Gender Differences in the Technical Efficiency and Profitability of Yam Production among Farmers in Ikole-Ekiti Local Government Area, Ekiti State, Nigeria.

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ABSTRACT

The study examined the gender differences in the technical efficiency and profitability of yam production among farmers in Ikole-Ekiti Local Government Area, Ekiti State, Nigeria. Data were obtained from primary source using structured questionnaire and interview schedule. A multi-stage sampling procedure was used to select a sample of 100 respondents comprising of 50 male farmers and 50 female farmers. The data collected were analyzed using descriptive statistics and the Stochastic Frontier Production Function models (SFPF).

Maximum Likelihood Estimates of the Stochastic Frontier Production Function results showed that use of fertilizer, labor, yam sett, and agrochemicals were the determinants of output of male yam farmers while use of fertilizer, labor and yam sett were the determinants of output of female yam farmers in the study area. In addition, age, farming experience, level of education and household size were the major determinants of efficiency of male yam farmers while age, farming experience and level of education were the determinants of efficiency of female yam farmers. The technical efficiency of male yam farmers ranges between 0.5 and 0.9 with a mean of 0.76 while the technical efficiency of female yam farmers ranges between 0.5 and 0.8 with a mean of 0.62. Arising from the findings of the study, some recommendations were made for increased productive efficiency and income of male and female yam farmers in the study area.

(Keywords: efficiency, Ekiti State, farmers, profitability, yam production, Nigeria)

INTRODUCTION

Yam is an important food crop produced in Nigeria. The crop is grown throughout Africa with West Africa producing over 90% of the total world production of yam (Hahn et al., 1993). Nigeria is the world largest producer of yam, followed by Ghana, Cote D'Ivoire, Benin, Togo, and Cameroon (FAO, 2013). It contributes two-thirds of the global yam production each year (National Bureau of Statistics, 2013). The nation's yam production is estimated at about 38.92 million metric tonnes annually (FAO, 2008). The crop constitutes a major staple food for the Nigerian population contributing about 20% of the daily calorie intake of the people (Nweke et al., 1991).

Despite this, there has been a decline in yam production in Nigeria over the years (IITA, 2002) with the area under cultivation and total yam output declining (IITA, 2002 and Ayanwuyi et al., 2011). Previous studies carried out on food crop production in Nigeria have shown that food crop farmers have low productivity because of inefficiency in resource use (Idiong, 2005). 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 the study area, yam production is of high economic benefit to the people due to amount of resources committed to its production and the proportion of their income which it represents. Prevalent food scarcity is becoming common problem in Nigeria because as a developing nation which is tending towards industrial economy from agricultural economy. Nigeria is said to be experiencing a progressive and rapid

population growth with the attendant increase in the demand for food crops. Over the years, the farm hectarage of yam production has been increasing with corresponding increases in the usage of inputs. Unfortunately, the increase in output seems not to have been commensurable with those in input usage (Jonathan and Anthony, 2012).

According to Reuben and Barau (2012) yam contributes more than 200 dietary calories per capita daily for more than 150 million people in West Africa and also an important source of income generation and trade. It is thus important that the profitability of its production be assessed. It is obvious that there is a potential for the increase in its production and much can be done to derive foreign exchange from its export (Ebewore et al., 2013). In spite of this, little or no study has been conducted to assess the gender differences in the efficiency and profitability of yam production among farmers, especially in Ikole-Ekiti Local Government Area of Ekiti State.

Objectives of the Study

As the campaign for household food security gains momentum all over the world that extreme hunger and poverty must be eradicated, yam is one of the food crops whose production has got to be emphasized (Michael, 2011). It is therefore pertinent to examine the gender differences in the technical efficiency and profitability of yam production among farmers in Ikole-Ekiti Local Government Area, Ekiti State, Nigeria.

Rationale of the Study

The study is justified based on the need for food security in Nigeria. A rapidly increasing Nigeria's population marked by growth "hotspots", urbanization, and aging is a major problem. The production of food in Nigeria has not met the needs of the country. The demand for food outstrips the supply and this has negative consequences for households' food security. However, the ability of Nigerian agriculture to perform its roles in development has been on the decline in the last three decades. There is therefore need to examine the efficiency of yam farmers in the study area.

LITERATURE REVIEW

Several studies relating to the technical efficiency and profitability of yam production have been carried out.

Bagi (2004) employed the stochastic frontier Cobb-Douglas production function model to investigate differences in technical efficiencies of sole and mixed enterprise farm in West Tennessee. The study found that the variability of farm effects was highly significant. The mean technical efficiency of mixed enterprise farms was found to be smaller (0.76) than for sole crop farms (0.85). The study show that mixed enterprise farms were inefficient as compare to the sole crop farms as demonstrated by their various efficiency ratios. According to Udoh (2006), Maximum Likelihood Estimation of the stochastic production function was used to examine the land management and resource use efficiency in South-Eastern Nigeria. The study found a mean output-oriented technical efficiency of 0.77 for the farmers, 0.98 for the most efficient farmers and 0.01 for the least efficient farmers.

Okike (2000), investigated crop-livestock interaction and economic efficiency of farmers in the savannah zones of Nigeria. The study found that average economic 18 efficiency of farmers was highest in the Low-Population Low Market domain; Northern Guinea and Sudan Savannahs ecological zones; and Crop-based Mixed Farmers farming system.

Similarly, in a study of resource-use efficiency in yam production in Ondo State, Fasasi (2006) reported inefficiency in the use of land, hired labor, family labor and investment on seed yam. They were underutilized by farmers. In another study, Ekunwe et al. (2008) revealed that there was under-utilization of land, labor and planting materials (seed yam), as the ratio of the value of marginal product to marginal fixed cost were greater than one in both Delta and Kogi States. Awoniyi and Omonona (2007), in a study carried out under three yam production systems (wet land, upland and combination of the two), discovered that yam setts were over-utilized in all three production systems.

In addition to this, family labor and fertilizers were also over-utilized in wetland production system. Ike and Inoni (2006), in their study on determinants of yam production and economic efficiency among small-holder farmers in south-

eastern Nigeria, using a stochastic frontier production function, observed that farmer-specific variables such as education, farming experience and access to credits were significant factors causing inefficiency among yam producers, while labor and material inputs such as yam seed were the major factors that influenced changes in yam production. In a study of farmers' perception of and action on resources management constraints in the yam-based system of western Nigeria, Manyong et al. (1998) reported that women (35% of surveyed farmers) were widely involved in yam production. Women were found more efficient in yam production than men. They observed that the major constraint in yam production were pests and diseases in both field and storage.

Several researchers have used gross margin approach as a tool for determining the profitability of production. Folorunso et al. (2013) examined the profitability analysis of small-holder root and tuber crop production among Root and Tuber Expansion Programme (RTEP) farmers in Plateau state using the net farm income analysis and found that RTEP farmers had an average total cost and total revenue of ₦97, 447.00/Ha and ₦225, 916.60 /Ha respectively, with an average Net farm Income of ₦128, 469.60. Also, the average total cost and total revenue for Non-RTEP farmers were ₦100,710.00/Ha, and ₦202,172.30/Ha respectively with an average net farm income of ₦91, 462.30/Ha. The result shows that RTEP farmers' total revenue and net farm income was higher than that of Non-RTEP farmers in the study areas.

MATERIALS AND METHODS

Data Source and Sampling Technique

Primary data were used for this study. The data were collected from the respondents with the aid of a structured questionnaire. Multistage Sampling Procedure was used for selecting the respondents used in this study. The first stage was the purposive selection of Ikole-Ekiti Local Government Area because of the prevalence of yam production in the area. The second stage was the random selection of five communities from the Local Government Area. Ten male and ten female respondents were selected from each community, making fifty male respondents and fifty female respondents and a total sample size of 100 respondents.

Analytical Technique and Model Specification

Data collected were analyzed with the use of descriptive statistics, budgeting analysis and econometric analysis involving the use of stochastic frontier production function. Descriptive statistics (mean and standard deviation) was used to present the socio-economic characteristics of the respondents. Budgeting analysis was used for the estimation of profitability of yam production in the study area while the stochastic frontier production function model was used to analyze the farmers' technical efficiency.

Budgeting Analysis

The Gross Margin (GM) of an enterprise is the difference between the Total Value of Production (Total Revenue) and the Total Variable Cost (TVC) of production that is (Equation 1):

$$GM = TR - TVC = \Sigma P_iQ_i - \Sigma C_jX_j \quad \textbf{(1)}$$

Where: subscripts I refers to the i-th respondents while j represents observation of the j-th variable costs and

GM = Gross margin

TR = Total value of yam output/ha

TVC = Total variable costs/ha

P_i = Unit price of yam produce from the i-th enterprise in naira

Q_i = Quantity of yam produce in tonnes/ha

C_j = Unit price of inputs used in naira

X_j = Quantity of variable inputs used in number

If GM >0, then the farm enterprise is profitable

If GM < 0, then the farm enterprise is not profitable

The Net Revenue (NR) represents the difference between total revenue and total cost. The Net Revenue is given by (Equation 2):

$$NR = TR - (TVC + TFC) \quad \textbf{(2)}$$

Where:

TFC = Total Fixed Cost

TVC = Total Variable Cost

The Stochastic Frontier Production Function Analysis (SFPFA)

The Stochastic Frontier Production Function model was estimated using the Maximum Likelihood Estimation (MLE) method. The Model is implicitly specified as (Equation 3):

$$TE = \frac{\ln Y_i}{\ln Y^*} = \frac{f(X_i, \beta_i)\exp(V_i - U_i)}{f(X_i, \beta_i)\exp(V_i)} = \exp(-U_i) \quad \textbf{(3)}$$

Where: TE is the Technical Efficiency, Yi is the observed output and Yi* is the frontier output. V_i = random error assumed to be independent of Ui, identical and normally distributed with zero mean and unknown variance. U_i's are non-negative random variables called technical inefficiency effects of production which are assumed to be independent of V_i, β_i's are vectors of unknown parameters to be estimated; and X_i is the vector of input quantities for ith farming household. The TE ranges between 0 and 1 i.e. 0≤ TE ≤ 1.

Model Specification for Technical Efficiency

The production function analysis for yam farmers was assumed to be specified by the Cobb-Douglas functional form as stated below:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + (V_i - U_i) \quad \textbf{(4)}$$

Where: subscript i refers to the observation of the i-th farmer and

Y_i = total output of yam

X_1 = farm size (ha)

X_2 = cost of labor in naira

X_3 = cost of fertilizer in naira

X_4 = cost of seed yam planted in naira

X_5 = cost of herbicides in naira

β_i = the parameters to be estimated

1n = natural logarithm

Technical Inefficiency Model

The inefficiency model estimated the influence of some farmers' socio-economic variables on the technical efficiency of the farmers.

The model is specified by (5):

$$U_i = \partial_0 + \partial_1 Z_1 + \partial_2 Z_2 + \partial_3 Z_3 + \partial_4 Z_4 + \partial_5 Z_5 + \partial_6 Z_6 \quad \textbf{(5)}$$

Where:

U_i = Technical inefficiency effects

Z_1= Age of the farmers (years)

Z_2 = Farming experience in years

Z_3 = Years of formal education

Z_4 = Household size (number)

Z_5 = Yam variety used (improved variety =1, Local variety =0)

Z_6 = Number of extension contact

∂i = Unknown scalar parameters to be estimated

RESULTS AND DISCUSSION

Costs and Return Analysis of Yam Production

Table 1 presents the Gross Margin results of male and female yam farmers in the study area. The total revenue per hectare obtained for male and female farmers was ₦437,805.00 and ₦239,148.0 respectively. The total variable cost per hectare incurred by male and female yam farmers in the study area was ₦198,028.91 and ₦130,510.67 while the gross margin was ₦239,776.09 and ₦108,637.33, respectively.

Table 1: Costs and Return Analysis of Yam Production.

Variable	Male		Female	
	Value (₦/ha)	Percentage (%) of Total Cost	Value (₦/ha)	Percentage (%) of Total Cost
Yam Revenue	**437,805.00**		**239,148.0**	
Variable Cost				
Yam Sett	125,775	40	69,993.25	41.91
Family Labor	11,170	3.3	5,950	3.60
Hired Labor	24,800	9.8	34.328.29	20.60
Fertilizer	32,062	10.3	17,882.44	10.70
Agrochemical	4240.08	2.0	23,56.69	1.41
Mean Variable Cost	**39,605.78**	**Total = 65.4**	**26,102.13**	**Total 78.24**
Total Variable Cost	**198,028.91**		**130,510.67**	
Fixed Cost				
Land Renting	40,170	19	15,000	8.9
Interest on Loan	30,386	14.5	19,867.9	11.9
Depreciation on Hoe	468.00	0.2	306.03	0.18
Depreciation on machete	658.15	0.3	430.10	0.25
Depreciation on spade	1015.43	0.5	663.94	0.40
Depreciation on Head pan	334.10	0.2	218.48	0.13
Mean Fixed Cost	12,176.48	Total= 34.6	**6,081.08**	**Total 21.76**
Total Fixed Cost (TFC)	**73,031.88**		**36,486.45**	
Total Cost(TC)=(TVC+TFC)	**271,060.39**		**166,997.12**	
Gross Margin(GM)=(TR-TVC)	**239,776.09**		**108,637.33**	
Net Farm Income (NFI)= (TR-TC)	**166,748.00**		**72,150.88**	

Source: Computed from field Survey, 2018

This finding indicated that yam production by male and female farmers is a profitable enterprise in the study area. The result also implies that yam production by male farmers was more profitable.

Estimated Technical Efficiency of the Respondents

The maximum likelihood estimate of the stochastic production frontier function for male and female farmers in the study area is as presented in Table 2. The variables such as labor, fertilizer, yam sett and agrochemicals were the significant determinants of output of male yam farmers while the variables such as labor, fertilizer and yam sett were the significant determinants of output of female yam farmers.

The coefficients for labor, fertilizer and yam sett were positively significant for both male and female yam farmers. These results agree with *apriori* expectation as the level of production depends largely on the quantities of these inputs

used on the farm. The result implies that output increased with an increase in their values. The coefficient for agrochemicals was also positive and significant at 1% level of probability for male yam farmers while the coefficient was not significant for female counterparts. These results are expected and in accordance with apriority expectation. Any increase in these variables will lead to a corresponding increase in yam output.

On the other hand, the results of the inefficiency model showed that the coefficients of age and level of formal education were estimated to be negative indicating that these factors led to increase in technical efficiency of both male and female yam farmers in the study area while the coefficients of farming experience and household size were estimated to be positive for male yam farmers. The coefficient of farming experience was also positively significant for female yam farmers indicating that these variables led to decrease in technical efficiency. The results of the relationship that existed between age, level of education and technical inefficiency is in conformity with the findings of Oduntan *et al*., (2015) which stated that there was a negative relationship between age, level of education and technical inefficiency.

The estimated variance (r^2) was statistically significant at 10% and 1% levels of probability for the male and female farmers respectively. This indicates goodness of fit. The gamma (γ) is estimated at 0.77 and 0.97 for the male and female farmers respectively and is significant at 5% and 1% level of significant respectively. This indicates that 77%and 97% of the total variation in yam output for male and female farmers, respectively, was due to technical inefficiencies.

Table 2: Maximum Likelihood Estimates of the Stochastic Frontier Production Function.

Production Factors	Parameter	Coefficients	
		Males	Females
Constant term	B_0	8.6229 (7.4599)***	6.6324 (12.3883)***
Farm size (Ha)	B_1	0.2332 (1.4143)	-0.0942 (-0.7822)
Labor (man-days)	B_2	0.1309 (7.2523)***	0.4288 (11.4957)***
Fertilizer used (kg)	B_3	0.2159 (2.5366)**	0.1589 (2.5352)**
Yam sett (kg)	B_4	0.0425 (2.6354)**	0.0511 (4.3486)***
Agrochemicals (liters)	B_5	0.3704 (4.1169)***	0.0264 (0.5182)
Efficiency factors			
Constant term	Z_0	2.5064 (1.8274)*	-0.3649 (-0.4879)
Age (yrs)	Z_1	-0.0579 (-1.7091)*	-0.0374 (-1.8416)***
Farming experience (yrs)	Z_2	0.0332 (6.9864)***	0.0537 (3.6457)***
Education (yrs)	Z_3	-0.0362 (-2.8928)**	-0.03098 (-3.0303)***
Household size	Z_4	0.1940 (1.8615)*	0.0226 (1.2401)
Yam variety	Z_5	-0.0373 (-1.0209)	0.0236 (1.2930)
Extension Contacts(Number)	Z_6	-1.0072 (-0.8209)	-0.0070 (-0.4113)
Gamma	Γ	0.7752 (2.8361)**	0.9733 (51.3708)
Log likelihood function	N	-30.4007	18.7118

Source: Computed from field Survey, 2018

Table 3: Distribution of Technical Efficiency Estimates.

Efficiency Level	Male		Female	
	Frequency	Percentage (%)	Frequency	Percentage (%)
0.51-0.60	4	4.0	27	27.0
0.61-0.70	10	10.0	38	38.0
0.71-0.80	43	43.0	23	23.0
0.81-0.90	38	38.0	12	12.0
0.91-1.00	5	5.0	0	0.0
Total	100	100.0	100	100.0
Mean		**0.76**		**0.62**

Source: Computed from field Survey, 2018

Technical Efficiency Distribution

Table 3 revealed that the average technical efficiencies of 76.0% and 62.0% were recorded for male and female yam farmers respectively in the study area. Hence, in the nearest future, there is possibility of increasing yam productivity by about 24.0% and 38.0% for male and female yam farmers respectively by adopting new technologies and improved management practices practiced by the best farmer in the area. From this estimation, maximum technical efficiency is not yet achieved suggesting a need for more effort at improving efficiency of yam farmers in the study area.

CONCLUSION

In summary, yam production by both male female farmers was found to be a profitable enterprise in the study area as shown by the magnitude of the gross margin and net revenue obtained. However, yam production by male farmers was found to be more profitable. Therefore, the study concludes that yam production as an enterprise can be used to increase the standard of living of farmers through income generation in the study area.

The study further revealed that age and level of education of male and female yam farmers in Ikole-Ekiti LGA, Ekiti State, Nigeria increased their efficiency. It also revealed that farming experience and household size decreased the technical efficiency of male yam farmers while farming experience only decreased the efficiency of female yam farmers. Education of farmers should therefore be encouraged by government since the level of education increases their technical efficiencies. All factors related to technical efficiencies call for policies aimed at incorporation of all the significant variables, especially those that will encourage farmers of their tendency to allocate the bulk of their landholdings to yam production and those that have limited access to production inputs.

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