ECONOMIC ANALYSIS OF COCOYAM PRODUCTION IN OSUN STATE, NIGERIA

[1]Falola, A., [2]Fakayode, S. B. & [3]Banjoko, I. K.
[1]Department of Agricultural Economics and Farm Management, University of Ilorin, Nigeria
[2]Department of Agricultural Economics and Extension, Federal University, Oye Ekiti, Nigeria
[3]Department of Agricultural Technology, Kwara State Polytechnic, Ilorin, Nigeria
Correspondence Author's E-mail: falolaabraham@yahoo.com

Abstract
The quest to achieve food security and at the same time make production of underutilised species a profitable venture necessitated the focus of this study. Among other objectives, the study determined the profitability of cocoyam production, the technical efficiency of the farmers and the factors that influenced commercialisation of the crop. Data were obtained from 140 cocoyam farm households using interview schedule. Data collected were analysed with descriptive statistics, cost and returns analysis, stochastic frontier model, household commercialisation index (HCI) and regression tool. The result obtained indicated that majorities of the farmers were male, married and less educated, had no access to extension services, small-scale and financed their operations mainly with personal savings. The outcomes of gross margin, return to farm management and labour, gross ratio, operating ratio and return to capital invested by the farmers indicated that cocoyam production is a profitable enterprise. The result of the technical efficiency of the farmers also suggest that opportunity still exists for increasing productivity through increased efficiency in use of existing farm technology. The outcome of the HCI of the farmers indicated a gap of about 51 per cent which implies that cocoyam production is market-oriented. The study further revealed that the significant factors influencing cocoyam commercialisation were educational level, farming experience, farm size, modern technology and age of the farmers. To improve on this, agricultural development agencies should encourage young and educated individuals to actively engage in cocoyam production in Osun State by providing the necessary incentives such as fund and inputs.

Keywords: Cocoyam, Profitability, Food security, Technical efficiency, Market-oriented, Osun State
JEL Classification: D 24, O13, Q12

Introduction

Food insecurity has remained a global issue of concern over the years, more so in the last decade. According to Food and Agricultural Organization (FAO) (2013), despite all efforts towards achieving the first Millennium Development Goal (MDG) of eradicating hunger, 12 percent of the global population was unable to meet their dietary energy requirements in 2011–13. FAO (2013) also reported that around one in eight people in the world were likely to have suffered from chronic hunger, not having enough food for an active and healthy life within the period and a vast majority of these people lived in developing regions where the prevalence of undernourishment was estimated at 14.3 per cent. The report further revealed that the sub-Saharan African region ranked second after Southern Asia, with 223 million people being undernourished (accounting for about 26.5 per cent of undernourished people globally in 2011 – 2013). Nigeria is not left out in the battle. According to Federal Ministry of Agriculture and Rural Development (FMARD) (2012), Nigeria's food imports were growing at an unsustainable rate of 11 per cent per annum. This suggests the need for relevant agricultural development agencies not to concentrate only on production of the 'common' crops but also on 'neglected and underutilized species' (NUS).

One of the NUSs whose potential has not been fully harnessed is 'cocoyam' (*Colocasia esculenta*). It is a tuber crop grown in the tropics and sub-tropical regions of the world particularly in Africa (Onwubuya & Ajani, 2012). Cocoyam is composed of 70 - 80 per cent water, 20 – 25 per cent starch and significant

amount of vitamins and is nutritionally superior to cassava and yam (Amusa, Enete & Okon, 2011). The authors also posited that its nutritional value makes it suitable for diabetic patients. Ogunniyi (2008) noted that the crop is tolerant to drought, pests and diseases and it is suitable to a variety of climatic and soil conditions. Given these inherent importance of the crop, therefore, its production could be undertaken in a market-oriented pattern using the existing level of technology available to its producers. This can be done when factors of production are tailored towards transforming production of the crop from subsistence to commercialised level while still maintaining high profitability of the its production.

Against the background of the foregoing, this study examines cocoyam production in Osun State, Nigeria. In specific items, the study examines the socio-economic characteristics of cocoyam farmers, determined profitability of cocoyam production by the farmers, estimated the technical efficiency of the farmers, determined level of commercialisation of the crop, and analysed factors influencing commercialisation of the crop in Osun state.

Study Area, Materials and Method of Data Analysis

This study was carried out in Osun state, Nigeria. The state is an inland state in south-western Nigeria. It is located at coordinates 7°30′N 4°30′E and has a total land area of 14,875km^2. The state is bounded in the north by Kwara State, in the east partly by Ekiti State and partly by Ondo State, in the south by Ogun State and in the west by Oyo State. It has thirty (30) Local Government areas (LGAs) and a population of about 3,423,535 people (NPC, 2006). The state has humid climate with temperature between 21.1^0 and 31.1^{0}C, and a mean annual rainfall of about 1000mm (OSSADEP, 1997). The mainstay of the state's economy is agriculture. The food crops produced in the state are maize, cassava, yam, beans and cocoyam, while the cash crops grown include tobacco and oil palm.

It is worthy of note that the choice of Osun state for the study was based on the recent efforts by the state government to promote cultivation of cocoyam. These efforts include the design and implementation of Cocoyam Rebirth Programme (CRP) in the state and inclusion of cocoyam-based nutrition in the state government schools' feeding programme tagged "O Meal" (Osun Elementary School Feeding and Health Programme, 2012; Vanguard, 2012).

The target population for the study was cocoyam producing households in the state. Both primary and secondary data were used for the study. Primary data were collected from 140 farm households, using three-stage sampling technique. First, Atakunmosa East and Atakunmosa West LGAs were purposively selected based on the high volume of cocoyam produced in the LGAs. Second, seven cocoyam producing communities were randomly selected in each of the LGAs. Lastly, ten (10) farm households were randomly selected in each of the communities, giving a total of 140 respondents in each household. Interview schedule was also constructed to elicit responses from the farmers. Data obtained include socio-economic and agricultural data of the respondents that are cocoyam farmers.

The analytical tools used for the study were descriptive statistics, cost and returns measures, the stochastic frontier model, household commercialisation index (HCI) and regression analysis. Descriptive statistics such as the mean, percentage, range and frequency table were used to report the socio-economic profile of the farmers and to present the results of the study. The cost and returns techniques used were essentially the farm income analyses. They include the gross margin, returns to farm management and labour and profitability ratios. Following Olukosi & Erhabor (1998), and Falola, Ayinde & Ojehomon (2013) gross margin was used to evaluate the difference between gross farm income (gross values of farm output) and total variable cost. Thus,

$$GM = GFI - TVC \quad (1)$$

Where:

GM is the gross margin, GFI is the gross farm income; and TVC is the total variable cost.

Return to farm management and labour was evaluated as the difference between the gross margin of the respondents and their imputed costs. It is the measure of earnings to labour and management of the farm business.

The profitability ratios used in the study include the gross ratio and operating ratio. The gross ratio measures the overall success of the farm. The lower the ratio, the higher the return per naira. It is expressed as:

GR = TFE/GI (2)

Where GR is the gross ratio; TFE is total farm expenses; and GI is the gross income.

Operating ratio is directly related to variable input usage (Ojo, Onwordi, Olaleye, Ojo, Tsado, & Abu). The lower the ratio, the higher the profitability of the farm enterprise. The ratio is estimated as:

OR = TOC/GI (3)

Where:

OR is operating ratio, TOC is total operating cost, and GI is the gross income.

Stochastic frontier model was used to evaluate technical efficiency of the respondents. The use of this model is based on its ease to capture the structure of production technology (the deterministic production frontier) and the external events, favourable and unfavourable beyond the control of the farmer (Lovell, 1993). Besides, the model deals with the stochastic noise and permits statistical test of hypotheses pertaining to the structure and degree of inefficiencies (Sharma, Leung & Zaleski, 1999).

Following Battese & Coelli (1995), the model is expressed as:

$Yi = f(X_i, \beta) + (V_i - U_i)$ (4)

Where:

Yi is the output of the i^{th} farm.

X_i is a k x l vector of physical input quantities of the i^{th} farm. The inputs considered in the study were farm size, labour, planting materials and fertilizer.

β is a vector of unknown parameters estimated.

V_i are random variables which are assumed to be normally distributed N(0, δv2) and independent of the U_i. It is assumed to account for measurement error and other factors not under the control of the farmer.

U_i are non-negative random variables, called technical inefficiency effects (Aigner, Lovell, & Schimidt, 1977). The independent variables of the inefficiency model used in the study were age of household head, household size, sex of household head, educational status, faming experience, and access to extension services.

HCI was used to determine how well cocoyam production was market-oriented in Osun state. It was evaluated as the ratio of gross value of cocoyam output to the value sold. The value ranges from 0 to 100 per cent. The closer the index is to 100 the higher the degree of commercialisation. A value of zero is an indication that the farmer is operating under subsistence agriculture (Onyebinama, 2000; Omotesho, Falola, & Agbonpolor, 2012). Adopting Okezie (2006) and Omotesho, Falola and Agbonpolor (2012), the HCI is specified as:

$$HCI = \frac{GVS}{GVP} X\ 100\% \quad (5)$$

HCI =household commercialisation index.

GVS= Gross value of cocoyam sold.

GVP = Gross value of cocoyam produced.

Factors influencing commercialisation were ascertained with regression analysis. The implicit functional form of the regression model is expressed as follows:

HCI = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, U) (6)

Where:
HCI = Household commercialization index.
X_1 = Educational level of household head.
X_2 = Age of household head (years).
X_3 = Planting materials.
X_4 = Farming experience (years).
X_5 = Agrochemicals.
X_6 = Farm size (hectares).
X_7 = Use of modern technology (yes = 1, No = 0).
U = Error term.

Since economic theory does not specify an exact model for the relationship between the independent variables and HCI, four different functional forms, namely: linear, double-log, semi-log and exponential – were fitted and the lead equation was selected based on econometric criteria (Gujarati & Sangeethe, 2007).

Results and Discussion

Socio-economic Characteristics of the Cocoyam Farmers in Osun State

Table 1 presents the socio-economic profile of the cocoyam farmers in Osun state. Majority (75.71%) of the farmers were males. The age of the farmers ranged from 27 to 69 years, with an average of 51years. Just 10 per cent of the farmers were not older than 30 years. This suggests that the cocoyam farm population in Osun state essentially comprised old individuals. This might be due to the high level of apathy exhibited by the youth to agriculture (Adedoyin, 2005; Adewale, Oladejo & Oguniyi, 2005; Adekunle, Adefalu, Oladipo, Adisa & Fatoye, 2009; Muhammad-Lawal Omotesho & Falola, 2009; Falola et al., 2013).

About 68.57 per cent of the farmers were married. Also, 73.57 per cent of them had a household size of at least six persons. Further analysis of the results revealed that the average household size of the farmers was about nine persons. This suggests that cocoyam production could be a means of catering for the family by the farmers.

Distribution of the farmers according to educational attainment shows that most of them had low level of formal education. Only 10.71 per cent of them had secondary education while just about 1.43 per cent had tertiary education. This scenario might result from the preference for white collar jobs by well-educated individuals, with negligence to agriculture, especially in developing countries like Nigeria (Falola, et. al., 2013; Muhammad-Lawal, et. al, 2009).

The majority (63.57%) of the farmers had no access to agricultural extension services. As regards source of fund for farm activities, most (94.29%) of the farmers financed their operations with personal savings. Just 1.43 per cent and 0.71 per cent of the farmers funded their farming activities with credit obtained from cooperatives and banks respectively. The likely implication of this is that personal savings may not be large enough to create room for expansion of the farm operations.

Table 1: Distribution of the Farmers by Socio-economic Characteristics (N = 140)

Variable	Category	Frequency	Percentage
Gender	Male	106	75.71
	Female	34	24.29
Age (years)	≤ 30	14	10.0
(Mean = 51 years)	31 – 40	30	21.43
	41 – 50	40	28.57
	51 – 60	42	30.0
	> 60	14	10.0
Marital status	Single	27	19.29
	Married	96	68.57
	Widowed	17	12.14
Household size	1 – 5 persons	37	26.43
(mean = 8.57 persons)	6 – 10 persons	58	41.43
	11 – 15 persons	34	24.29
	> 15 persons	11	7.86
Highest education attained	No formal education	67	47.57
	Primary education	56	40.0
	Secondary education	15	10.71
	Tertiary education	2	1.43
Access to extension services	Yes	51	36.43
	No	89	63.57
Main source of finance	Personal savings	132	94.29
	Relatives and friends	5	3.57
	Cooperatives	2	1.43
	Banks	1	0.71
Farm size (hectares)	≤ 1.00	34	24.29
	1.01 – 1.50	52	37.14
	1.51- 2.00	34	24.29
	>2.00	20	14.29
Farming experience	1 – 5	10	7.14
(years)	6 – 10	17	12.14
(Mean = 14.49years)	11 – 15	47	33.57
	16 – 20	34	24.29
	> 20	32	22.85

Source: Authors' computation, 2013.

The farm size of the farmers ranged from 0.6 to 2.2 hectares, with an average of 1.42 hectares. This indicates that cocoyam production in Osun state is still dominated by small-scale production. This has implications for food security, especially with respect to producing 'neglected and underutilised crops' in quantity that would help in meeting the challenges of food availability in the state.

The majority (92.86%) of the farmers had been in farming for over five years. The mean farming experience of the farmers was about 14.5years. This suggests that farming is a long-standing venture in the state.

Analysis of Profitability of Cocoyam Production by the Farmers in Osun State

Table 2 gives the analysis of the profitability of cocoyam production by the cocoyam farmers in Osun state. The mean gross value of output of the farmers was N49,795.63/ha (USD 311.22/ha) while the total variable cost incurred per hectare was N14,440.73 (USD 90.25) [Note 1USD = N160]. The major components of the variable costs incurred by the farmers were costs of land preparation, hired labour and agrochemicals (fertilisers and pesticides) and these constituted 36.35 per cent, 29.95 per cent and 16.71 per cent of the total variable costs respectively. These results are in consonance with previous findings on cocoyam production in Nigeria which provided an overall gross margin of N35,354.90/ha (USD 220.97/ha) (see Ogbonna & Nweze, 2012; Onwubuya & Ajani, 2012).

Table 2: Analysis of Profitability of Cocoyam Production in Osun State

Variables (per hectare)	Value (per hectare)
Gross value of output (A)	N49,795.63
Variable cost	N5,250.00
Cost of land preparation	N1,253.04
Cost of planting materials	N1,200.00
Cost of mulch	N2,413.32
Cost of agrochemicals	N4,324.37
Cost of hired labour	N14,440.73
Total variable cost (B)	N35,354.90
Gross margin (C) = A – B	
Imputed costs	N6372.50
Cost of family labour	N590.72
Depreciation	N2000.00
Imputed rent for land	N8,963.22
Total imputed cost (D)	N26,091.28
Returns to farm management and labour (E) = C – D	0.47
Gross ratio {(B + D)/A}	0.29
Operating Ratio (B/A)	2.51
Return on Capital Invested (C/B)	

Source: Authors' computation, 2013.

The imputed costs of family labour, depreciation on implement and rent for land were N6,372.50, N590.72 and N2000.00 respectively (1USD = N160.00), giving a total of N8,963.22/ha (USD 56.02/ha). Given the gross margin of N35,354.90/ha obtained, the returns to farm management and labour by the farmers is N26,091.28/ha (USD 163.07/ha). The operating ratio of the farmers was 0.29, implying that 29 percent of gross income was used for operating expenses. Return on capital invested by the farmers was 2.51, indicating that for every N1 invested by them, N2.50 was earned as returns from cocoyam production. These results, therefore, show that cocoyam production is a profitable enterprise in Osun state.

Analysis of Technical Efficiency of the Farmers in Osun State

Table 3 shows the technical efficiency indices of the formers in Osun state. The results show that none of the farmers had a technical efficiency of 100 per cent, signifying that none of the farmers was operating on the stochastic frontier. The technical efficiency of the farmers ranged from 0.29 – 0.81, signifying a wide gap between the least efficient farmer and the best one. The mean efficiency of the farmers was 61 per cent. Further analysis of the results showed that about 59 percent of the farmers were operating below the mean efficiency. The mean efficiency obtained from this study shows there is a gap of 39 per cent (100 – 61) per cent for all the cocoyam farmers in the state to attain production frontier. This suggests that opportunity still exists for increasing farmers' productivity and income through increased efficiency in the use of existing farm technology.

Table 3: Distribution of Farmers by their Technical Efficiency in Osun State

Technical Efficiency	Frequency	Percentage
≤0.300	5	3.57
0.301 – 0.400	12	8.57
0.401 - 0.500	20	14.29
0.501 - 0.600	44	31.43
0.601 - 0.700	50	35.71
0.701 - 0.800	8	5.71
>0.800	1	0.71
No. of Observations	140	100.0

Source: Authors' computation, 2013.

Table 4 shows the outcome of the factors that affected the technical efficiency of the farmers in Osun state. The estimated variance (σ^2) was significant at 5 per cent level of probability. This indicates goodness of fit and correctness of the specified distribution assumption of the composite error term. The gamma (γ) was estimated at 0.9886 and was significant at 1 per cent. This implies that 98.89 per cent in total variation in cocoyam output of the farmers is due to technical inefficiency. The outcome of the study also shows that the significant variables that affected the technical efficiency of the farmers were planting materials, fertilisers, level of education and access to extension services.

Table 4: Maximum-likelihood Estimates for parameters of the Cobb-Douglas Stochastic Frontier Production of the Farmers in Osun State (N = 140)

Variables	Parameter	Coefficient	Std. Error	t-value
Stochastic frontier model				
Constant	β_0	4.9747***	0.3165	15.7179
Farm size	β_1	-0.0029	0.0554	-0.0523
Labour	β_2	0.1394	0.0963	1.3126
Planting materials	β_3	0.3695***	0.0525	2.6552
Fertilizer	β_4	0.3504***	0.1084	3.4087
Inefficiency model				
Constant	δ_0	6.5436	4.8312	1.3544
Age	δ_1	-5.8481	3.8518	-1.5183
Household size	δ_2	-0.0899	0.8499	-0.1058
Sex	δ_3	4.0262	2.7459	1.4663
Education	δ_4	-2.8292*	1.5877	-1.7820
Farming experience	δ_5	-0.6024	0.8468	-0.7114
Access to extension services	β_6	-0.3544**	0.1600	-2.215
Variance parameters				
Model variance	σ^2	6.3529**	2.9561	2.1491
Variance ratio	γ	0.9886***	0.0073	135.4247
Log likelihood		-73.4573		

Note: *, **, *** - Variable is significant at 10%, 5% and 1% respectively
Source: Authors' computation, 2013.

Rate of Commercialisation of Cocoyam Production by the Farmers in Osun State

Table 5 shows the distribution of the farmers in Osun state according to their household commercialisation indices. The HCI of the farmers ranged from 9.0 per cent to 62.1 per cent, with and average HCI of about 48.6 per cent. Further analysis of the household commercialisation indices of the farmers revealed that 54.3 per cent of them fell below the average HCI, while 45.7 per cent of the others had their HCIs greater than it. Overall, the average HCI of 48.6 per cent obtained indicates that there is still a gap of 51.4 per cent (100 – 48.6) per cent for the farmers to achieve full commercialisation of cocoyam production.

The results of the regression analysis carried out to determine factors that influenced commercialisation of cocoyam production by the farmers in Osun state are shown in Table 6. The double-log function was selected as the lead equation based on its value of R^2 (coefficient of multiple determination), F-statistic, and the signs of the coefficients of the regression in conformity with the a-priori expectations. The R^2 of 0.624 obtained indicates the explanatory variables included in the model explain 62.4 per cent of the total variations in the HCI of the farmers. The F-ratio (18.231) is significant at 1 per cent level of significance, implying that the data attest to the overall significance of the regression model. The results also shows that the significant variables that influenced the level of commercialisation of cocoyam production by the farmers in Osun state were level of education attained, age of household head, farming experience, farm size and use of modern technology. Educational attainment of household head was positively and significantly related to HCI, implying that household heads with more educational qualifications had the tendency of producing at market-oriented level than their less educated counterparts. This might result from the fact that well educated farmers are much likely to adopt innovations that would better their production (see also Olukosi & Erhabor, 1998).

Table 5: Distribution of Farmers in Osun State by Household Commercialisation Indices

Commercialisation Index	No of Famers	Percentage	Minimum	Maximum	Mean
≤ 10.0	1	0.71	9.0	9.0	9.0
11.0 – 20.0	3	2.14	16.82	19.7	17.8
21.0 – 30.0	2	1.43	27.6	29.0	28.3
31.0 – 40.0	15	10.71	32.6	40.0	39.0
41.0 – 50.0	59	42.14	41.5	49.7	48.2
51.0 – 60.0	30	21.43	51.6	59.3	53.2
61.0 – 70.0	27	19.29	61.2	62.1	61.5
Sample	140	100	9.0	62.1	48.6

Source: Authors' computation, 2013.

Age of household head was negatively significant at 1 per cent level of significance. This suggests that the older a farmer is, the less likely he can produce at commercial scale. This is likely due to the fact that all things being equal, young farmers have more physical strength required to carry out farming activities than their older colleagues (Muhammad-Lawal, et. al., 2009; Omotesho, et. al., 2012). In the same vein, Falola, et. al. (2013) argued that the youths have more risk-bearing ability, innovativeness and mental capacity to cope with life challenges than the ageing population. All these might explain the negative relationship between the age of the farmers and their HCIs.

Table 6: Determinants of Commercialisation of Cocoyam Production by Farmers in Osun State

Variables	Linear	Semi-log	+Double-log	Exponential
Constant	3760.423	1575.973**	8.124***	7.672***
	(3047.344)	(709.259)	(0.578)	(0.147)
Educational attainment	-586.838	-130.718	0.156**	-0.0366
	(230.042)	(129.809)	(0.067)	(0.270)
Age of household head	-72.606**	-12.006*	-22.353***	-0.143
	(28.462)	(6.589)	(8.038)	(0.090)
Planting materials	68.926	-32.096	0.0124	-0.0035
	(405.447)	(142.649)	(0.077)	(0.026)
Farming experience	0.382***	-0.143	42.623***	-2.342
	(0.145)	(0.091)	(6.776)	(-1.551)
Agrochemicals	128.701	-2.059	0.0024	-0.0003
	(579.734)	(2.684)	(0.109)	(0.0009)
Farm size	1302.527***	301.667***	0.273***	0.0562***
	(351.559)	(59.594)	(0.067)	(0.012)
Labour	-380.923	-0.767	-0.0553	-0.0004
	(365.569)	(0.596)	(0.079)	(0.0003)
Use of modern technology	2569.101***	1456.334***	0.424***	0.267***
	(659.759)	(376.703)	(0.125)	(0.078)
R^2	0.538	0.559	0.624	0.508
R^2 Adjusted	0.509	0.538	0.591	0.485
F-statistics	11.286	16.743***	18.231***	14.203***

Note: *, **, *** - Variable is significant at 10%, 5% and 1% level respectively;
+ - Lead equation; Figures in parenthesis are standard errors.
Source: Authors' computation, 2013

Farming experience of the farmers was also positively and significantly related to their HCIs. This is in line with the *a-priori* expectation, as farmers with much experience are likely to have acquired skills over time that will improve their agricultural activities. Also, the positive and significant relation of farm size to HCI of the farmers indicates that the lager the farm size of the farmers, the higher the HCI. This is logical, as more farms are put to cultivation of a crop, *ceteris paribus*, the quantity produced is likely to increase. Consequently, the percentage of the produce that would be meant for sale would definitely increase. The same scenario also explains the positive relationship between the use of modern agricultural technology and the farmers' HCI.

Conclusion and Recommendations

It can be inferred from this study that cocoyam production in Osun state is undertaken mainly by married less educated and ageing individuals who have little access to extension services and mostly financed their farm operations with their personal savings. The study has also revealed that cocoyam production is a profitable venture that could serve as a viable means of generating income by farmers. However, its production is still less market-oriented and the farmers have not fully achieved their potential output given their existing level of farm technology. These are as a result of some challenges which have to be overcome for the crop to take its rightful place in agricultural production.

Based on these findings, therefore, it is recommended that there is need by agricultural development agencies to encourage young and educated individuals to actively engage in cocoyam production. This will not only enhance the skills with which the crop is being produced but also encourage farmers to adopt innovations that will boost cocoyam production. In addition, agricultural development agencies at all levels (state and local government levels) should provide the farmers with fertilizers, improved planting materials and extension services. This will improve quantity of cocoyam output by the farmers as well as the amount of the output that will be meant for sale. In the same vein, farmers should be

introduced to modern technologies that will facilitate their production. Farmers in the state, too should increase the current farmland that is being put into cultivation of cocoyam.

References

Adedoyin, S. F. (2005). Youth and children programme in Nigeria. In *Agricultural extension in Nigeria*: AESON, 251.

Adewale, J. G., Oladejo, J. A., & Ogunniyi, L. T. (2005). Economic contribution of farm children to agricultural production in Nigeria: A case study of Ekiti State. *Journal of Social Sciences*, 10(2), 149 – 152.

Adekunle, O. A., Adefalu, L. L., Oladipo, F. O., Adisa, R. S., & Fatoye, A. D. (2009). Constraints to youth's involvement in agricultural production in Kwara State, Nigeria. *Journal of Agricultural Extension*, 13(1),102-108.

Aigner, D. J., Lovell, C. A. K., & Schimidt, P. (1977). Formulation and estimation of stochastic frontier function models. *Journal of Econometrics*, 6, 21– 37.

Amusa, T. A., Enete, A. A., & Okon, U. E. (2011). Socioeconomic determinants of cocoyam production among small-holder farmers in Ekiti State, Nigeria. *International Journal of Agricultural Economics and Rural Development*, 4(2), 97 – 109.

Battese, G.E., & Coelli, T. J. (1995). Inefficiency effects in a stochastic frontier production function for panel data. *Empirical Econometrics*, 20, 325 – 332.

Falola, A., Ayinde, O. E., & Ojehomon, V. E. T. (2013). Economic analysis of rice production among the youths in Kwara State, Nigeria. *Albanian Journal of Agricultural Sciences (AJAS)*, 12 (3), 503-510.

Federal Ministry of Agriculture and Rural Development (FMARD) (2012). *Agricultural transformation agenda: Repositioning agriculture to drive Nigeria's economy.* Retrieved from www.emrc.be. 25/06/2013.

Gujarati, D. N., & Sangeethe (2007). *Basic econometrics.* (4th ed.). New Delhi: Tata McGraw-Hill Publishing Company Limited.

Lovell, C.A.K. (1993). Production frontiers and productive efficiency. *In H. O. Fred, C.A.K. Lovell & S.S. Schmidt (Eds.). The measurement of productive efficiency.* New York: Oxford University Press.

Muhammad-Lawal, A., Omotesho, O. A., & Falola, A. (2009). Technical efficiency of youth participation in agriculture: A case study of the youth-in-agriculture programme in Ondo State, Southwestern Nigeria. *Nigerian Journal of Agriculture, Food and Environment*, 5(1), 20-26.

Ogbonna, P. E., & Nweze, N. J. (2012). Evaluation of growth and yield responses of cocoyam (*Colocasia esculenta*) cultivars to rates of NPK 15:15:15 fertilizer. *African Journal of Agricultural Research*, 7(49), 6553-6561.

Ogunniyi, L. T. (2008). Profit efficiency among cocoyam producers in Osun State, Nigeria. *International Journal of Agricultural Economics and Rural Development*, 1 (1), 38 – 46.

Ojo, M. A., Onwordi, S. O., Olaleye, R. S., Ojo, A. O., Tsado, J. H., & Abu, O. (2011). Analysis of socio-economic effects of the use of tractor in arable crops production in Zamfara State, Nigeria. *Proceedings of the 12th Annual National Conference of Nigerian Association of Agricultural Economists*, 150 – 158.

Okozie, C. A. (2006). Effects of agricultural commercialisation on production, consumption and nutrition in farm households in Abia State. *Unpublished Ph.D Thesis*. Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike.

Olukosi, J. O., & Erhabor, P. O. (1998). *Introduction to farm management economics: Principles and applications.* Zaria: Agitab Publishers Ltd.

Omotesho, O. A., Falola, A., & Agbonpolor, G. (2012). Analysis of sweet potato production in Offa and Oyun Local Government areas of Kwara State, Nigeria. *Benin International Journal of Agricultural Economics and Extension Services*, 2(1), 67-75.

Onwubuya, E. A., & Ajani, E. N. (2012). Strategies for improving production and processing of cocoyam among women farmers in Anambra State, Nigeria. *Universal Journal of Education and General Studies*, 1(6), 169-173.

Onyebinama, U. A. U. (2000). Economics incentive and strategies for commercialisation of agriculture in Nigeria. *African Journal of Business and Economic Research*, 1(2), 182 – 184.

Osun Elementary School Feeding and Health Programme (2012). Short report on on-going cocoyam project in the State of Osun. Retrieved from http://www.o-meals.com/short-report-on-on-going-cocoyam-project-in-the-state-of-osun/ 05/05/2012.

Osun State Agricultural Development Programme (OSSADEP, 1997). *The report of 1996 crop area and yield survey*. Osogbo: Planning, Monitoring and Evaluation Department, OSSADEP.

Sharma, K. R., Leung P., & Zaleski H. M. (1999). Technical, allocative and economic efficiencies in swine production in Hawaii: A Comparison of parametric and non-parametric approaches. *Agricultural Economics*, 20, 23-35.

Vanguard. (2012, May 5) *Osun state government to feed pupils on cocoyam-based formula.* Retrieved from http://www.vanguardngr.com/ 05/05/2012.