Technical Efficiency of Plantain Production in Ekiti Southwest Local Government Area of Ekiti State, Nigeria.

Owoeye, R.S and Osundare, F. O.

Department of Agricultural Economics and Extension Services, Ekiti State University, Ado – Ekiti, Nigeria

Email: rufus.owoeye@eksu.edu.ng, Tel.: +2348038662142

Abstract

This study examined the technical efficiency of plantain production in Ekiti Southwest Local Government Area (LGA) of Ekiti State, Nigeria. The study used multistage sampling techniques for data collection. Data were collected from 90 plantain farmers through well-structured questionnaires from the LGA with three towns purposively selected. The collected data were analyzed using descriptive statistics, budgetary analysis and stochastic frontier production model. Results from descriptive analysis showed that 48.88 percent of the plantain farmers had secondary education and above. Majority of the respondents (66.67 percent) had between 5 and 8 members that made up the household in the study area. Findings further showed that majority of the respondents produced on small scale with average plantain farm size of 0.96 hectares. The farmers were fairly experienced with 44.44 percent of them had more than 15 years of farming experience. With mean profit of ₦251,500 per hectare and percentage profit of 63.11 percent, the venture was considered to be highly profitable. Farmers who invested ₦1 realized revenue of ₦0.63. The RTS parameter (0.931) was obtained from the summation of the coefficients of the estimated inputs (elasticities) which indicated that plantain production in the study area was in Stage II of the production surface meaning that these variables were efficiently utilized. Depreciation, hired labour, family labour, farm size and quantity of suckers planted were the significant variables that influence efficiency of the plantain farmers. Age, land acquisition and access to credit contributed significantly to technical inefficiency. Among the most prevalent constraints were; price fluctuation (72.22%), heavy wind (70.00%), high cost of farm input (68.89%), pests and diseases and pilferage (63.33%) each, insufficient credit facility, storage facility and poor agricultural extension services (62.22%) respectively.

Indexing terms/Keywords: Plantain production, budgetary analysis, technical efficiency

Language: English

Date of Submission: 2018-01-13

Date of Acceptance: 2018-02-16

Date of Publication: 2018-03-01

ISSN: 2349-0837

Volume: 08 Issue: 01

Journal: Journal of Advances in Agriculture

Publisher: CIRWORLD

Website: https://cirworld.com

1.0 Introduction

Plantain is one of the most important staple food crops for millions of people both in developed and developing countries, a fact reflected in the gross value of its production. It reaches its greatest importance in parts of East Africa, where annual consumption is over 200kg per capita and in West and central African where more than 10 million tons are produced annually and are traded locally (Latham, 2001). According to Aina *et al*., (2012), plantain serves as a source of income for small holders who produce it around their compound farms, mixed farms and small scale sole plantain farms. In some parts of Nigeria, plantain sells as processed products such as roasted plantain (*boli),* chips, flour and others which are thriving business that provide job opportunities for thousands of youths (Aina *et al*., 2012). Plantain is a seasonal crop with relative short shelf life hence, it is available for a limited period and post-harvest losses are very high.

Plantain is the major source of food in many regions throughout the world. Plantains represents the world's second largest fruit crop with an annual production of 144 million metric tons (FAOSTAT, 2013). About 70 million people in the African sub-region are estimated to derive more than one quarter of their food energy requirements from plantain. Plantain is very critical in bridging the gap between the demand and supply of the basic carbohydrate staples. The majority (82%) of plantain in Africa is produced in the area stretching from the lowlands of Guinea and Liberia to the central basin of the Democratic Republic of Congo. West and Central Africa contribute 61 and 21%, respectively (FAO, 1986). Nigeria is one of the largest plantain producing countries in the world with annual production of about 2.8 million metric tons mostly obtained from the southern states (FAOSTAT, 2013; Maps of world, 2016). Despite its prominence, Nigeria does not feature among the plantain exporting nations as she produces more for local consumption than for export (Fortaleza, 2012).

Nigeria is regarded as the largest producer of plantain in West-Africa having an annual production of about 2.4 million metric tonnes (Okoruwa *et al.*, 2014). The two-third of the total estimated 12 million metric tonnes annual production of plantain in Africa comes from West Africa, INIBAP, 2003 (International Network for Improvement of Banana and Plantain). Researches have shown that the current level of plantain production in Nigeria has been inconsistent and low, thus allowing for home consumption and local trade but no export *(*Tijani *et al.,* 2009). Ants, termites, grasshoppers and the banana weevil (Cosmopolites sordidus) are considered as some of the commonest insect pests to plantain production in Ekiti State which have destructive effects on plantain and hence reduce the productivity level and this in return results in the abandonment of plantain after two or three years of production (Oso *et al*., 2014). The major problems militating against seamless production of plantain in Nigeria include; insufficient storage facilities and credit facilities, old method of production (local varieties of suckers), inadequate labour, high cost of transportation (input materials and output) (Oso *et al*., 2014). Aside these, there is need to check those factors reducing the efficiency level of plantain production. The decline in the yield of plantain production in Ekiti State, Nigeria necessitates this study.

2.0 Research Method

2.1 Study area

The study was carried out in Ekiti State, Nigeria. The State was created on October 1 1996 with a total land area of 6,353km^2. The State is blessed with 2,384,212 people, hence ranked 29th in Nigerian population (NPC 2006). The State has an annual rainfall range between 2000-2400mm and consist of sixteen (16) Local Government Areas. It is located within southwestern part of Nigeria. It has indicating land surface with characteristics landscape that consists of old plants broken by top sided slopes. Ekiti State is located within the tropics between latitude $7^0\,15^1$ to $3^0\,5^0$ north of the equator and longitude $4^0\,45^1$ to $5^0\,45^1$ east of the prime median (Greenwish Meridian). Temperature in the State ranges between 21 and 28 Degree Celsius with high humidity, (Wikipedia, 2016). Tropical forest exists in the south while guinea savannah occupies the northern part. The major occupation of the people in the study area is farming while their major food crops are yam, cassava, plantain and maize with cash crops such as cocoa, oil palm etc. (Sekumade and Owoeye, 2016).

2.2 Sampling technique and Data Collection

Multistage sampling technique was used to select the respondents for the study. The first stage involved the purposive selection of one LGA i.e. (Ekiti Southwest Local Government Area) based on the volume of plantain production in the State. The second stage involved the purposive selection of 3 towns (Ilawe, Ogotun and Igbara-Odo-Ekiti) from the LGA. Lastly, 30 plantain farmers engaged in plantain production were randomly selected from each town. This gave a total of ninety (90) respondents which constituted the sample size for the study. Primary data were collected using a well-structured questionnaire that was self-administered and supplement with oral interview.

2.3 Data analysis

Descriptive Statistics were used to analyze the socio-economic variables of the plantain farmers and constraints to plantain production while Budgetary Analysis and Stochastic Frontier Production Function were used to analyze the costs and returns on plantain production and the resource use efficiency of the plantain production in the study area respectively.

2.3.1 Budgetary analysis

This was used to estimate the costs and returns on plantain production of farmers in the study area. It is specified as follows;

GM = TR – TVC..... (1)

NR = GM – TFC..... (2)

TC = TVC + TFC..... (3)

Profit = TR – TC..... (4)

Where,

GM = Gross margin

TVC = Total variable cost

TC = Total cost

TR = Total revenue

NR = Net revenue

TFC = Total fixed cost

2.3.2 The Stochastic Frontier Production Function

This was used to analyze the resource use efficiency in plantain farming in the study area. According to (Tadesse, 1997) technical efficiency of paddy farms of Tamil Nadu, the production technology of the farmers was assumed to be specified by the cobb-douglas frontier production function that is defined by:

$$InYi = In\beta_0 + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX3 + \beta_4 InX_4 + \beta_5 InX_5 + \beta_6 InX_6 + \beta_7 InX_7 + Vi - Ui$$

Where;

Yi = Farm output in monetary terms (₦)

Xi = Vector of inputs used measured in units

X_1 = Farm size (in hectares)

X_2 = quantity of planted material used (kg)

X_3 = Hired labour (man-days)

X_4 = Family labour (man-days)

X_5 = Operating expenses (₦)

X_6 = Depreciation on farm implement (₦)

X_7 = quantity of agro-chemical used (litres)

Vi = Random variability in production that cannot be influenced by the farmers (Random errors)

Ui = Deviation from maximum potential output attributable to technical inefficiency

β = Vector of production function parameters to be estimated.

Technical inefficiency effects (Ui) is defined as;

$Ui = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8$

Where;

Z_1 represents the Age (years);

Z_2 represents the sex (Male =1 or Female =0);

Z_3 represents the household size (Numbers);

Z_4 represents level of education (Years);

Z_5 represents farming experience (Years)

Z_6 represents Access to credit (Yes = 1, No = 0)

Z_7 represents access to Fertilizer (kg)

Z_8 represents access to extension service (Yes = 1, otherwise = 0)

δ = Parameters to be estimated

3.0 Results and discussions

3.1 Socio-economic Characteristics of Respondents

Respondents between the ages of 50 and 59 years was 28.89 percent while 93.33% of the sampled respondents were male. Distribution of respondents by marital status indicates that 91.11 percent of plantain farmers were married. The result further revealed that 48.88 percent of the plantain farmers had secondary school education and above. The farmers were fairly experienced with 44.44 percent of them had more than 15 years of farming experience. It was revealed that majority of the respondents produced on small scale with average plantain farm size of 0.96hectares. Distribution of labour revealed that majority (62.22%) of the labour were hired labour. Majority of the respondents (66.67 percent) had between 5 and 8 members that made up the household in the study area. This study conforms to the study of Sekumade and Owoeye, 2016.

Table 1: Socio-economic characteristics of respondents

Variable	Frequency	Percentage
Age		
<30	2	2.22
30 -39	21	23.33
40 – 49	19	21.11

50 – 59	26	28.89
60 and above	22	24.45
Total	**90**	**100**
Gender		
Female	6	6.67
Male	84	93.33
Total	**90**	**100**
Land acquisition		
Inheritance	73	81.11
Purchase	15	16.67
Lease	2	2.22
Total	**90**	**100**
Marital status		
Single	3	3.33
Married	82	91.11
Widowed	4	4.45
Divorced	1	1.11
Total	**90**	**100**
Educational level		
No formal education	23	25.56
Primary education	23	25.56
Secondary education	34	37.77
Tertiary education	0	11.11
Total	**90**	**100**
Farming experience		
< 15 years	50	55.56
15-20 years	19	21.11
>21 years	21	23.33
Total	**90**	**100**
Farm size		
0.01-2.00	77	85.56
2.01-4.00	10	11.11
4.01 and above	3	3.33

Total	**90**	**100**
Sources of labour		
Family labour	18	20.00
Hired labour	56	62.22
Family/hired labour	16	17.78
Total	**90**	**100**
Household Size		
1 – 4	14	15.55
5 - 8	60	66.67
9 - 12	15	16.67
13 and above	1	1.11
Total	**90**	**100**

Source: field survey, 2017.

3.2 Productivity analysis of plantain production

3.2.1 Estimates of Stochastic Frontier Production Function Model

Table 2 presents the estimates of the stochastic frontier production function for the plantain farmers considered in the study. Estimates of the parameters of the stochastic frontier production model revealed that all the estimated coefficients of the variables of the production function were positive except that of agrochemicals. The positive coefficients of farm size, quantity of planting material, family labour, hired labour, and depreciation imply that plantain output increased with increase in these variables while the negative coefficient of agrochemicals implies that plantain output decreased with increase in the agrochemicals. Farm size, family labour, quantity of sucker used and depreciation did exert significant effects on plantain output as shown by their t-ratio values. The implication of this is that increase in the level of use of these variables, will increase output of plantain in the study area.

Efficiency analysis of plantain production in the area revealed that considerable technical inefficiency effects existed in plantain production in the study area as confirmed by the gamma value of 0.674. The gamma (γ) ratio indicates the relative magnitude of the variance σ^2 associated with the technical inefficiency effects. Therefore, the gamma value of 0.674 implies that 67.4 percent variation in the output of plantain farmers was due to differences in the technical inefficiencies of the plantain farmers. The gamma value obtained in this study contradicts the study of Osundare and Owoeye, 2016 who reported 0.93. The implication of this is that the plantain farmers under this study were technical inefficient.

The parameter estimates from the inefficiency model included in the stochastic frontier production estimation revealed that age, extension access, land acquisition and access to credit had significant negative effect on technical inefficiency. The simple implication of this is that any independent variable that reduces technical inefficiency will enhance technical efficiency. This also underscores the importance of age, land acquisition, and access to credit in plantain production through improvement in the technical knowledge of plantain farmers in Nigeria.

Table 2: Maximum Likelihood Stochastic Function Estimates

Variable	Parameter	Coefficient	Standard Error	t-ratio
Constant	β_0	-0.217	0.145	-1.496
Farm size	β_1	0.409***	0.143	2.860
Agrochemicals	β_2	-0.459	0.397	-1.156
Family labour	β_3	0.495***	0.103	4.805
Depreciation	β_4	0.341***	0.109	3.128
Quantity of sucker	β_5	0.383***	0.145	2.641
Hired labour	β_6	0.192***	0.071	2.704
Inefficiency factors				
Constant	δ_0	0.837	0.503	1.664
Age	δ_1	-0.472	0.315	-1.498
Sex	δ_2	0.323	0.503	0.642
Educational Level	δ_3	0.174	0.156	1.115
Extension Access	δ_4	0.127	0.016	7.934
Farming Experience	δ_5	0.501***	0.121	4.140
Land Acquisition	δ_6	-0.147***	0.412	-4.140
Access to Credit	δ_7	-0.653***	0.231	-2.827
Access to Fertilizer	δ_8	0.765	0.468	1.635
Summary of TE				
Mean TE		0.631		
Min. TE		0.369		
Max. TE		0.987		
Variance Parameters				
Sigma Squared	σ^2	0.42	0.254	
Gamma	γ	0.674	0.431	
Log likelihood function		-0.147		

*** P < 0.01; ** P < 0.05

Source: field survey, 2017

3.2.2: Returns to scale analysis

The returns to scale (RTS) analysis which served as a measure of resource productivity is given in Table 3. The RTS parameter (0.931) was obtained from the summation of the coefficients of the estimated inputs (elasticities) which indicated that plantain production in the study area was in Stage II of the production surface meaning that these variables were efficiently utilized. The RTS reported in this study was very close to the value of 0.84 reported by

Ogundari and Ojo, (2005) in a study on examination of technical, economic and allocative efficiency of smallholder farmers in Osun State, Nigeria.

Table 3: Elasticities and returns to scale (RTS) analyzes of production function

Variables	Elasticities
Farm size	0.409
Family labour	0.195
Hired labour	0.192
Agrochemical	-0.459
Depreciation	0.241
Quantity of sucker	0.353
Returns to Scale	0.931

Source: field survey, 2017.

3.2.3: Technical efficiency analysis

The technical efficiency (TE) ranged between 0.37 and 0.99 with mean value of 0.63. The decile range distribution of the TE showed that more than half (57.78%) of the plantain farmers had technical efficiency of 0.8 and above while 20% of the farmers had TE range 0.6-0.8. This result implies that the sampled farmers were relatively technically efficient. This result conforms to the study of Osundare and Owoeye, 2016 on appraisal of efficiency of fadama maize farmers in Osun State, Nigeria.

Table 4: Frequency Distribution of Technical Efficiency Indices

Technical efficiency range		Frequency	Percentage
<0.3		5	5.55
0.3-0.6		15	16.67
0.6-0.8		18	20.00
0.8 and above		52	57.78
Total		**90**	**100**
Min.	**0.37**		
Max.	**0.99**		
Mean	**0.63**		

Source: field survey, 2017.

3.3 Budgetary analysis

3.3.1 Costs and returns

The budgetary analysis (Table 5) showed that the TVC formed the bulk 86.52% of the TC while the TFC was just 13.48%. This implies that farmers who want to be cost efficient have to reduce TVC especially the cost of labour that is more than three quarter (66.12%) of the total cost. TFC is small probably because of very low cost of land rent in the area. This is typical of core rural communities in Southwestern Nigeria where most lands are currently held by inheritance as presented in the result. The total profit of ₦251,500 per hectare and percentage profit of 63.11 percent

shows that plantain farming is a highly profitable venture in the area. The cost-benefit ratio showed that a farmer that invested ₦1 realized ₦1.63k as revenue or gained ₦0.63k on each Naira expended.

3.3.2 Profitability measures

(a) Profit= Total revenue – Total cost, ₦650,000 – ₦398,500 = ₦251,500

(b) Gross margin= Total revenue – Total variable costs, ₦650,000 – ₦278,500 = ₦371,500

(c) Cost ratio= TR/TC= ₦650,000 / ₦398,500 = ₦1.63

(d) Gross ratio= TC/TR= ₦398,500 / ₦650,000 = 0.613

(e) Percent profit= Profit/Total cost x 100% = ₦251,500/ ₦398,500 x 100% = 63.11%

Table 5: Budgetary analysis

S/N	Description Value (₦)	Percentage
Variable Costs		
Cost of labour	263,488.20	66.12
Cost of pesticides	39,053.00	9.80
Cost of herbicides	42,241.00	10.60
Total variable cost (TVC)	**344,782.20**	**86.52**
Fixed Costs		
Land rent	14,425.70	3.62
Depreciation	39,252.25	9.85
Total fixed cost (TFC)	**53,667.95**	**13.48**
Total cost (TC)	**398,500**	**100.00**
Total revenue		
(Income) (TR)	**650,000.00**	
Profit (TR – TC)	**251,500.00**	

Source: field survey, 2017

3.4 Constraints to plantain production in the Study Area

Table 6 disclosed different constraints to plantain production in the study area. Among the prominent constraints as reported through multiple responses gathered from the respondents were; price fluctuation (72.22%), heavy wind (70.00%), high cost of farm input (68.89%), pests and diseases and pilferage both had (63.33%) each, insufficient credit facility, storage facility and poor agricultural extension services (62.22%) respectively. Other constraints reported in the study area were; low income (60.00%), poor rainfall (56.67%), availability of planting materials (52.22%) and 45.56% of them indicated labour availability as the major problem facing plantain production while 41.11% and 25.56% of them mentioned erosion and land tenure as their constraints respectively. Constraints reported here by the plantain farmers were similar to those reported by Awotide *et al.,* 2014.

Table 6: Distribution of respondents according to constraints being faced

Constraints	Frequency	Percentage
Price fluctuation	65	72.22

Heavy wind	63	70.00
High cost of farm input	62	68.89
Pests and diseases	57	63.33
Pilferage	57	63.33
Insufficient credit facility	56	62.22
Storage facility	56	62.22
Poor agricultural extension services	56	62.22
Low income	54	60.00
Poor rainfall	51	56.67
Availability of planting material	47	52.22
Labour availability	41	45.56
Erosion	37	41.11
Land tenure	23	25.56
Government policy	19	21.11

Multiple responses

Source: field survey, 2017

4.0 Conclusion

In conclusion, plantain production is highly profitable and leaves farmers with high returns on their investments. The farmers were highly efficient in their production at the present level of technology available to them. There are substantial opportunities to increase productivity and income through more efficient utilization of productive resources. Farmers have to cut down the variable costs in order for them to increase their profit since the bulk of the variable cost was incurred on labour. Reducing the cost, will lead to greater gross margins and hence the profitability of the enterprise. It is therefore recommended that in order to increase farmers' profit, variable costs have to be cut down, since the bulk of the variable cost is incurred on labour, which will lead to greater gross margins and hence the profitability of the enterprise, and efforts should be made to increase scale of operation of the farmers through easy access to land and credit facility. Easy access to productive inputs at affordable price should be encouraged.

References

1. Aina, O. S., Ajilola, S., Bappah, M. T., Ibrahim, I. and Musa, I. A. 2012. Economic Analysis of Plantain Marketing in Odigbo Local Government. Global Advanced Research Journal of Agricultural Science. Vol. 1(4), pp 104-109.
2. Awotide, D.O, Rahji, M.A.Y, Adejobi, A.O and Bamire, A.S (2014). Technical Efficiency and Management Factors in Plantain Production in Humid Forest Zone of Nigeria: A Simulation Analysis. South African Journal of Economic and Management Sciences. NS 8 (2005) No 2: 238-245.
3. Fortaleza, C (2012). The ultimate wealth guide to making millions of Naira yearly with plantain farming in Nigeria. http://www.plantain farming.blogspot.com/
4. Food and Agriculture Organization FAO STAT (2013): FAO Statistics Division 2013. Food and Agriculture Organization of the United Nations. *Production Year book*, FAO Rome. http://faostat.fao.org/site/567/DesktopDefault.aspx#ancor

5. Food and Agriculture Organization. 1986. Production Yearbook 1986. FAO, Rome. http://faostat.fao.org/site/567/DesktopDefault.aspx#ancor International Network for Improvement of Banana and Plantain (INIBAP) 2003; Networking Banana and Plantain, Montpellier, France, 24.
6. Latham, M. C. 2001. La nutrition dans les pays en development, In Info *Musa Africa*: Abstract from International Conference on plantain and banana for Africa. *International Journal on Banana and Plantain,* 16 (1):5 - 12.
7. Maps of world (2016) Top 10 Plantain Producing Countries. www.mapsofworld.com (Assessed 13/6/2016).
8. Ogundari K, Ojo S.O. The determinants of technical efficiency in mixed crop food production in Nigeria: A stochastic parametric approach. Proceedings of the 1st Annual Conference on Developments in Agriculture and Biological Science, 21st April, 2005. School of Agriculture and Agricultural Technology, Federal University of Technology, Akure, Nigeria. 2005; 159–164.
9. Okoruwa, V. O., Sowunmi, F. A., Ogundele, F. O., Omigie, C. O (2014): Resource - Use Efficiency: An Application of Stochastic Frontier Production Function to Plantain Farmers in Ogun State, Nigeria. *Journal of Economics and Sustainable Development* www.iiste.org ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online) Vol.5, No.21, 2014.
10. Oso, A.A., M. O. Olaniyi and O. J. Ayodele (2014): Plantain Production Systems of Ekiti and Ondo States, Nigeria: Farmers' Perception of Loss in Perennial Productivity and Abandonment of Orchards. *Asian Journal of Agricultural Extension, Economics & Sociology* 3(6): 630-637, 2014; Article no. AJAEES.2014.6.014.
11. Osundare, F.O. and R.S. Owoeye (2016): Appraisal of Efficiency of Fadama Maize Farmers in Osun State, Nigeria. Asian Research Journal of Agriculture 1(4): 1-9, 2016, Article no.ARJA.28904.
12. Sekunmade, A.B., and R.S. Owoeye (2016): Climate Change Adaptation Practices and Technical Efficiency of Cassava Production in Ekiti State, Nigeria. Journal of Agricultural Economics, Extension and Rural Development: ISSN-2360-798X, Vol. 4(5): pp 440-447, June, 2016.
13. Tadesse B, Krishnamoorthy S (1997) Technical Efficiency in Paddy Farms of Tamil Nadu: An Analysis based on Farm Size and Ecological Zone. Agricultural Economics. 16:185-192.
14. Tijani, I. A., B.T. Omonona, Ashaolu, O.F. and O.M. Bamiro (2009): Advances in Natural and Applied Sciences, 3(2): 183-187, 2009 ISSN 1995-0772 © 2009, American Eurasian Network for Scientific Information.