Developing Country Studies
ISSN 2224-607X (Paper) ISSN 2225-0565 (Online)
Vol.3, No.8, 2013

Parametric Approach of Assessing Performance of Yam Farms in Oyo State of Nigeria

*Oladeebo, J.O. and O. M. Okanlawon

Department of Agricultural Economics, Ladoke Akintola University of Technology,

P.M.B 4000, Ogbomoso, Nigeria.

*E-mail of corresponding author: jooladeebo@lautech.edu.ng

Abstract

This study aimed at determining the performance of yam farms in Oyo State of Nigeria. Data collection was through well structured questionnaire administered on 110 respondents selected by simple random sampling technique. The methods of analysis used were descriptive statistics and stochastic frontier production function analysis using the Ordinary Least Square (OLS) and Maximum Likelihood Estimates (MLE) criteria to estimate the parameters of the production function. Results showed that majority of the farmers were middle aged and quite experienced in yam production. Also, there was moderate level of literacy as 88 % of the respondents had one form of education or the other. Farming was majorly on small-scale level as the average farm size was 2.5hectares. Result further showed that age, farm size, quantity of yam planted, agro-chemicals and cost on implements were positively related to output while total labour, education, experience, access to extension and credit facility carried negative signs. However, farm size, agro-chemicals and quantity of yam have significant influence on total output. It was recommended that in order to boost yam production more land should be devoted to its production in the study area.

Keywords: Parametric Approach, Performance, Yam Farmers, Nigeria

1. Introduction

Agriculture belongs to the real sector of Nigeria's economy and it is characterized by multitude of small scale farmers scattered over wide expanse of large area, with small holdings ranging from 0.05 to 3.0 hectares per farm land, rudimentary farm systems, low capital utilization and low yield per hectare (Fasasi, 2006). The supply of agricultural products from any nation to satisfy human wants and the resources used in their production are very vital because of their limited supply and stiff competitions for them by many enterprises.

According to Idowu (2005) yam (*Dioscorea spp*) is a major tuber staple in West and central Africa where it provides food for over 160 million people. Yam belongs to the class of crop called tuber crops and they are found majorly in the western part of the country. Nigeria's output of yam is composed of production from various states in the country with Oyo State as one of the major producers.

The important varieties of yam being cultivated in Oyo State of Nigeria includes: White yam (*Dioscorea rotundata*); Water yam (*Dioscorea alata*); Aerial yam (*Dioscorea bulbifera*); Yellow Yam (*Dioscorea cayanensis*); Bitter or Trifoliate yam (*Dioscorea dumentorium*); Chinese yam (*Dioscorea esculenta*) (Akanbi, 2004).

Fasasi (2006) claimed that yam is an important agricultural crop in Nigeria and that its importance in the diets of the various tribes in the country differs. Although, Nigeria is a global leader in yam production, most of the yams produced are also consumed within Nigeria with little or no exportation at all. In Oyo State, yam production is of high economic benefit to the people due to the amount of resource committed to its production and the proportion of their income which it represents.

Prevalent food scarcity is becoming a common problem in Nigeria because as a developing nation which is tending towards industrial economy from agricultural economy, Nigeria can be said to be experiencing a progressive urbanization and rapid population growth with the attendant increase demand for food crops. Study by Scott and Best (2000) on yam has shown that the absolute level of production both in West Africa and globally have remained static for the last three decades. This static or declining trend may not be unconnected with productive resources, which are not being efficiently utilized, leading to low productivity. Inefficient resource allocation could limit the level of returns to an enterprise and in turn affect its attractiveness for resource allocation.

Therefore, this study aimed to provide answers to the following research questions:

(1) How productive are the yam farmers in the Ibarapa region of Oyo State?
(2) What are those factors that significantly influence farm level productivity in the study area?

1.1 Objectives of the Study

The general objective of the study was to examine the performance of yam farms in Oyo State of Nigeria using parametric technique. The specific objectives were to:

(1) Examine the socio-economic characteristics as well as other factors affecting the level of yam productivity in the study area.

(2) Determine the amount of gains obtainable from improving yam farmers' performance through the examination of their level of efficiency in yam production.

2.0 Methodology

2.1 Study Area

The study was conducted in the Ibarapa Central Local Government Area of Oyo State which has its headquarters in Igbo-Ora. The study area has the estimated population of over 560,000 people (NPC 2006), and it is the largest community that has the highest population out of the several towns and villages that makes up the Ibarapa zones of Oyo State. Several villages and hamlets makes up the Local Government Area (LGA).

The major occupation of the people in this area is mainly agriculturally based (most of them are farmers) while other secondary income generating activities in the area include: Trading, Hunting, Blacksmithing, Teaching, Weaving, Tailoring, Carpentry, *et cetera*.

There are two main planting seasons in the LGA and these are the dry and the wet seasons. The dry season usually occurs between the months of November to March while the wet season occurs between the months of April and October.

The major crops being cultivated in the LGA are yam, maize, cassava, okra, melon, groundnut and cash crops like mango, cashew, and citrus and so on.

The larger percentages of people in this part of the country are Yorubas though there exists other tribes like the Fulanis and the Hausas.

Ibarapa Central Local Government Area is made up of ten political wards namely:

Idere 1-3, Igbole, Pako, Iberekodo 1 and 2, Isale oba, Oke-Iserin and Oke-odo out of which Igbo-Ora has seven wards. It is divided into six blocks with a total of 62 different Enumeration Wards (EAs) with numbers of buildings designed for demographic purposes. (OYSADEP, 2007).

2.2 *Population of the Study*

The population of the study area comprised of both male and female farmers engaged in the cultivation of yam with other food crops in the study area.

2.3 *Sampling Procedure and Sample Size*

The study area consists of ten wards in the Local Government Area in which seven of the wards are situated at Igbo-Ora, the headquarters' of the LGA while the remaining three wards are located at Idere town in the LGA.

Based on the preponderance of yam farmers, simple random sampling technique was used in selecting 22 yam farmers from five wards in the LGA making a total of 110 yam farmers from whom primary data were elicited.

2.4 *Instrument for Data Collection*

The instrument used for the collection of data was the use of structured questionnaire which was divided into sub-sections in order to gather various forms of relevant information. The questions were translated to the farmers in their mother tongue as at when necessary.

2.5 *Method of Data Collection*

Data was collected through the use of structured questionnaire administered personally to the farmers and through the help of some extension agents that were available in the study area. Observations and other information given by the famers apart from the questionnaire were also taken note of. The completed questionnaires were then processed for the relevant information.

2.6 *Analysis of Data*

Descriptive statistics like the frequency count and percentages was used to analyse the socio-economic characteristics of the respondents as well as other factors involved in yam production. The use of stochastic frontier efficiency model (parametric method) was employed to estimate the technical efficiency- a performance measure of the yam farmers.

2.6.1 *Model Specification*

The stochastic frontier production function model for estimating farm level technical efficiency is specified as:

$$Y_i = f(X_i; \beta) + \varepsilon_i \ (i=1, 2\ldots n) \quad (1)$$

Here Y_i is the output, X_i denotes the actual inputs vector, β is the vector of parameters to be estimated and ε is the error term which is composed of two elements, that is;

$$\varepsilon = V_i - U_i \quad (2)$$

Where V_i is the symmetric disturbances assumed to be identically, independently and normally distributed as N $(0, \sigma 2)$ given the stochastic structure of the frontier

The second component U_i is a one-sided error term that is independent of V_i and is normally distributed as $(0,\sigma^2_u)$, allowing the actual production to fall below the frontier but without attributing all short falls in output from the frontier as inefficiency.

Following Jondrow *et al* (1982), the technical efficiency estimation is given by the mean of the conditional distribution of inefficiency term U_i given ε; and thus defined by:

$$E(U_i/\sigma) = \frac{\sigma_u \cdot \sigma_u [f(\varepsilon_i\lambda/\sigma) - \varepsilon i\lambda]}{\sigma[1-F(\varepsilon_i\lambda/\sigma) \quad \sigma]} \qquad (3)$$

Here, $\lambda = \sigma_u/\sigma_v$, $\sigma^2 - \sigma_u^2 + \sigma^2_v$ where f and F represents the standard normal density and cumulative distribution function respectively evaluated at $\varepsilon_i\lambda/\sigma$

The farm-specific technical efficiency is defined in terms of observed output (Y_i) to the corresponding frontier output (Y_i*) using the available technology derived from the result of the above equation.

$$TE_i = \frac{Y_i}{Y_i^*} = \frac{E(Y_i/u_i, \quad X_i)}{E(Y_i/u_i=0, Xi)} = E[\exp(U_i)/\varepsilon_i] \qquad (4)$$

TE takes values within the interval (0 and 1), where 1 indicates a fully efficient farm.

3.0 Results and Discussion

3.1 Socio-Economic Characteristics of Respondents

3.1.1 Age of Respondents

Table 1 shows that 49% of the farmers have their age bracket between 31-50 years, about 45% of them are between the ages 51-70 years. Only about 5% of the respondents are less than 30 years of age while just 0.91% of them are above 70 years.

An average farmer is about 50 years of age which indicates that majority of the farmers are middle aged and this leads to productivity.

3.1.2 Educational Qualification of Respondents

Table 2 shows that 33% of the respondents attained secondary level of education, 30% of them are primary school leavers while about 14% of them obtained tertiary education.
The result further shows that about 1% of the farmers have no formal education and only about 11% of them obtained university education. An average farmer obtained a junior secondary educational qualification. The implication of the result in this table is that majority of the respondents had one form of education or the other ranging from primary education to tertiary education. Hence, the respondents might easily adopt new and improved technology which can boost yam production, all other things being equal.

3.1.3 Household Size of Respondents

Table 3 shows that 53.64% of the respondents had a household size of between 4-6 people, 30% had household size between 7-9 people. About 15% had family size of between 1-3 people while only 1.82% of the respondents had household size greater than 9. An average household size of the respondents is about 6 people which means that there was availability of family labour.

3.1.4 Farm Size of Respondents

Table 4 explains that about 78% of the farmers cultivated between 1-3 hectares of land, it further indicated that about 1% of them had a farm size of between 4-6 hectares while about 5% cultivated less than 1 hectare of land. Only 4% of them had a total farm size between 7-9 hectares and about 2% of the respondents had total farm size of above 9 hectares. The average farm size used for yam cultivation by the respondents was 2.49 hectares which indicated that an average farmer in the study area is a small scale farmer (Olayide, 1980).

3.1.5 Farming Experience of Respondents

Table 5 shows that 36% of the farmers had between 6-10 years of farming experience while about 16% had between 16-20 years of farming experience. It also revealed that about 1% of them had experience between 11-15 years and only 3% farming experience of above 20 years. An average farmer had about 10 years of farming experience which implies that an average farmer in the study area had substantial years of farming experience which could boost productivity.

3.1.6 Access to Extension Visit by Respondents

Table 6 indicated that about 73% of the farmers had no access to extension visitation; about 15% had just 1access to extension visitation during the planting season while 10% of the farmers had 2 opportunities to extension visitation. The result further shows that 9% of the respondents had above 4 opportunities to extension visitation while 2% had 3 opportunities to extension services. Contact with extension agents leads to access to innovations which could boost yam productivity. An average farmer hardly had access to extension services.

3.1.7 Respondents' Source of Land Acquisition

Table 7 shows that 76.36% of the farmers acquired their farmland through family inheritance, 10% of them purchased their farmland while 9.1% of the respondents rented the land they use for yam cultivation. 3.64% of the farmers acquired their farmland through gift and only 0.91% of them actually obtained their farmland through leasing. This implies that, a large percentage of the farmland used for cultivation by the farmers was acquired through family inheritance implying that the farmers had no problem of accessibility to farmland. This could lead to improvement in yam productivity all other things being equal

3.1.8 Respondents' Source of Credit

Table 8 shows that 36.36% of the respondents got their credit source from commercial banks, 35.45% of them from co-operative societies, and 10% of the farmers obtained their credit sources from agricultural credit co-operations while 8.18% of them obtained theirs from money lenders. It further shows that 7.27% of the respondents acquired their credit source from thrift and credit societies while 1.82% and 0.91% obtained their credit from their personal savings and family members respectively.

This result implies that majority of the farmers obtained credit facility from one source or the other which ensures increased productivity as the farmers will have more access to purchase farm inputs, implements and even farmland for cultivation.

3.1.9 Total Labour Used By Respondents

Table 9 shows that 30% of the farmers used total labour of between 71-90 man days per annum. 28.18% of the respondents used between 91-110 man days while about 21% of the respondents used between 51-70 man days. 10% of them used between 31-50 man days and also above 110 man days respectively. Meanwhile, 0.91% used below or equal to 30 man days for their cultivation. An average farmer used 81.2 man days for the cultivation of yam.

3.2. Stochastic Frontier Production Analysis (Performance Measure)

3.2.1. Production Frontier and Technical Efficiency Estimates

Table 10 shows both the Ordinary Least Square (OLS) (Model 1) and the Maximum Likelihood Estimates (MLE) (Model 2). In total, 13 parameters were estimated in the stochastic production frontier model including 7 in the Cobb-Douglas (CD) production frontier model and 6 in the Inefficiency Model.

Out of the 13 parameters, 3 are statistically significant at 5% probability level for Model 1 while 4 are statistically significant at the same level for Model 2.

Coefficients for agro-chemicals, quantity of yam and farm size have expected positive signs and are all significant at 5% probability level.

It should however be noted that in the Inefficiency Model, variables are included as inefficiency variables. The coefficients for farmer's age, education, access to extension services, experience and access to credit facility have the expected signs which implied that as the level of these variables increased the technical inefficiency of the yam farmers decreases (Ojo *et al*, 2009). However, for policy purposes the results of the inefficiency model should be taken with caution because none of the variables had significant coefficient.

3.3 Decile Range of Technical Efficiency

3.3.1 Distribution of Yam Farmers Based On Their Technical Efficiency

Table 11 shows that about 46% of the farmers had technical efficiency indices of above 90 while about 42% of them had efficiency indices ranges from 60 to 89.9. About 5% of the farmers had technical efficiency indices of between 30-59.9 and less than 10 respectively.

The result further shows that 2.73% of the farmers had technical efficiency ranges from 10-29.9. An average farmer had technical efficiency of 79.43 which implies that he is an efficient small-scale farmer. The technical efficiency indices of small-scale farmer which ranged from 11-91 conforms to the findings of Elibariki (2008).

Therefore, an average small-scale farmer in the study area incur about 21% loss in output due to technical inefficiency which implies that average output can be increased by at least 21% by adopting the technology of the best practiced yam farmers and if the inefficiency factors are fully addressed.

4.0 Conclusion

The study revealed that majority (about 88%) of the farmers had one form of education or the other and that an average farmer in the study area is a small scale farmer with an average farm size of 2.5 hectares and that they are mostly middle-aged with mean age of about 50 years. The farmers use much of hired labour than any other type of labour with medium output. Large percentage of the farmers had access to credit facilities but hardly had access to extension services.

The results from the stochastic frontier analysis which indicated the level of performance of yam farmers showed that yam farmers were not fully technically efficient. Since farm size was one of the significant variables in the production function model, it is suggested that more farms could be allocated to willing farmers to boost yam production.

REFERENCES

Akanbi, W.B. (2008); "Crop Production Techniques", LAUTECH Agronomy Production Guide.

Pp. 24-26.

Elibariki, E. (2008); "Explaining Productivity Variation among Smallholder Maize Farmers in Tanzania", School of Economics, Faculty of Economics, Kyoto University, Japan. Pp. 15-31.

Fasasi, A.R. (2006); "Resource Use Efficiency in Yam Production in Ondo State, Nigeria".

Agricultural Journal. **1** (2): 36-40.

Idowu, F.E. (2005); "Economic Implication of Yam Marketing in Abeokuta North Local Government Area of Ogun State", *Unpublished B.Tech Thesis* Department of Agricultural Economics and Extension, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. 35Pp.

Jondrow, J., C.A. Lovell, I. Materov and P. Smith (1982): "On the Estimation of Technical Efficiency in the Stochastic Frontier Production Function Model" *Journal of Econometrics*, **19**(3): 233-238.

National Population Commission (NPC) (2006): Nigeria Provisional Census Report

Ojo, M.A., U.S. Mohammed, A.O. Ojo and R.S. Olaleye (2009): "Return to Scale and Determinants

Of Farm Level Technical inefficiency among Small Scale Yam based Farmers in Niger State, Nigeria:

Implications for Food Security". *International Journal of Agricultural Economics and Rural*

Development, **2**(1):43-51.

Olayide, S.O (1980): "Characteristics, Problems and Significance of Farmers" in Olayide, S.O *et al* (Eds.):

Nigerian Small Farmers: Problems and Prospects in Integrated Rural Development. Ibadan: CARD.

p 1 –15.

Oyo State Agricultural Development Programme, OYSADEP (2007); Annual Report.

Scott, G.J., Best R. (2000); "Roots and Tubers in the Global Food System: Vision

Statement of the year 2020. International Potato Centre, Lima Peru. Pp. 67-70.

Table 1:- Frequency Distribution of yam farmers by their age.

Age(years)	Frequency	Percentage
≤30	6	5.45
31-50	54	49.09
51-70	49	44.55
≥70	1	0.91
Total	**110**	**100.0**

Source:-Field Survey Data

Average	49.92
Minimum	25
Maximum	75
Standard deviation	10.73

Table 2:- Frequency Distribution of Respondents by Level of Education

Educational qualification	Frequency	Percentage
No formal education	13	11.8
Primary	33	30.0
Secondary	37	33.6
ND/NCE	15	13.6
University	1	10.9
Total	**110**	**100.0**

Source:-Field Survey Data

Table 3: Frequency Distribution of Respondents by Household Size

Household size(no.)	Frequency	Percentage
1-3	16	14.55
4-6	59	53.64
7-9	33	30.00
>9	2	1.82
Total	**110**	**100.0**

Source:-Field Survey Data

Average 5.45

Minimum 1

Maximum 11

Table4: Frequency Distribution of Respondents by Farm Size

Farm size(hectares)	Frequency	Percentage
<1	5	4.55
1-3	86	78.18
4-6	13	11.82
7-9	4	3.64
>9	2	1.82
Total	**110**	**100.0**

Source:-Field Survey Data

Average 2.49

Minimum 0

Maximum 10

Standard deviation 1.78

Table 5:-Frequency Distribution of Respondents by Farming Experience

Experience(years)	Frequency	Percentage
<5	40	36.36
6-10	37	33.64
11-15	13	11.82
16-20	17	15.45
>20	3	2.73
Total	**110**	**100.0**

Source: Field Survey Data

Average 9.53

Minimum 2

Maximum 25

Standard deviation 5.93

Table 6: Frequency Distribution of Respondents by Extension Visitation

Number of extension visit	Frequency	Percentage
0	80	72.7
1	16	14.5
2	11	10.0
3	2	1.82
≥4	1	0.91
Total	**110**	**100.0**

Source: Field Survey Data

Average 0.44

Minimum 0

Maximum 4

Table 7: Frequency Distribution of Respondents by Source of Land Acquisition

Source of Land	Frequency	Percentage
Family inheritance	84	76.36
Rented	10	9.10
Leased	1	0.91
Purchased	11	10.0
Gift	4	3.64
Total	**110**	**100.0**

Source:-Field Survey Data

Table 8: Frequency Distribution of Respondents by Source of Credit Obtained

Source of credit	Frequency	Percentage
Personal savings	2	1.82
Family members	1	0.91
Thrift &credit society	8	7.27
Co-operative society	39	35.45
Agricultural Credit Corporation	11	10.00
Commercial banks	40	36.36
Money lender	9	8.18
Total	**110**	**100.0**

Source:-Field Survey Data

Table 9: Frequency Distribution of Respondents by Total Labour Used

Total labour(man days)	Frequency	Percentage
≤30	1	0.91
31-50	11	10.00
51-70	23	20.91
71-90	33	30.00
91-110	31	28.18
≤110	11	10.00
Total	**110**	**100.0**

Source:-Field Survey Data

Average	81.19
Minimum	27
Maximum	149
Standard deviation	23.44

Table 10:- Parameter Estimates of Cobb-Douglas Production Frontier

Variables	Model 1	(OLS)	Model 2	(MLE)
Production function	**Coefficient**	**t-ratio**	**Coefficient**	**t-ratio**
Constant(β_0)	10713.22	0.44851	2028.074	8805.544
Farm size(β_1)	7152.3295	1.31333*	7152.1507	3694.9457*
Total labour(β_2)	-295.1877	-1.213514	-313.3485	-1.8607025
Herbicides(β_3)	-9983.5069	-2.16406	-9983.4184	-7711.3838
Quantity of yam(β_4)	28.5336	7.1159*	28.44819	13.51663*
Agrochemical(β_5)	15.40093	3.08573*	15.32660	9.70620*
Implement(β_6)	-2.7907	-1.08829	-2.967091	2.855531*
Inefficiency Model				
Constant(δ_0)	0	0	5.304	3.438
Age(δ_1)	0	0	-4.9118	0.107819
Education(δ_2)	0	0	-2.6680	-0.107739
Extension(δ_3)	0	0	-6.1114	-0.053167
Experience(δ_4)	0	0	-0.1987	-0.094756
Credit(δ_5)	0	0	-0.1161	-0.31773
Variance Parameters				
Sigma squared	2973549400		2875865200	2875865200
Gamma	0		0.05795	0.48027
Log likelihood	-1352.1831		-1352.0401	

Source: Field Survey Data Analysis

NOTE: * means statistically significant at 5% probability level.

Table 11: Frequency Distribution of Respondents by Their Technical Efficiency Indices

Technical efficiency Indices	Frequency	Percentage
<10	5	4.55
10-29.9	3	2.73
30-59.9	5	4.55
60-89.9	46	41.82
≥90	51	46.36
Total	**110**	**100.0**

Average	79.43
Minimum	49.62
Maximum	98.92
Standard deviation	29.96

Source: Field Survey Data