassava, yam, cocoyam, soybean and rice. The major occupation of the people is farming (OGADEP, 2015). There are four Agricultural Development Project (ADP) zones in the state as categorized by the Ogun State Agricultural Development Project (OGADEP) namely Ilaro, Ijebu-Ode, Abeokuta and Ikenne zones. Thus, a peculiar nature of OGADEP is that zones are further divided into blocks and cells.

The data for the study was collected in 2015 through the use of structured questionnaires by employing a multi-stage sampling technique. Three agricultural zones were purposely selected from a total of four due to the availability of rice farmers who participated in the fertilizer subsidy programme. They are Abeokuta, Ikenne and Ilaro zones. The second stage involved the random selection of three local government areas from the selected zones, these included Ewekoro (Abeokuta Zone), Obafemi Owode (Ikenne Zone) and Yewa North (Ilaro Zone). Next, cells were randomly selected in each of the zones. Lastly, a total of 270 questionnaires were distributed to the farmers; 263 were used for analysis consisting of 113 and 150 participating and non-participating farmers respectively.

RESULTS AND DISCUSSION

Socioeconomic characteristics of participating and non-participating farmers

The description of farmer characteristics is presented in Table 1 and it reveals that both groups (participants and non-participants) have similar characteristics with only slight differences recorded. Rice farming was a male dominated activity in the study area.

Generally, there were more households headed by males than females participating in the programme. Most of the farmers were middle-aged, economically active and productive with a mean age of forty six years. The implication of this is that they are still within the

Table 1. Socio-economic characteristics of rice farmers (n=263).

Variable	Participants	Non-participants	Mean difference
Sex			
Male (%)	82.30	82.67	
Female (%)	17.70	17.33	
Age (mean)	47.92	44.80	3.12***
Household size (mean)	5.58	5.11	0.46*
Years of education (mean)	5.92	6.36	-0.44
Years of farming experience (mean)	24.98	22.33	2.66**
Rice farm size in *ha* (mean)	1.726	1.448	0.28***
Output in kg (mean)	2022.57	1526.60	495.97***
Total annual income (mean)	542,272.56	367,800.00	174472.57***

Source: Field Survey, 2015. *, **, *** implies that coefficients are statistically significant at 10, 5 and 1%, respectively.

productive class. According to Okoruwa and Ogundele (2004), being in the productive class would have a positive effect on rice production in the country. There was a significant difference in the mean ages of participants and non-participants with the average age of the participants higher than that of the non-participants.

The average household size for both groups is between five and six persons per farming household. This closely follows Okoedo-Okojie and Onemolease (2009) finding that larger household size of participants could imply that they have enough free labour for farm activities. A significant difference occurs between the mean household sizes of both groups of farmers at the 10% level.

A majority of the farmers spent an average of six years in school. There exists no significant difference in the number of years spent by farmers in school. This is consistent with the results of Azhar (1991) who reported that elementary education (4 - 6 years of schooling) does not have much effect on agricultural productivity in traditional farm settings. Other authors who lend support to this notion include Bravo-Ureta and Evenson (1994), Ajibefun and Aderinola (2003) and (Okoruwa et al., 2006).

With respect to the farm characteristics of the farmers, the average years of farming experience for participants was found to be significantly higher than that of the non-participants. There was also a significant difference in the farm size allocated to rice production between both groups of farmers with the participants having the larger sizes. This could also encourage the participating farmers to access more input for usage on their farms. Table 1 also shows that the mean output were about 2,023 and 1,527 ha for participants and non-participants while the total annual income for both groups were about ₦542,272.56 and 367800, respectively.

Factors affecting participation in the fertilizer subsidy programme

This section reports the results from the binary logistic model used to evaluate the determinants of participation of rice farmers in the fertilizer subsidy programme. The result of the regression analysis is presented in Table 2. The diagnostics reveal the model has a log likelihood of 158.59 and a chi-square statistics of 42.18; which is significant at 1%. This shows that the model is a good fit for the data. Seven of the eleven variables were statistically significant. All of the significant variables have positive signs. The variables are marital status (married), household headship (male), ownership of motorcycle, ownership of mobile phone, access to credit, membership of farmers' association/groups, and total farm size; positively associated with the probability of participation in the subsidy programme.

The coefficient of marital status (married) is significant at 5%. Thus a 1% increase in the number of married farmers may likely increase the likelihood of famers' participation by 0.53%.

With respect to household headship, the coefficient is significant and positively influences the probability of participation. Households headed by females were less likely to have received a coupon in the sample than those headed by males (consistent with the results of Chibwana et al., 2010). The marginal effect result implies that a 1% increase in the number of male headed households is likely to increase the probability of participation by about 0.43%.

The coefficient for the ownership of a means of transportation (motorcycle) was positive and statistically significant at 10%. Redemption centres are usually some kilometers away from the farmers residence, therefore, a motorcycle increases the probability of participating in the programme. This result is consistent with the study of Takeshima and Liverpool-Tasie (2013) which reported that farmers who lived closer to town are more likely to receive subsidized fertilizer. In this case, ownership of motorcycle could get a farmer to town in a timely manner. The result of the marginal effect reveals that a 1% increase in the ownership of motorcycle increases the probability of participation increases by 0.13%.

Table 2. Logit regression result of factors influencing participation in the fertilizer subsidy programme.

Variable	Coefficients (Std. Error)	t-value	Marginal effect
Age	0.0231 (0.0208)	1.11	0.0055
Marital status	2.2237** (1.0380)	2.14	0.5333
Household headship	3.3094*** (1.9778)	1.67	0.4251
Years of farm experience	-0.0023 (0.0171)	-0.13	-0.0005
Years of education	-0.0232 (0.0360)	-0.65	-0.0056
Ownership of motorcycle	0.5581* (0.2910)	1.92	0.1327
Ownership of mobile phone	1.4307*** (0.6865)	2.08	0.2745
Access to credit	0.7732** (0.3277)	2.36	0.1891
Membership of farmers' association	0.5063* (0.2920)	1.73	0.1191
Total farm size	0.1000*(0.0538)	1.86	0.0240
Ownership of land	-0.1394 (0.2974)	-0.47	0.0336
Constant	-11.3470*** (4.1236)	-2.75	

Source: Generated by Authors using Stata. *, **, *** implies that coefficients are statistically significant at 10, 5 and 1%, respectively. Number of observation = 263; LR chi^2 (13) = 42.18; Prob> chi^2 = 0.0000; Log likelihood = -158.59451; Pseudo R^2 = 0.1174.

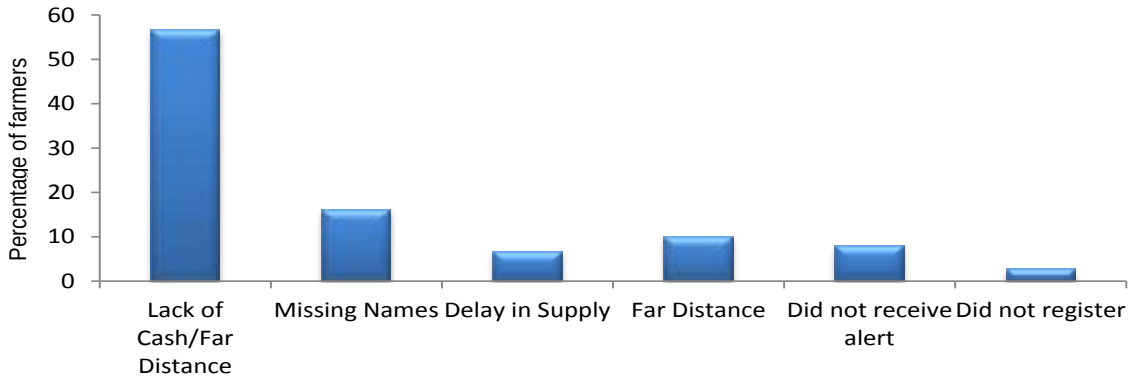

Figure 1. Reasons for non-receipt of subsidized fertilizer. Source: Field Survey, 2015.

With respect to the ownership of a mobile phone, there exists a positive and significant relationship between the variable and participation. One of the main components of the GES was that farmers must own mobile phones through which they can be alerted to retrieve their voucher. Therefore, this result is consistent with the objective of the programme as the marginal effect has shown that a 1% increase in the ownership of mobile phone was likely to increase the probability of participation increases by about 0.27%.

Access to credit also has a positive and significant relationship with participation. It is expected that a farmer might be encouraged to take advantage of the subsidy to relieve the burden of the credit facility. The result of the marginal effect shows that there is a likelihood of about 0.19% to participate in the subsidy programme with every 1% increase in access to credit facility.

Furthermore, the coefficient of the membership of a farmer association has a positive and significant effect on participation. This result is consistent with the studies of Ricker Gilbert and Jayne (2008) and Liverpool-Tasie (2012) which reported that social networks increases the probability of participation. Also, the result of the marginal effect reveals a 0.20% likelihood of a socially connected farmer to participate in the fertilizer subsidy programme.

Lastly, farm size has a positive and significant coefficient. It is expected that the bigger the farm, the more inputs that are needed to sustain production. Therefore, it provides an incentive for the farmer to take advantage of cost reduction in form of a subsidy. The result of the marginal effect shows that a 1% increase in farm size induces a 0.02% likelihood that a farmer participates in the subsidy programme.

Reasons for non-receipt of subsidized fertilizer

Figure 1 show the distribution of reasons why farmers did not participate in the fertilizer subsidy programme. About 57% of the farmers could not receive subsidized fertilizer

either due to lack of cash/long distance, 16% because of missing names, 10% because of long distance and about 7% because of delay in supply. Also, 8% of the farmers did not receive an alert to redeem their vouchers while about 3% did not register.

Conclusion

This study investigated the factors/determinants responsible for rice farmer participation in the fertilizer subsidy programme using Ogun State of Nigeria as a case study. There exist statistical mean differences in age, household size, farming experience, farm size, output and total annual income between participants and non-participants. Also, the factors which significantly influence participation include marital status (married), household headship (male), ownership of a means of mobility (motorcycle), mobile phone ownership, access to credit, membership of farmers' association and total farm size. The study hereby recommends that Stakeholders (government and the private sector) should ensure the establishment of more redemption centres or make available means of mobility for farmers. Also, membership of a farmer association and other social groups should be encouraged to avoid information asymmetry. In addition, availability and timely delivery of fertilizer should be ensured to avoid farmer apathy towards the programme.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Ajibefun IA, Aderinola EA (2003). Determinants of Technical Efficiency in Traditional Agricultural Production: Application of Stochastic Frontier Modeling to Food Crop Farmers in South-Western Nigeria. AJEP. 10(2):31-56.

Azhar R (1991). Education and Technical Efficiency during the green revolution in Pakistan. Econ. Dev. Cult. Change 39:651-665.

Bationo A, Waswa B, Kihara J, Adolwa I, Vanlauwe B, Saidou K (2012). Lesson learned from long-term soil fertility management experiments in Africa. Springer Life Sci. Agric. http://www.springer.com/gp/book/9789400729377.

Bravo-Ureta BE, Evenson RE (1994). Efficiency in agricultural production: the case of peasant farmers in eastern Paraguay. Agric. Econs. 10: 27-37.

Chibwana C, Fisher M, Jumbe C, Masters W, Shively G (2010). Measuring the Impacts of Malawi's Farm Input Subsidy Programme. Paper presented at the 2010 annual meeting of the African Association of Agricultural Economists in Cape Town, South Africa. http://ssrn.com/abstract=1860867.

FAO, ITPS (2015). Food and Agricultural Organization of the United Nations and Intergovernmental Technical Panel on Soils, Rome, Italy. Status of the World's Soil Resources (SWSR) – Main Report.

FMARD (2011). Federal Ministry of Agriculture and Rural Development. Agricultural Transformation Agenda: Blueprint on Agriculture and Rural Development; A Presentation to the National Economic Management Team by the Honourable Minister of Agriculture and Rural Development, Abuja, Nigeria.

FMARD (2016). Federal Ministry of Agriculture and Rural Development. The Agricultural Promotion Policy. Building on the Successes of the ATA, Closing Key Gaps. Policy Strat. Document P 5.

Gujarati DN (2004). Qualitative Response Models in Basic Econometrics, African Edition 15:541-591.

IFPRI (2012). International Food Policy Research Institute-Africa Lead Report on Assessment of Nigeria Agriculture Transformation Agenda (ATA) and Capacity Building Needs. Africa Leadership Training and Capacity Building Programme.

Kelly VA (2006). Factors Affecting Demand for Fertilizer in Sub-Saharan Africa. Agriculture and Rural Development Discussion Paper 23. Washington, D.C.: The World Bank.

Lesschen JP, Asiamah RD, Gicheru P, Kanté S, Stoorvogel JJ, Smaling EMA (2003). Scaling Soil Nutrient balances. Rome, FAO.

Liverpool-Tasie LSO (2012). Targeted Subsidies and Private Market Participation. An Assessment of fertilizer demand in Nigeria. IFPRI Discussion Paper 01194.

NPC (2011). National Population Commission. Projected Population (2008 – 2011).

OGADEP (2015). Ogun State Agricultural Development Programme. Annual Report.

Okoedo-Okojie DU, Onemolease EA (2009). Factors affecting the adoption of yam storage technologies in the Northern Ecological zone of Edo State, Nigeria. J. Hum. Ecol. 27(2):155-160.

Okoruwa VO, Ogundele OO (2004). Technical efficiency differentials in rice production technologies in Nigeria. World J. Agric.Sci. 3(5):53-58.

Okoruwa VO, Ogundele OO, Oyewusi BO (2006). Efficiency and productivity of farmers in Nigeria: A study of rice farmers in North Central Nigeria. Poster paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia P 12.

Ricker-Gilbert J, Jayne TS (2008). The Impact of Fertilizer Subsidies on National Fertilizer Use: An Example from Malawi, Paper presented at the American Agricultural Economics Association Annual Meeting, Orlando, FL.

Seck A (2015). Fertilizer Subsidy and Agricultural Productivity in Senegal. Department of Economics Cheikh Anta Diop University Dakar, Senegal.

Sheldrick WF, Lingard J (2004). The use of nutrient audits to determine nutrient balances in Africa. Food Policy Vol. 29(2):61-98.

Stoorvogel JJ, Smaling EMA (1990). Assessment of Soil Nutrient Depletion in Sub-Saharan Africa: 1983-2000. Main Report, 2nd Edition. Winand Staring Centre, Wageningen. Netherlands 1:28.

Takeshima H, Liverpool-Tasie LSO (2013). Fertilizer subsidy, political influence and local food prices in sub-Saharan Africa: Evidence from Nigeria. Selected paper prepared for presentation at the Agricultural and Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4-6, 2013.

Toenniessenn G, Adesina A, DeVries J (2008). Building an Alliance for a Green Revolution in Africa. Annals of the New York. Acad. Sci. 1136:233-242.

World Bank (2014). Fertilizer Consumption (kilograms per hectare of arable land). Food and Agricultural Organization, electronic files and web site.