MARKETS AND RURAL SERVICES AS DETERMINANTS OF IMPROVED SEEDS USAGE BY CROP FARMERS IN OSUN STATE, NIGERIA

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ABSTRACT

The use of improved inputs has been associated with a substantial increase in agricultural growth in Nigeria. Farmers often revert to the markets for input procurements. This paper examines the role of markets and other rural services on the use of improved seeds by crop farmers. Data were collected from 270 farming households in Osun State of Nigeria using a Multistage sampling technique. Data collected were analysed using descriptive statistics and the logistic model. The results obtained show that households' access to input market information and other rural services such as extension, and rural credit; as well as socio-economic characteristics of farmers significantly influence the probability of use of improved seeds. To this end, it was recommended that aggressive market infrastructural development and improvement in rural services delivery are critical to the improved seed policy of the government.

Key Words: Extension, improved seed, market price, rural credit access

RÉSUMÉ

L'utilisation des intrants améliorés a été associée à une augmentation substantielle de la croissance agricole au Nigeria. Les fermiers font souvent recourt au marché pour s'en procurer. Cet article examine l'impact des marchés et autres services ruraux sur l'utilisation des semences améliorées par des fermiers. Deux cents soixante dix ménages étaient sélectionnés dans l'Etat d'Osun au Nigeria par la technique d'échantillonage à niveaux multiples. Les données collectées étaient analysées par la statistique descriptive et le modèle logistique. Les résultats obtenus montrent que l'accès des ménages à l'information sur le marché des intrants et autres services ruraux tels que la vulgarisation, le crédit rural ainsi que les caractéristiques socioéconomiques qui influencent la probabilité d'utilisation des semences améliorées. A cet effet, un effort dans le développement des infrastructures de marché et une amélioration des services agricoles sont recommendés eu égard à la politique gouvernementale sur les semences améliorées.

Mots Clés: Vulgarisation, semences améliorées, prix du marché, accès au crédit rural

INTRODUCTION

The key to renewed growth in the agricultural sector, and hence to general economic growth and poverty reduction is rapid technological change in food production and preservation (Green and Ng'ong'ola, 1993; Scoones, 2000; Adejobi *et al.,* 2005). Also, the use of appropriate farm inputs such as chemical fertilisers, pesticides, improved seeds, and farm machinery induces a productivity increase which in turn facilitates a rise in farmers' income and overall economic development. The adverse food situation in Nigeria about four decades ago was a phenomenon brought about by the poor technology of traditional agriculture, which also weighed against attempts to increase food production (Ogunfowora *et al*., 1975). The food

situation, however, has not witnessed any significant improvement, in spite of several breakthroughs in the area of improved farm inputs. This has been attributed to low demand for and consumption of improved inputs in most developing countries and particularly Nigeria (Orlu, 1992; Adejobi, 2004). An overwhelming majority of small-scale farmers still rely on crude inputs, mostly land and human labour. Chemical fertilisers and improved varieties of seeds are often less used by these crop farmers (Brossier, 1991; Green and Ng'ong'ola, 1993; Kormawa et al., 2004). Studies have shown that some socioeconomic characteristics of farmers, a faulty distribution system, unavailability of suitable hybrids for specific agro-ecological zones, and inadequate extension services and other rural services, among others affect the farmers' demand for improved inputs (Orlu, 1992; Green and Ng'ong'ola, 1993; Kormawa et al., 2004; Adejobi, 2012).

Seed is basic to production and makes a major contribution to agricultural productivity. However, no crop cultivar is of value to farmer unless its seed is available in the right place, at the right time and in adequate quantities (Falusi and Adubifa, 1975; Diamini, 1976; FAO, 1978; Manyong et al., 2005). It was further revealed that officially recognised channels for multiplication and distribution of improved seeds are in place in Nigeria, but improved seeds are not yet available to farmers in sufficient quantities. The most important reasons for this were that the seed multiplication and distribution systems are inefficient, and also the farmers could not pay for input out of their meager savings (George, 1989; Omaliko, 2000). This led to the evolution of different agricultural policies and programmes aimed at making this input more accessible to the farmers. Important among these policies is the subsidising of input prices by the government, which expectedly was to stimulate the demand and consumption of these inputs in addition to the reduction in the cost of production (Diamini, 1976; Manyong et al., 2005; Adejobi, 2012). Another policy adopted was the establishment of National Agricultural Institutes, saddled with the responsibility of breeding crops and others with a similar responsibility of seed multiplication. Also, the government embarked on importation of improved farm inputs (Manyong et al., 2005). These measures seemed not to yield desired results, thus giving room to the development of other special agricultural programmes such as the River Basin Development Authorities (RBDAs) and the State Agricultural Development Programs (ADPs); with a view to providing these inputs at a "cheaper" rate, while ensuring timely supply and provision of extension services to the farmer (FMAWR, 2008). With all these measures, much is still left to be achieved in terms of improved seed availability to farmers.

Recently, seed demand for Nigeria was estimated at about 814,420 tonnes; this ranks among the highest in the sub-Saharan Africa. Currently, there are only a few seed producing facilities in the country (FMAWR, 2008). These have left farmers to often rely on own production and markets for the supply of their inputs. These trends call for urgent intervention strategies to avert impending food insecurity in the country.

This paper analyses the demand and consumption of improved seeds by crop farmers in Osun State as influenced by market access and other rural services with a view to suggesting ways of improving input distribution and enhancing agricultural production as well as farmers' income and welfare.

MATERIALS AND METHODS

Theoretical framework. The demand for a factor of production is treated as a derived demand, as it is derived from the demand for the product (Dunn and Hein, 1985). Due to this derived nature of demand for farm inputs, agricultural development and growth may be studied either through the change in farm production and productivity, or through the change in demand for various farm input. Thus, the demand for improved seeds is based on the theory of input demand because this is a highly divisible farm input. The aggregate demand for an input by crop farmers is simply the sum of the demand by individual farm-firm. Hence, firm theory, which explains the behaviour of the average firm, forms the basis for deriving the demand function and explaining the aggregate behaviour. The firms' demand for input shows the relationship between

the quantity of input, which the firm is willing and able to purchase at the various price levels of the input.

Considering a case of only one input flow in which a current resource can be varied within the production period; the production function of a representative firm can be written as:

$$Q = f\left(X_1 / X_2 --- X_n\right) \dots\dots\dots\dots (1)$$

Where,

Q= Flow of output

X_1=current input and

X_2— X_n=fixed input.

To maximise profit, the firm should operate when the marginal physical product of X_1 (MPP_{X1}) is declining; more specifically when MPP is equal to APP. At this point,

$$MVP_{X1}=MC \dots\dots\dots\dots\dots\dots\dots (2)$$

Due to diminishing marginal physical productivity (MPP) of X_1, Marginal Value Product (MVP_{X1}), declines with increasing X_1. Since a firm's demand curve of an input shows the quantity which it wishes to purchase at the various prices of the input, assuming the representative firm maximises its profit, its demand curve of X_1 is its marginal value product curve for X_1; since it will use a quantity of X_1 that equates the marginal value product of X_1 to its price. The demand curve tells us that the demand for X_1 is related inversely to its price. The extent to which the demand for X_1 changes as a result of a given change in the price will depend on a number of factors including the production use itself and the product prices (Orlu, 1992). The product price is in turn affected by the market and its operators and this makes market more critical in input demand in any production environment.

Apart from the prices of input, several other factors such as the socioeconomic, natural environment, and institutional frameworks, affect the demand for and consumption of inputs such as improved seeds (Orlu, 1992; Christopher *et al.*, 1999).

Study area. Osun State falls within the Rainforest zone of Nigeria; and lies within Latitude 7° and 8° North of the equator and Longitude 4° and 5° East of the Greenwich Meridian. Though the study area has great potentials for the cultivation of almost all types of crops, the most important crops grown in the study area include maize, rice, roots and tubers and perennial crops. The small-scale farmers who cultivate between 0.5 and 2.5 ha constitute about 80% of the farming population in the study area (OSSADEP, 2008). The dominant farming system is mixed cropping. Apart from crop production, tree crop production also occupies a very important position as cocoa and oil palm cultivation are widely practiced.

There are two distinct seasons in the State, namely, the rainy season which lasts from March/April to October/November and the dry season which lasts for the rest of the year, October/November till February/March. Annual rainfall is within the range of 1,000 mm in the derived savannah agro-ecology to 1,200 mm in the rainforest belt (OSSADEP, 2008). The sources of seeds include on farm previous harvest, relatives, local inputs markets, ADP, Research Centers, Private companies (Dugje *et al.*, 2008).

Sampling design and data collection. Data for the study were collected mainly from primary sources, with the aid of questionnaires. According to Osun State Agricultural Development Programme (OSSADEP), the state is divided into three operational zones for administrative convenience - Ife/Ijesa, Iwo and Osogbo. Multistage sampling technique was adopted for data collection. At the first stage, all the zones were purposively selected because of the wide spread of farmers across the State. At the second stage, three Local Government Areas were randomly selected from each of the zones, making 9 Local Government Areas. At the third stage, three villages were randomly selected from each of the nine LGAs, making a total of twenty-seven villages. At the last stage, ten crop farmers were randomly selected from each of the twenty-seven villages giving a total of 270 respondents.

Empirical models. Since the objective of this paper was to analyse the effect of market access and rural services delivery on the use of improved seeds, the following analytical models were developed.

Logistic model. For the input use study, a model was required which reflected the empirically observed status of improved input use on any particular farm. Such observations reflect a dichotomous variable, 'using' or 'not using' input. More often than not, the alternative proposal is to apply linear probability models, but in some cases the probability values may fall outside the 0-1 intervals; thereby violating the basic tenets of probability axioms. The use of probit and logit models, which give maximum likelihood estimators, overcome most of the problems associated with the linear probability models and provide parameter estimators which are asymptotically consistent, efficient and Gaussian so that the analogue of the regression t-test can be applied (Jondrow *et al*., 1982).

For this paper, a Logit function was estimated. Conceptually, the equation below is the improved seed users' behavioral model used to examine the effect of market access and rural services delivery on improved seed usage:

$$Y_i = g(I_i) \dots\dots\dots\dots\dots\dots\dots (3)$$

$$I_i = b_0 + \sum_{j=1}^{n} b_j X_{ji} \dots\dots\dots\dots\dots\dots (4)$$

Where,

Y_i is the observed response for the ith observation (i.e. the binary variable, Y_i=1 for an improved seed user and Y_i=0 for a non-user). I_i is an underlying and unobserved stimulus index for the ith observation (conceptually, there is a critical threshold (I_i^*) for each farmer; if $I_i < I_i^*$ the farmer is observed to be a non-user, if $I_i \geq I_i^*$ the farmer is observed to be a user). g is the functional relationship between the field observations (Y_i) and the stimulus index (I_i) which determines the probability of using improved seeds.

The logit model assumes that the underlying stimulus index (I_i^*) is a random variable, which predicts the probability of using improved seeds. Therefore, for the ith observation (an individual farmer):

$$I_i = \ln\frac{P}{1-P_i} = b_0 + \sum_{j=1}^{n} b_j X_{ji} \dots\dots\dots (5)$$

The relative effect of each explanatory variable (X_{ji}) on the probability of using improved seeds is measured by differentiating with respect to X_{ji}, using the quotient rule (Green and Ng'ong'ola, 1993):

$$\frac{dP_i}{dX_{ji}} = \left[\frac{e^{I_i}}{(1+e^{I_i})^2}\right]\left[\frac{I_i}{X_{ji}}\right] \dots\dots\dots\dots (6)$$

Where,

Pi = the probability of an ith farmer to use or not to use improved seed

X_i	=	Vector of explanatory variables which are defined below:
AGE	=	Age of farmer in years
FARMINC	=	Average farm income of farmers per annum (₦)
PSEED	=	Average price of improved seed (₦/kg)
COTHER	=	Cost of other inputs (₦)
ACRDT	=	Access to credit (D=1, if yes; D=0, otherwise)
COOP	=	Co-operative membership (D=1, if yes; D=0, otherwise)
EDUC	=	Level of education of a farmer (years)
DIST	=	Distance to nearest market (km)
MKIS	=	Access to market information (D=1, if yes; D=0, otherwise)

EXTAG   = Number of extension contacts

A priori behavioural expectations of the variables. The effect of age of the farmer on adoption has been established to be a composite of the effects of farming experience and planning horizon (Lapar and Pandey, 1999). While longer farming experience as synonymous with older farmers is expected to have positive effect on the adoption and intensity of use of improved seeds, younger farmers may have longer planning horizon and may likely invest in land conservation; hence, the behaviour of age as a variable may be difficult to determine a priori. Adesina and Baidu-Forson (1995) found age to be positively related to adoption; while Hoover and Wiitala (1980) found age to be negatively related.

The level of farm income is also expected to be positively related to adoption and intensity of use of improved seeds. The higher the income of a farmer the more the retained income ploughed back into farm operations; therefore, it was hypothesized that farm income is positively related to use of improved seeds.

Education at higher levels may be closely linked to greater information on good farm practices. It has also been found out to positively affect the efficiency of adoption of farm innovations (Rahm and Huffman, 1984). It is, therefore, hypothesized that number of years of farmers education will be positively correlated to adoption and intensity of use of improved farm input.

Membership of a farmers' cooperative society is linked with enhanced access to input supply in terms of financial empowerment to purchase inputs and information sharing among members. Therefore, it is expected that there will be a positive relationship between memberships of farmers' cooperative society and adoption and use of improved seeds. Membership may also facilitate informal training in farm management practices, which may make the variable positively related to adoption and use of improved seeds. Access to input delivery (markets), captured as average distance to market and access to market information, are expected to be positively correlated to the adoption and use of improved

seeds. It is, therefore, hypothesized that reduced distance and availability of information will positively affect the adoption and intensity of use of improved seeds.

Prices of improved seeds and costs of other inputs are expected to be negatively related to adoption and use of improved seeds. The usual high costs of other associated inputs such as fertiliser and herbicide may reduce the probability of adoption and use of improved seed. It is, therefore, hypothesized, that these variables will induce the farmer not to adopt and use more of improved seeds.

The variables capturing rural service delivery include access to extension service and access to rural credit. These two variables are expected to be positively related to the probability of adoption and use of improved input. This would be an indication that improved input usage is dependent on the ability of farmers to access and finance the procurement of such inputs (Orlu, 1992).

RESULTS

Socioeconomic characteristics. From Table 1, the analysis shows that majority of the farmers are middle aged with a mean age of 58 years; 76% of the respondents were above 50 years of age. Only 4% of the respondents were less than 30 years in age. Most farmers were, therefore, in the old age range.

The study further reveals that, typically Osun State farming populations are mostly illiterate; 57.5% of the respondents have had no formal education. The vocational training schemes instituted for mass literacy could reach only 23.5% of the respondents. Male farmers dominate the farming sector in the area with about 84%. The majority of the farmers practiced mixed cropping (90.4%); most have an average of four plots each with a mean size of 0.5 hectares. Only a minority of the farmers sampled (42.5%) belong to one cooperative society or another.

Three major seed sources were the seed industries and agents, ADP, and other sources (e.g., open market). The analysis, however, showed that majority of the farmers (85%) got their inputs from uncertified sources (i.e. the open

markets). Therefore, most of the seeds procured by these farmers might be prone to adulteration, which invariably affects their resource use efficiency as well as farm productivity.

Furthermore, rural services as captured by access to credit, extension agents, distances to major urban markets and availability of markets were found to have tremendous impact on the livelihood of rural households (Scoones, 2000). The distribution of the services in the study area (Table 1) reveals that there is generally low level of access to the services in the study area.

Factors affecting the probability of use of improved seed. The partial derivative of the multinomial Logistic model best fit the model and gives a direct estimate of the probabilities of the factors considered (37.87, P<0.01). Six factors were found to be significant; namely: age of farmer, income of the farmer, and price of seed. Others included access to rural credit, extension contacts and distance to the nearest market. However, cost of other inputs, years of education, membership of cooperative societies, and access to market information had no influence on improved seed adoption and use (Table 2).

TABLE 1. Description of the socio-economic characteristics of respondents

Characteristics	Dominant indicator	Mean value
Gender of household head	About 84% of the respondents are male	-
Age	76% of respondents are above 50 years old	58.00
Level of education	57.5% spent less than 6 years in formal school	1.44
Type of farming	90.4% of the respondents are into mixed cropping on	-
Membership of cooperative societies	42.5% belong to one form of cooperative association or the other	-
Distance to nearest market	47.66% of the farms are 13 Km or more to the nearest market.	8.01
Access to extension services	68.7% had no access to extension services	-
Access to formal credit	82.3% had access to formal credit	-
Access to market information	78.6% of the households did not have access to market information	-
Distance to all weather roads	75.5% of the settlements are 7 Km or less to the nearest all weather road	4.48
Distance to major urban center	75.9% of the farms are 12 Km or more to major urban centers	13.45
Source of input (seed)	85% got their seed from uncertified source (open markets)	-
Number of farm plots owned	88% of the respondents have more than 5 plots	4

TABLE 2. Logit model result on improved seed use

Variables	Estimated parameters	Standard error	z-value
Cons	-6.374	2.452	-2.599**
Age (years)	-0.908×10^{-2}	0.401×10^{-2}	-2.264**
Farming (₦)	0.395×10^{-2}	0.202×10^{-2}	1.955*
Cother	0.224×10^{-2}	0.142×10^{-2}	1.577
EDUC (years)	-7.964×10^{-1}	6.173×10^{-1}	-1.29
PSEED (₦)	-0.288×10^{-2}	0.105×10^{-2}	-2.742***
ACRDT	0.565×10^{-2}	0.281×10^{-2}	2.01**
COOP	0.411×10^{-1}	0.888×10^{-1}	0.462
EXTAG	0.766×10^{-2}	0.400×10^{-2}	1.915*
DIST	-0.112×10^{-1}	0.0527×10^{-1}	-2.153**
MKIS	-0.109×10^{-3}	0.0880×10^{-3}	-1.238

Log likelihood function = -94.146; ***Significant at 1%; Restricted log likelihood = -113.55; **Significant at 5%; Chi-square = 37.87; *Significant at 10%; $P = 0.36 \times 10^{-4}$; N= 270; DF= 259

Income of the farmer. The income variable was significant (P<0.1) and positive. This implies that as the farmer's income increased, there was an increase in the probability of adoption and use of improved seed in the study area.

Age. The usual inverse relationship was observed between the use of improved seeds and the farmer's age; the coefficient of the variable was significant (P<0.05) and negative. Specifically, an increase in age of farmers led to a reduction in the probability of use of improved seed.

Extension services. The coefficient for the number of extension contacts was found to be significant at 10% and positive. This suggests that farmers with higher number of extension contacts have higher probability of adoption and use of improved seed in the study area.

Average price of seeds. The coefficient of the average price of seed was significant (P<0.01) and negative. An inverse relationship existed between the probability of using improved seed and the average price of improved seed. This is in line with the law of demand that "the higher the price, the lower the quantity demanded"; particularly when there is a close substitute for the commodity in question.

Access to rural credit. Access to rural credit was found to have a direct relationship with improved seed use. The coefficient of the variable was positive and significant at 5% (P<0.05). This means that the higher the farmer's access to rural credit, the higher the probability of adoption and use of improved seed.

Distance to the nearest markets. Access to markets was also very important in adoption and use of improved seed. The variable was significant (P<0.01) and negative. The result shows that farmers with greater access to markets have higher probability of adoption and use of improved seed in the study area.

DISCUSSION

Socio-economic characteristics. Most farmers were male and old with poor level of education.

The gender distribution is such that the men dominated the farm sector in the study area, this is due to the culture and tradition of Africans, where women have limited ownership of productive assets like land. The age distribution shows that the younger generation is avoiding going into farming. This trend, if not tackled urgently, could lead to a loss of agricultural productivity and food crisis in future as there will be fewer people in the farms. The low membership of cooperative, may also deny most farmers access to credit facilities and other sundry benefits derivable from membership of such organisations.

Risk management is one farming priority among the group as attested by mixed cropping and the number of plots owned. This makes access to improved seed a good strategy for improving farming productivity. The high access to formal credit market despite the poor access to market information would better complement that strategy. The high use of open markets as source of improved inputs makes this the appropriate channel for making improved seed available to farmers especially in view of the poor access to extension services. The poor access to extension services is expected to have adverse effect not only on improved seed use but the general livelihood of the farmers in the study area. Improving the market information system would also go a long way at increase access to improved seed.

Factors affecting use of improved seed. Improved seed adoption among farmers is expected to be low as a result of old age, as most farmers were found to be above 50 years and age being a significant factor of improved seed adoption with a negative sign. This result which conflicts with Nchinda *et al*. (2010), implies that older farmers are more conservative in adopting new technologies than the younger farmers. There is, therefore, the need to adopt measures that would encourage the youth into farming to increase adoption of improved seeds.

Income is also a significant factor of improved seed adoption; meaning that rich farmers would easily adopt improved seed; they therefore constitute privileged targets of improved seed markets probably because of the high cost and

the high risk loving behavior income confers. High prices of improved seeds will definitely reduce the probability of crop farmers using them, who would rather go for the local varieties with lower prices, which usually are more readily available in the open markets. High price of improved seeds therefore implies the need to increase access to credit facilities among low income farmers to improve adoption (Langyintuo and Mekuria, 2008).

Access to credit facilities significantly increased adoption. This is so because, the use of improved seed and recommended practices to ensure increased productivity has associated costs, in which resource poor farmers require adequate and timely access to funds.

Extension contact and reduced market distance improved adoption of improved seed. This is plausible in that it implies greater extension reach, while farmers still also have to rely on the open markets to access improved inputs. Orlu (1992) and Kaliba *et al.* (2000) found that access to extension services aid in the adoption of new technologies. Extension services should, therefore, target younger farmers; while improved seed market channels should include markets nearness to farmers instead of extension services channels only as currently observed in Nigeria. Membership of cooperative had no influence over adoption, contrary to previous reports by Nchinda *et al.* (2010); Tura *et al.* (2010) who found a significant positive relationship. There is need for sensitising farmers to join farmers' organisations in view of the relative poor membership and to include such structures into improved seed channels.

CONCLUSION

Market access and the rural service delivery have significant effects on the adoption and use of improved seed in Osun State in Nigeria. Farmers' personal characteristics such as age and income level of farmers are also determinants of adoption and use of improved seed. To this end, there is an urgent need for liberalisation of the input market to increase competition and allow the prices of input to be determined by market forces, which of course might lower the prices.

Furthermore, there is need to expand market access and rural service delivery (particularly extension contacts and rural credit) to promote adoption and use of improved seed vis-à-vis increase in farm productivity. A policy-mix that can boost farmers' income is also desirable as income is also a critical predictor of improved seed adoption and use.

REFERENCES

Adejobi, A.O. 2004. Rural poverty, food production and demand in Kebbi State, Nigeria. Ph.D. Thesis, Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.

Adejobi, A.O. 2012. Agricultural transformation in West Africa: The case of Nigeria. Paper presented at the 15th Annual Symposium of the International Association of Research Scholars and Fellows. 15th March, 2012; IITA, Ibadan, Nigeria.

Adejobi, A.O., Omolayo F.O. and Williams, S.B. 2005. Expanding the improved seed market in Nigeria: An imperative for increased rice production. *Conference Proceedings on Rice Policy and Food Security in sub-Saharan Africa.* pp. 376-386.

Adesina, A. A. and Baidu-Forson, J. 1995. Farmers' perceptions and adoption of new agricultural technology: evidence from analysis in Burkina Faso and Guinea West Africa. *The Journal of International Association of Agricultural Economics.* 13(1):1 - 9.

Aja, O.L. and Okorie, A.L. 1984. Recent experience in farm input supply and distribution in Nigeria. pp. 110-25. In: David, J.P and Idachaba, F.S. (Eds). Crop marketing and input distribution in Nigeria. FACU, Ibadan, Nigeria.

Brossier, J. 1991. Agricutural technology: The priorities for sub-Saharan Africa and some argument in debate. pp. 97-99. In: Suzanne, G. and Anderson, J.R. (Eds). Proceedings of a Workshop on Research Issues. *World Bank Discussion Paper.* Washington D.C.

Christopher, J.O., Shunway, C.R. and Ball, V.E. 1999. Input demands and inefficiency in U.S

Agriculture. *American Journal of Agricultural Economics* 81(4): 865-80.

Diamini, S. 1976. The demand for pesticides in the Cocoa Belt of Western Nigeria. MSc. Thesis, Department of Agricultural Economics, University of Ibadan, Nigeria.

Dugje, I.Y., Onyibe, J.E., Ekeleme, F., Kamara, A.Y., Tegbaru, A., Omoigui, L.O. and Bassi, S.A. 2008. Guide to certified seeds production in Borno State, Nigeria. IITA, Ibadan, Nigeria.

Dunn, J. and Hein, H. 1985. The demand for farm inputs. *Western Journal of Agricultural Economics* 10(1):13-22.

F.A.O. 1978. The economics of fertiliser use, the use of direct fertiliser subsidies in developing countries, F.A.O., Rome, Italy.

Falusi, A.O. and Adubifa, A. 1975. Economics of fertiliser distribution in Nigeria. Monograph series, NISER, Ibadan, Nigeria.

FMAWR (Federal Ministry of Agriculture and Water Resources). 2008. National Food Security Programme, Abuja, Nigeria.

George, W.I. 1989. Can increasing an input price increase consumption profit? *North Central Journal of Agricultural Economics* 11(1):11-13.

Green, D.A.G and Ng'ong'ola, D.H 1993. Factors affecting fertiliser adoption in less developed countries: An application of Multivariate Logistic Analysis in Malawi. *Journal of Agricultural Economics* 44(1):611-25.

Hoover, H. and Wiitala, M. 1980. Operator and landlord participation in soil erosion in the Mample Creek Watershed in Northeast Nebraska. *U.S. Department of Agriculture, Washington D.C., USA.*

Jondrow, J.C.A., Lovell, K., Materov, I.S. and Schmidt, P. 1982. On the estimation of technical inefficiency in the Stochastic Frontier Production Function Model. *Journal of Econometrics* 19(1):233-38.

Kaliba, A.R.M., Verkuijl, H. and Mwangi, W. 2000. Factors affecting adoption of improved maize seeds and use of inorganic fertiliser for maize production in the intermediate and low land zones of Tanzania. *Journal of Agricultural and Applied Economics* 32(1):35-47.

Kormawa, P.M., Okoruwa, V.O., Adejobi, A.O. and Ayanwale, A.O. 2004. Profitability and

determinants of fertiliser usage by crop farmers in the drier savannah zone of Nigeria. *Nigerian Journal of Science* 38:145-153.

Langyintuo, A. and Mekuria, M. 2008. Assessing the influence of neighborhood effects on the adoption of improved agricultural technologies in developing agriculture. *African Journal of Agricultural and Resource Economics* 2(2):151-169.

Lapar, M.L.A. and Pandey, S. 1999. Adoption of soil conservation: the case of the Philippine uplands. *Agricultural Economics* 21(3):241-256.

Manyong, V.M., Ikpi, A., Olayemi, J.K., Yusuf, S.A., Omonona, B.T., Okoruwa, V. and Idachaba, F.S. 2005. Agriculture in Nigeria: Identifying opportunities for increased commercialisation and investment. International Institute of Tropical Agriculture, Ibadan. Nigeria.

Nchinda, V.P., Ambe, T. E., Nathalie, H., Leke, W., Che, M. A. Nkwate, S.P. Ngassam, S.B. and Njualem, D. K. 2010. Factors influencing the adoption intensity of improved yam (*Dioscorea* spp.) seed technology in the western highlands and high guinea savannah zones of Cameroon. *Journal of Applied Biosciences* 36: 2389 - 2402.

Ogunfowora, O., Essang, S.M. and Olayide, S.O. 1975. Resources productivity in traditional agriculture: A case of four agricultural divisions in Kwara State. Kwara State Ministry of Agriculture, Ilorin, Nigeria.

Omaliko, C.P.E. 2000. Nigeria seed industry and its potential role in food security within the West and Central African Sub-region. Department of Agricultural and Natural Sciences, Federal Ministry of Science and Technology, Abuja, Nigeria.

Orlu, J.I. 1992. Analysis of farmers demand for modern input in upland areas of river State, PhD Thesis, Department of Agricultural Economics, University of Nigeria, Nsukka.

OSSADEP [Osun State Agricultural Development Programme] 2008. "Year 2007 crop area and yield survey" conducted by planning monitoring and evaluation department of Osun State Agricultural Development Programme, Nigeria.

Rahm, M. and Huffman, W. 1984. The adoption of reduced tillage: the role of human capital and other variable. *American Journal of Agricultural Economics* 66:405-413.

Scoones, I. 2000. Sustainable rural livelihoods: A framework for Analysis. *IDS Working Paper 72.*

Tura, M., Aredo, D, Tsegaye, W., La Rovere, R., Tesfahun, G., Nwangi, W. and Mwabu, G. 2010. Adoption and continued use of improved maize seeds: Case study of Central Ethiopia. *African Journal of Agricultural Research* 5(17):2350-2358.