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Research Article

Technical Efficiency of Resources use in Yam Production among Small Scale Farmers in Delta State, Nigeria

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ABSTRACT

The study examined technical efficiency of yam production in Delta State of Nigeria and focused on the socio-economic characteristics of the respondents and focused on determination of the presence of technical efficiency and the factors contributing to technical efficiency. Primary data collected from a cross section of 208 respondents through the administration of 230 questionnaires and adopting the multistage sampling method were analyzed using descriptive statistics and the stochastic frontier production function. The results showed that males dominated yam production (93.3%), the respondents were ageing (X = 53 years) and majority of them were married (85.1%). They had low level of education with mean years of schooling of 7 years, were experienced in farming (X = 20 years) and cultivated large farm size (X = 2.0ha). There was presence of technical inefficiency effects in yam production, although technical efficiency was found to be high with a mean technical efficiency of 0.83 and with 79.3% of the respondents having technical efficiency of 0.80 and above. The educational level of the respondents, extension agent visit and household size were found to be the variables that contributed to technical efficiency achievement of the farmers. It was recommended that young school leavers be advised to take to the venture as they were found to contribute to technical efficiency achievements.

Key words: Technical, Efficiency, Resource, Yam, Production

INTRODUCTION

Agriculture is the largest employer of labour, with about 70% of the country's Labour force engaged in the sector and accounts for 31% of the nation's Gross Domestic Product (GDP), World Bank (2008). Agriculture serves as a vehicle for diversifying the economy and enhancing activities for economic development. The sector is dominated by small-scale resource poor farmers living in the rural areas and characterized by small-scale farm holdings and cultivating between one to two hectares. These farmers have fragmented farm holdings, and rudimentary farming system, low capitalization and low yield per hectare (Esobhawan and Alabi, 2009). According to them, small farm holders in Nigeria constituted about 80% of the farming population while over 90% of the domestic food production in the country comes from small-scale farmers.

However, problem of acquisition of farm inputs' and utilization are of great concern. Oluwatosin (2011) wobserved that most arable crop farmers in Nigeria are poorly endowed in terms of farm inputs acquisition and allocation. The inefficient allocation of these resources by the farmers has made agriculture in Nigeria to remain at the traditional and rudimentary level. This trend must be reversed in order to allow Nigeria be one of the top economies and be able to achieve her development potentials and meet the millennium development goals. In addition, small-scale agriculture has suffered from limited access to credit facilities and rural-urban migration resulting in low input acquisition and labour shortages amongst others. Furthermore, due to high population growth rate in Nigeria, the demand for agricultural products is continually rising and this has resulted in the need to allocate farm resources efficiently to meet the challenges of food insecurity.

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Yam is arguably, the most important crop Nigerians often refer to as the king of crops which not just grown for its nutritional value and as an important source of income but also, for its cultural, social and religious significance in many areas of the country including Delta State (Durno and Stuart, 2005). Yam is a member of the class of staple food called root and tuber and refer to, as any growing plant that stores edible materials in subterranean root, corm or tuber (Oke, 1990). Yams are source of daily carbohydrate intake for the large population of the world. Yam is an annual or perennial tuber-bearing and climbing plant which is commonly grown in the warmer regions of North and South hemisphere.

According to the FAO (2012), Nigeria was the leading World producer of yam with about 38.0 million tons followed by Ghana with 6.6 million tons, Cote d'lvoire with 5.6 million tons, and Benin with 2.5 million tons (Table 1.1). But annually Ghana exports the largest quantity of yam (about 12000 tons). Benin has the highest average yam consumption per capita per day (about 364kcal) followed by Cote d'lvoire (342kcal), Ghana (296kcal) and Nigeria (258kcal) (FAO, 2005). This has indicated that what Nigeria produces is not even enough to meet the country's consumption need and not to talk of export. The National Bureau of Statistics, (2007, 2012) reports showed that 27 States in Nigeria produce yam, with the total area planted during the 2009/2010 season put at 3,236,160ha. Benue State led with 396,450ha followed by Niger State with 367,160ha, Taraba State with 272,520ha and Delta State with 106,120ha. The corresponding total outputs were 37,328,170 metric tonnes for the country with Benue, Niger, Taraba and Delta States producing 3,914,170, 3,166,120, 2,854,950 and 860,020 metric tonnes respectively (NBS, 2012).

Yam production in Nigeria has more than tripled over the past 50 years from 6.7 million tonnes in 1961 to 38.0 million tonnes in 2012, (FAO, 2012). This increase is however attributed to larger hectares of land planted to yam with decrease in productivity (Nwosu and Okoli 2010). However, the decline in yield per hectare in Nigeria has been rather drastic, dropping from 14.9% in 1986/1990 to 2.5% in 1996/2000, (CBN, 2002; Agbaje *et al*, 2005; FAO, 2007). This declining trend might have been connected with inefficiency in the resources used (Nwosu and Okoli, 2010). It is therefore important for yam farmers to use resources optimally for increased yield production. According to Udoh and Etim (2007), farming operation in Nigeria requires the allocation of available inputs as efficiently as possible to achieve optimum production. They maintained that inefficiency of resource-use and allocation can seriously jeopardize and hamper food production and security. However, the extent to which farmer in the study area are technically equipped in the utilization of available resources for yam production is of great concern. The study therefore assessed technical efficiency of resources use in yam production among small scale farmers in Delta State, Nigeria.

Objective of the study

The main objective of the study is to assess the economic efficiency of resources use in yam production among farmers in Delta State, Nigeria. The specific objectives are to;

i. examine socio- economic characteristics of small-scale yam farmers in the study area

ii. examine the technical efficiency of small-scale yam farmers in the study area

Hypothesis of the study

Ho_2: There is no technical inefficiency effect in yam production in the study area.

MATERIALS AND METHODS

The study was carried out in Delta State of Nigeria. Delta state is located in the southern part of the Niger-Delta at longitude 5º.00" and 6º.04" East and latitude 5º.00" and 6º.30", North of the equator. It occupies an area of 176,108 square kilometers and it is generally low-lying with vegetation interspersed with the mangrove swamp and the rain-forest and has a coastline of about 160 kilometers on the River Niger and interlaced with rivulets and streams. Multistage sampling procedure was used to select the respondents. The first stage in the sampling was the purposive selection of Delta North Agricultural zone out of the three Agricultural zones in the state because, the zone is the major yam producing area of Delta State. The second stage involved purposive selection of 5 Local Government Areas out of the 9 Local Government Areas in the Delta North Agricultural zone due to prominence of yam production in these L.G.As. The L.G. As selected were; Aniocha South, Ika North East, Ika South, Oshimili North and Ukwani. The third stage was the purposive selection of four communities, which was based on the prevalence of yam producing activities in these communities. The communities selected are contained in the Table 3 The fourth and the final stage was the simple random sampling technique to select the yam farmers which was based on 10% of the farming population of yam farmers in the communities. From Table 1, this came to 299 small scale yam farmers that were selected for the study and presented with questionnaires. Out of the 299 questionnaires, a total of 208 questionnaires were retrieved and used for analysis. Statistical tools involving the estimation of frequency counts, percentages, mean and standard deviation and Stochastic frontier production function were used data analysis.

The presence of technical efficiency, the level of technical efficiency achieved and the productivity of factors employed in yam farming were determined, using inferential statistics, involving stochastic frontier production function of efficiency studies. The Cobb-Douglas production function is usually fitted with the survey data. It is expressed as:

$$\text{Log } Y_i = \text{Log}\beta o + \beta_1 \log X_{1i} + \beta_2 \log X_{2i} + \beta_3 \log X_{3i} + \beta_4 \log X_{4i} + \beta_5 \log X_{5i} + \beta_6 \log X_{6i} + \beta_7 \log X_{7i} + V_i - U \ldots\ldots\ldots (17)$$

Log = (applied when linearizing Cobb Douglas production function).

Y = Annual yam output (kg)

β_0 = Constant

X_1 = Land size (ha)

X_2 = Fixed cost (depreciation) in naira

X_3 = Labour used (mandays)

X_4 = Fertilizer application (kg)

X_5 = Herbicides used (liters)

X_6 = Transport cost (₦)

Fig. 1: Sampling Frame

L.G.As	Communities sampled	Population of registered farmers	Sampled population based on 10%
Aniocha South	Ejeme-Aniogor	74	7
	Ewulu	106	11
	Isele-Nkpitime	92	9
	Nsukwa	79	8
	Sub-total	351	35
Ika North East	Idumesah	113	11
	Igbodo	180	18
	Umunede	191	19
	Ute-kpu	97	10
	Sub-total	574	57
Ika South	Abavo	212	21
	Alishime	91	9
	Emuhu	109	11
	Oki	81	8
	Sub-total	493	49
Oshimili North	Akuku-Igbo	91	9
	Ebu	105	11
	Illah	211	21
	Ugbolu	94	9
	Sub-total	501	50
Ukwuani	Amai	117	12
	Ndemili	86	9
	Umutu	83	8
	Utagba-uno	89	9
	Sub-total	375	38
	Grand total	2,294	228

Sources: Farmers' co-operatives organizations and Ministry of Agriculture and Natural Resource in the five L G As (2012).

X_7 = Marketing cost (₦)
β_{1-7} = Scalar quantities to be estimated (parameters)
i =ithnumber of farmers for I = 1,2,3 ………… 208
V_i = Stochastic or random error which are assumed to be identically, independently and normally distributed with mean zero and constant variance $N(0,\delta^2 v)$) and represents those shocks that cannot be controlled by the farmers such as weather failure, flooding, pests and disease, pilfering etc.
U_i = Disturbance term of technical inefficiency effect or non-negative random variables which are assumed to account for technical inefficiency in production and assumed to be independent of V_i. They capture the random variation in output of the farmers relative to the frontier output due mainly to events within the control of the farmers such as computational error, wrong application of inputs etc. If $U_i = 0$, there is no inefficiency effect but if $U_i > 0$ the production lies below the stochastic frontier and it is inefficient. It is often assumed to be normally distribution that is $N(0,\delta^2 u)$.

In order to determine the socio-economic variables contributing to technical efficiency of yam farming in the study area, the inefficiency model was estimated jointly with the stochastic frontier model, using computer software, FRONTIER version 4.1c (Coelli, 1996). The inefficiency model is composed of vector of explanatory variables (Z) which is hypothesized to affect technical efficiency of yam farmers and specified as:

$$Ui = d_0+d_1Z_{1i}+d_2Z_{2i}+d_3Z_{3i}+d_4Z_{4i}+d_5Z_{5i} \ldots\ldots\ldots\ldots \quad (18)$$

Where:
U_i = Inefficiency factor
d_o = Constant
Z_1 = Education level of the farmer (years of schooling)
Z_2 = Farming experience (years in farming)
Z_3 = Extension visit to farmer (a dummy with visit = 1, no visit = 0)
Z_4 = Co-operative membership (dummy with member =1, no member = 0)
Z_5 = Household membership (actual member of family)
i = ith number of respondents for i = 1,2,3…… 208

RESULTS AND DISCUSSION

Socio-economic characteristics

The socio-economic of the respondents is presented in Table 1. The results showed that majority (93.3%) of the respondents were male indication the dominance of male in yam production in the study area. This is similar to report by Izekor and Olumese (2010) the dominance of male in Edo State; they reported that 92% were male. The study found that the mean age of the respondents was 53 years indication that the respondents were aging. A possible implication of this result is that if youths are not encourage to go into yam farming, its production in the study area will be left in the hands of the aged who may not be in their active production age. Majority (85.1%) of the yam farmers were married. This high percentage of married respondents was an indication that there could be co-operation among couples as required for the success of the yam farming venture. The respondents maintained large family size with a mean of 7 persons per family. This could be of great asset to the yam farmers as it could guarantee the supply of family labour to assist them on the farming. The literacy level of the respondents was low with higher proportion (40.4%) of them not having formal education. The low level of the respondents' education could have negative effects on their yam production as they might not be able to acquire innovative skills and adopt productive technologies. This result disagrees with the result of the study of Idu, Kezi, Ekele and Adebayo, (2018) who found that 59.6% of yam farmers studied had formal education. It was revealed the yam farmers in the study area were highly experienced, having spent a mean

Table 1: Socio – economic Characteristics Distributions of Respondents (N=208)

Characteristics	Gender	Freq	%	Mean	SD
	Male / Female				
	194				
	93.3	14	6.7		
Age (yrs)	≤ 40	16	7.7		
	41-50	10	49.5		
	51-60	55	26.4	53	8.01
	61-70	34	16.3		
Marital Status	Married	27	85.1		
	Widow(er)	15	7.2		
	Divorced	10	4.8		
	Single	6	2.9		
Household Size	1-4	31	14.9		
	5-8	140	76.3		
	9-12	35	16.8	7	2.07
	13-16	2	1.0		
Level of Education	No Formal	84	40.4		
	Primary	52	25.0		
	Secondary	43	20.7		
	Tertiary	29	13.9		
Farming Experience (Years)	1-10	34	16.3		
	11-20	95	45.7		
	21-30	58	27.9	20	3.85
	31-40	21	10.1		
Farm Size (Hectare)	<1	58	27.9		
	1-1.99	40	19.2		
	2-2.99	71	34.1	2.0	1.24
	3-3.99	22	10.6		
	>4	17	8.2		
Source of Land	Rented	195	93.8		
	Inherited	12	5.8		
	Purchased	1	0.5		
Cooperative Membership	Member	142	68.3		
	Not Member	66	31.7		
Extension Agent Visit	Not Visited	194	93.3		
	Visited	14	6.7		
Fertilizer Use	Not used	180	86.5		
	Used	28	13.5		
Access to Loan	Accessed	156	75.0		
	Not Accessed	52	25.0		
Sales Outlets	Market	14	93.3		
	Farm	194	6.7		

Source: Field survey (2014).

of 20 years in yam farming. This finding agreed with the result of Ebowore *et al*. (2013) who noted that the farming experience of yam farmers in Ika South Local Government Area of Delta state enabled them to acquire practical knowledge which influenced their productivity. The respondent cultivated a mean of 2.0 hectares indicating that they cultivated large farm. Majority (93.8%) of the respondents acquired their farm land through rent. The farming status of the respondents shows that all the respondents (100) do not have yam farming as their only occupation. Result on cooperative membership shows that a high proportion (68.3%) of the respondents was member of cooperative association. The result extension visit revealed that majority (93.3%) of the respondents was not visited by extension agent. A high proportion (75.0%) of the respondents had access to loan which could be attributed to the fact that majority of the respondents belonged to cooperative associations. Majority (86.5) of the respondents did not use fertilizer, this could be the areas being cultivated are fertile. On the sales outlet use by respondents, the result shows that majority (93.3%) sold their produce in the market. This may be due to the fact that market is the best point of sales.

Table 2: Estimation of Parameters of the Stochastic Frontier Production Function for Yam Production in Delta State

Variables	OLS		MLE	
	Coefficients	T-ratio	Coefficients	T-ratio
Constants	6.270	7.101	6.360	6.775
	(0.883)		(0.939)	
Farm size (Ha)	0.736	4.633	0.700*	4.327
	(0.159)		(0.162)	
Fixed cost (₦)	0.077	1.121	0.060	0.931
	(0.068)		(0.064)	
Yam seedlings (kg)	0.116	1.681	0.119*	2.245
	(0.069)		(0.053)	
Hired labour (mds)	0.002	0.418	0.055	1.073
	(0.006)		(0.051)	
Herbicides (Lits)	0.425	2.740	0.424*	2.923
	(0.155)		(0.145)	
Staking cost (₦)	0.145	2.683	0.150*	3.092
	(0.054)		(0.049)	
Transport cost (₦)	0.060	0.885	0.070	1.117
	(0.068)		(0.059)	
Marketing cost (₦)	-0.052	-1.249	-0.033	-0.882
	(0.042)		(0.038)	
Sigma squared (δ^2)	0.159		0.460*	4.107
			(0.112)	
Gamma (γ)	0		0.820*	14.959
Log likelihood functn	-99.724		-76.704	

Note: Figures in brackets are standard error, *estimate is significant at P<0.05: Source: Data Analysis (2014).

Table 3: Hypothesis of no technical inefficiency effects of yam production

Parameters	Estimates
L(Ho)	-99.724
L(Ha)	-76.704
χ^2-computed	46.039
χ^2-tabulated(0.05,206)	15.510

Source: Data analysis (2014)

Table 4: Estimates of the Stochastic Frontier Production Function for the Inefficiency Model.

Variables	Coefficients	T-ratio
Constant	0.216	0.389
Level of Education	-0.018	0.946
Farming Experience	0.026	1.613
Extension Visit	-1.017	1.351
Cooperative Membership	0.049	0.210
Household Size	-0.317	2.689

Source: Data Analysis (2014)

Table 6: Distribution of Technical Efficiency Indices among Yam Farmers

Efficiency class indices	Frequency	Percentage
≤ 0.59	3	1.4
0.60 – 0.69	2	1.0
0.70 – 0.79	38	18.3
0.80 – 0.89	144	69.2
≥ 0.90	21	10.1
Total	208	100.0
Mean = 0.83	Minimum = 0.13	Maximum = 0.97

Source: Data Analysis (2014).

Presence of technical inefficiency and productivity of factors used for yam production

The summary of the two models is contained in the Table 2. In the Ordinary Least Square (OLS) all the variables, except marketing cost had the expected positive sign with three of the variables significantly different from zero ($\rho<0.05$). Also, in the MLE model, all the variables except marketing cost were positively signed as expected with three of the variables being significantly different from zero (ρ<0.05). In order to decide which of the two models was adequate for use in the analysis of the result, the generalized likelihood ratio test was carried out.

The results, as contained in Table 3 shows that the χ^2 - computed is 46.039 while the χ^2-tabulated at 5% level of probability with 206 degree of freedom is 15.510. Therefore, the null hypothesis, that there were no technical inefficiency effects in yam production in the study area was rejected while the alternative hypothesis that inefficiency effects existed in yam production was accepted (Table 3). This means that the observed variation in the output of yam from the efficient frontier output level was due mainly to inefficiency effects (u) and not due to the random or stochastic error (v). This means that inefficiency factor existed in the stochastic frontier (MLE) model and that the classical normal regression model based on OLS estimation technique would have been inadequate representation of the data.

The presence of inefficiency effects in yam production therefore made use of the MLE model and hence, this model was adequate in estimating the parameters of yam production function. Also, the model variance or sigma square (δ^2) value of 0.460 obtained from the MLE model is statistically significant at 5% level of probability (ρ<0.05), indicating that the included independent variables gave a good fit to the specified yam production function equation. This also justifies the adequacy of the model used. Furthermore, the variance ratio or the gamma (γ) which is associated with the variance of inefficiency effects in the stochastic frontier function has a value of 0.820 and it is statistically significant at 5% level (p<0.05), indicating that 82% of the variations of the yam output from the frontier output level was due to technical inefficiency. Therefore, based on these findings, the Maximum Likelihood Estimation (MLE) model was chosen for further economic and econometric analysis.

Analysis of Factors Contributing to Technical Efficiency

Analysis of the estimated coefficients of the variables in the inefficiency model (Table 4), reveals the contribution of each of these variables to the technical efficiency achievements. The negative sign carried by these variables is very important in explaining their contribution to technical efficiency achievements while the positive sign of the variables explain their contribution to technical inefficiency achievements. Three of the variables, that is, level of education (b = -0.018), extension visit (b = -1.017) and household size (b = -0.317) have the expected negative sign revealing that they decrease technical inefficiency, while increasing technical efficiency. The contribution of farmers' level of education to their technical efficiency is in conformity with *apriori* expectation that educational achievement of the farmers would improve their cognitive skills, adoption of modern farming technology, enhanced their productivity and efficiency. Similar results were posted by Ojo *et al* (2006) and Esobhawan *et al*. (2006).

The contribution of extension visit to technical efficiency of the farmers agrees with hypothesized negative sign and indicates that extension services help the farmers in adopting improved farming methods and avail them with access to high yielding and disease resistant seedlings. The negative sign carried by household size is also consistent with *a priori* expectation and agrees with the result obtained by Tijani and Sofoluwe (2011) where they concluded that large household size of the farmers would provide them with pool of family labour to carry out farming activities, thus, making the production process more efficient.

The remaining two variables, that is, farming experience (b = 0.0260 and cooperative membership (b = 0.049) have unexpected positive sign, indicating that they increased technical inefficiency, thereby reducing technical efficiency. The positive sign of the farmers' years of yam farming implies that experienced yam farmers would rely on their outdated and unproductive method of yam cultivation and would resist the adoption of modern and improved cultivation methods. It therefore indicates that young farmers and new entrants to yam production are more technically efficient. Finally, the positive sign carried by the coefficient of cooperative membership indicates that the yam famers would not have reaped the benefits of belonging to cooperatives such as bulk purchasing of farming inputs at reduced cost and guaranteed access to credit as they would not have availed themselves of these opportunities in their cooperative societies.

Decile Range of Technical Efficiency

The decile range of technical efficiency shown in the Table 6 reveals that technical efficiency of the sampled yam farmers is high with 97.6% of the farmers having technical efficiency of 70 and above. The best 10% of the farmers have technical efficiency of 90 and above while the worst farmers constituting 1.4%of the respondents have technical efficiency of 59 and below. The mean technical efficiency of 0.83 obtained indicates that on the average, yam farmers in the study area are able to obtain an average of 83% of potential output from a mix of production inputs. The result shows that only about 20%of the sampled farmers have technical efficiency below the mean technical efficiency level. The maximum technical efficiency of 0.97 obtained shows that technical efficiency in yam production by the farmers in the study area is very high. Similar result was obtained by Inedia, *et al* (2016), where maximum technical efficiency (TE) of 0.99 was obtained in up-land rice production in Edo state.

Conclusion

Based on the findings of the study, it was concluded that there was presence of technical inefficiency. Although technical inefficiency achievement was found to be high with the level of education, extension visit and household size.

Recommendations

The recommendations arising from the result of the study were

i. Young school leavers should be encouraged to take to yam production as they were found to contribute to technical efficiency achievement.

ii. The literacy level of farmers should be improved through adult education, seminars and workshop. This will help to increase their technical efficiency achievement.

Extension agencies should intensify effort in the delivery of extension services in the study area; in this regard yam farmers should be properly targeted. This will held to boost the technical efficiency achievement of yam farmers.

REFERENCES

Agbaje GO, Ogunsumi LA, Oluokun JA and Akinlosotu TA, 2005. Survey of yam production system and impact of government policies in South-western Nigeria. Journal for Agriculture and Environment, 3(2):222 – 229.

CBN, 2002. Central Bank of Nigeria, Statistical bulletin. Publication pp: 252-260.

Durno, J and Stuart, I. (2005). Gender issues in sustainable agriculture in over halt, Gender roles in development project, New Delhi, Fox Publication. pp: 54 – 58.

Ebowore SO, Egbodion J and Oboh OO, 2013. Profitability analysis of Yam Production in Ika south Local Government Area of delta State, Nigeria. Journal of Biology, Agiculture and Healthcare, 3: 188-129.

Esobhawan AO, Alabi RA and Chime CC, 2006. Economic Analysis of Factors that influences Nigeria Agriculture (1970 – 2002). In Onibi, G.O., Agele, S.O., Adekunle, V.A.J. and Akinbulumo, M.O., Proceedings of the 2nd Annual Conference of Federal University of Technology, Akure, Ondo State, Nigeria. Agricultural Research for Development in Nigeria. pp: 219-222.

Esobhawan, A.O. and Alabi, R.A. (2009). Small scale Farmers and Technical efficiency differential; The case of male and female pineapple farmer in Easn West and Uhuode Local Government Area of Edo State. International Journal of Agriculture, 2: 93-99.

FAO, 2012. Food and Agriculture Organization. U. N. FAO STAT. Statistics Division of Food and Agriculture Organization.www.faostat.org. Accessed November 21, 2013.

FAO, 2005. Food and Agriculture Organization.Statistical data.www.fao.org. Accessed November 21, 2013.

FAO, 2007. Food and Agricultural Organization Database. FAOSTAT website; http://faostat.fao. Accessed November 21, 2013.

FAO, (2012). Food and Agriculture Organization. U. N. FAO STAT. Statistics Division of Food and Agriculture Organization.www.faostat.org. Accessed November 21, 2013.

Idu EE, Kezi DM, Ekele CA, Adeyongo IL and Utaan DO, 2018. Time-series analysis and Adoption of Makka Kusa yam variety in Bwari area council of Nigeria's Federal Capital Territory. Journal of Agriculture and Food Environment. 5(3): 1-7.

Inedia GE, Onahemhen F and Ikheloa EE, 2016. Resource use efficiency in rice production in Edo State, Nigeria. The Nigerian Journal of Agriculture and Forestry. 5(1): 23-35.

Izekor, O.B. and Olumese, M.I. (2010). Determinants of yam production and profitability in Edo State, Nigeria.African Journal of General Agriculture. 6(4): 55 – 67.

NBS, (2007). NationalBureau of Statistical, fact sheet on economic and social development, the National Bureau of Statistics, Abuja.

NBS, (2012). National Bureau of Statistics, Economic survey on Nigeria, National Bureau Statistics Abuja.

Nwosu CS and Okoli VBN, 2010. Economic Analysis of Resource use by Wase Yam Farmers in Owerri Agricultural zone of Imo State, Nigeria. Proceedings of 44th Annual Conference of Agricultural Society of Nigeria held in Ladoke Akintola University. October 18 – 22, 2010.

Ojo SO, Afolabi JA and Fagbenro OA, 2006. Profitability and Technical Efficiency of Artisanal fishery Production in Nigeria. Journal of Sustainable Tropical Agricultural Reseach. Vol. 19:23 – 30.

Oke, O.L. (1990).Roots, Tubers, Plantain and Bananas in Human Nutrition, FAO Food and Nutrition Series No. 24.

Oluwatosin, F.M. (2011). Measuring technical efficiency of yam farmers in Nigeria. Agricultural Journal, 6(2):40 – 46.

Tijani AA and Sofoluwe NA, 2011. Profitability and Technical efficiency of Cowpea Production in Osun State, Nigeria. Proceeding of the Annual National Conference of the Nigerian Association of Agricultural Economists held at University of Benin. November 12 – 16, 2011. Pp454 – 460.

Udoh EJ and Etim NA, 2007. Application of Stochastic Production frontier in the Estimation of Technical Efficiency of Cassava Based Farms in Akwa Ibom State, Nigeria. Agricultural Journal. 2(6):731- 735.

World Bank, (2008). World Development Report, 2008. Agricultural inputs Table at Bank. Org. Ndi 2006/contents/Table3_2.htm.Accessed April 9, 2013.