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Resource use efficiency among Sweet Potato Farmers in Ifedore Local Government Area of Ondo State

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Abstract— *The study examines the resource use efficiency among sweet potato farmers in Ifedore Local Government Area of Ondo State. Specifically, it described the socio economic characteristics of the respondents, determine allocative efficiency of sweet potato production, determine factors that affect sweet potato production in the study area. Multistage sampling techniques was used to select two districts from the study area, ninety eight (98) respondents was randomly selected. Data were collected through the aid of a well-structured questionnaire and analyzed using descriptive and inferential statistics. The result of the findings revealed that the respondents were mostly male (71.4%), 78.6% were married, 36.7% had secondary education, 78.6% had years of experience of between 1-5years, 41.8% are between the age of 30-40years. Land and fertilizer were underutilized, output can increase if the quantities of these resources are increased and capital input was over utilized. Linear regression showed that there is significant relationship between educational levels, quantity of fertilizer, improved tillage practice and yield per hectare. Stochastic frontier result revealed that labor and farm size was significant at 1%. Pest and disease is the major constraints faced by the farmers. Therefore, it was recommended that farmers should use disease resistant varieties.*

Keywords— ***Sweet Potato, Production, Ifedore and Resource use.***

I. INTRODUCTION

The persistent food crisis in Nigeria has been a thing of concern for the government, development partners and the ordinary citizens. Over 40% of the Nigeria's estimated population of 133 million people is food insecure (Idachaba, 2004). This is partly because the food production in the country has failed to respond adequately to increase in demand for food by the ever-increasing population (Babatunde, *et al.*, 2005).

Sweet Potato is an important food crop of both tropical and sub-tropical regions with a cultivation spread across 100 countries according to Nnamdi *et al., (2015)*. Ndukwu (2010) noted that the crop has high photosynthetic efficiency. It has a high yielding capacity per unit area and ability to sustain human livelihood during periods of food shortage. Farmers engage in massive production of this crop because of its short gestation period and its ability to suppress weeds once it has been fully established, thus reducing the overhead cost of production more than that incurred by cassava and yam (Nnamdi *et al* 2015).

Sweet potatoes offer a particularly significant potential for increasing food production and income thereby reducing poverty and improving food security level in Nigeria. Sweet potatoes are consumed without much processing in most parts of the tropics (Ahmad *et al.*, 2014).

Sweet potatoes present diverse industrial uses, some of which are potentially highly profitable, such as sweet potato snacks (Adewumi and Adebayo, 2008). They are extremely adaptable to adverse environmental conditions; they can help increase food security in times of

drought and famine, particularly in post-conflict areas for displaced persons. (Andrade *et al.*,2009).

The importance of sweet potato is increasing in Nigeria's farming and food systems because its production has recorded good profit margin and is suitable for income generation. It has the potential for food security as well as serving as a cash crop (Adekoya *et al.*, 2010). It has edible tubers which can be eaten boiled, fried, or baked. The tubers can be consumed by man, the leaves and stems can provide important fodder sources for domesticated animals. Sweet potatoes produce carbohydrates much faster and require less labor than other crops. Sweet potatoes are used to restore access to food for resetting populations and alleviate future agro-climatic or political shocks. The challenge with using sweet potatoes in emergency response situations is the crop's low multiplication rate. Vine material needs to be ready to go and mechanisms in place to distribute vine materials to needy farmers. (Andrade *et al.*, 2009)

Spent fields of sweet potato have been widely noted as supplementary pig forage. The leaves are also consumed as vegetables because its leaf contains (on dry matter basis) about 8% starch, 4% sugar, 27% protein and 10% ash (Adekoya *et al.*, 2010). The leaves are much richer (than the root) in protein, minerals and vitamins and therefore are more nutritious (Adewunmi and Adebayo, 2008). Industrially, sweet potato flour can be used to substitute wheat bread making or maize flour in balanced feeds. Baby foods have been formulated using sweet potato while some bakeries blend 15-30% of sweet potato flour for making bread and 20-30% for pastries. It is also used in the brewing of alcoholic drinks and as sweeteners in non-alcoholics drinks (Agbo and Ene,1992). Sweet potato starch can also have medicinal value. According to Aboajah, *et al.*, (2018), the leaves decoction is used in folk remedies for tumor of the mouth and throat. Reported to be alternative, aphrodisiac, astringent, bactericide, demulcent, fungicide, laxative and tonic, industrial potentials of sweet potato have not been fully exploited due mainly to a chronic lack of awareness of the commercial benefits derivable from sweet potato (Azogu and Olomo, 2002).

Sweet potato has also been used in Africa to fight vitamin A deficiency that result in blindness and even death of about 25,000 – 500,000 African children per year (CIP, 2009). The leaves contain vitamin A with sufficient quantities of *beta-carotene***.** Vitamin A deficiency is a particular problem with children under five and for pregnant and lactating women (Sanusi and Adesogan, 2014).

Despite all these importance of sweet potatoes, its production has been low, these could be due to inadequate use of disease resistant varieties and high yielding sweet potato clones from National Root Crops Research Institute (NRCRI) and International Institute of Tropical Agriculture (IITA). The wide use of unimproved varieties such as *Cylaspuncticollis* by farmers due to shortage of improved planting materials at the beginning of every cropping season could be a reason for the low output of sweet potatoes.

It has been reported in several studies such as Nnamdi *et al.*, (2015), Ahmad *et al.*, (2014) and Nwaru *et al.*,(2011) that resources are not adequately utilized by sweet potato farmers leading to low yield and low income. Poor resource farmers' find it difficult to purchase inputs and adopts technology faster leading to low productivity. Therefore, this research aim to answer the following research questions to determine the resource use efficiency of potato production in Ifedore Local Government Area of Ondo State. What are the socio economic characteristics of the respondents? How technically efficient is sweet potato farming in the study area? How do farmers allocate their resources during production? What factors affect sweet potato production in the study area?

Specifically, the study sought to:

i. describe the socio economic characteristics of the respondents
ii. estimate the technical efficiency of potato production in the study area.
iii. determine the allocative efficiency of potato production in the study area.
iv. determine factors affecting potato production in the study area.

II. METHODOLOGY

The study was carried out in Ifedore Local Government Area of Ondo State, Nigeria. It lies between latitude 7.34°N and longitude 5.08°E within the tropical rainforest zone of Nigeria.

It has land area of 295km^2 and population of 176,327 at the 2006 census. It has an annual rainfall often exceeding 2000mm, while soil temperature has narrow range of 27°C and 28°C.

The inhabitants are majorly civil servant and farmers. Crops majorly grown include sweet potato, plantain, oil palm and yam. The Local Government is divided into five districts of Ipogun, Ijare, Ilara and Igbara Oke districts. These districts are further divided into towns and villages.

Sampling Procedure

Multistage sampling technique was used for the study. First stage was the random selection of two districts

from the five districts due high level of sweet potato production in the districts. The second stage involved random selection of five villages from the two districts and the third stage was the random selection of the ten (10) respondents from the villages however, 98 questionnaire was retrieved for further analysis.

Data Collection

Primary data was used for this study. A well-structured questionnaire was administered to the farmers since they were considered literate.

Demographic and non-demographic data was collected from the farmers. Information on age, gender, marital status, educational status, Area cultivated, input used and output etc. was also collected.

Analytical Techniques

Descriptive statistics such as percentage, frequency and mean were employed to describe the socio-economic characteristics of the respondents. Inferential statistics such as Cobb-Douglas stochastic frontier production function was used for objective ii, Allocative Efficiency Index was used for objective iii, while simple regression analysis was also used for objective iv

Simple Linear Regression

To determine factors affecting sweet potato production in the study area, the simple linear regression was used. The model is specified below

$Y = f(X_1\ X_2\ X_3\ X_4\ X_5\ X_6X_7\ X_8\ X_9)$……...(i)

Where;

Y_i= Sweet potato production in kilograms per hectare

X_1= Gender

X_2= Age in years

X_3=Educational level in years

X_4 = Farm size measured in hectares

X_5= Years of experience

X_6 = Access to credit

X_7 = Fertilizer application

X_8 = Extension visit

X_9 = Tillage practice

Allocative Efficiency Index

The allocative efficiency index (AEI) was used to determine the efficiency of resources used in production of sweet potato. This was done by computing the ratio of the marginal value product (MVP) to the marginal factor cost (MFC) used in production. The ratio used in determining the efficiency of resources was calculated as:

AEI=MVP or K= MVP, MFC Px ……. (ii)

Where: AEI or K= Allocative efficiency index, MVP=Marginal value product of the various inputs. (MPP x Py) MPP= marginal physical product, Py = unit price of output, MFC= Marginal factor cost (cost of unit input) (Px).

Rule of thumb: if the ratio is equal to one, it indicates that the resource is efficiently or optimally utilized. If the ratio is greater than one, it is indicative that the resource is underutilized, if the ratio is less than one, it indicates that resource is excessively utilized. Mathematically, this can be represented as:

MVP =1; the resource used is optimally efficient,

MVP >1; the resource used is under utilized

MVP < 1; the resource used is over utilized

The frontier model

The stochastic frontier production function for Sweet Potato production adopted in this study as specified by the Cobb-Douglas functional form (*Ahmad et al, 2014*) was defined thus:

$\text{Log } Y_i = b + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + e$….(iii)

Where Y_i = output of the farmer (kg)

X_1 = is labour

X_2 = is sweet potato vine

X_3 = is fertilizer in kg

X_4 = is capital inputs

X_5 = is farm size

Sweet potato output was expected to be influenced positively by labour, sweet potato vine, fertilizer used, capital inputs, and farm size. The functional form for the stochastic frontier is defined by equation (iii).

III. RESULTS AND DISCUSSION

Table 1: socio-economic characteristics of the Respondents

Characteristics	Frequency	Percentage (%)
Gender		
Male	70	71.4
Female	28	28.6
Age (years)		
Below 30	19	19.4
30-40	41	41.8
41-50	26	26.5
Above 50	12	12.2
Marital Status		
Single	13	13.6
Married	77	78.6
Divorced	5	5.1
Separated	1	1.0
Widowed	2	2.0
Education Level		
Primary Education	17	17.3
Secondary Education	36	36.7
Tertiary Education	32	32.7
Adult Education	13	13.3
Years of Experience		
1-5	77	78.6
6-10	13	13.3
11-15	7	7.1
16-20	1	1.0
Total	**98**	**100.0**

Source: Field Survey, 2021

Table 1 showed that 41.8% of the respondents are aged between 30 – 40 years, 26.5% are aged between 41 – 50 years, 19.4% are below 30 years while only 12.2% are above 50 years of age. According to Okoye *et al.*, (2008), the result showed that young people are involved in sweet potato production in the study area. This could be as a result of unemployment in the country and this serve as a means of employment to able bodied youths. Furthermore, 71.4 of the respondent are male while 28.6% of the respondents were female; According to Bonabana-Wabbi *et al.*, (2013), male are more involved in the production of sweet potato because male have more strength and energy to carry out agricultural activities than female. The result also shows that 78.6% of the respondents are married, 13.6% of the respondents are single. This shows that majority of the sweet potato farmers are married and have family responsibilities which sweet potato can cater for. Also they will have more helping hands on the farm. Also, 36.7% of the respondents had secondary education, 32.7% of the respondents had tertiary education, 17.3% of the respondents had primary education. According to Okoye *et al.*, (2008), the result shows that all the respondents are educated and can read and write which will enhance production through adoption of innovation. 78.6% of the respondents had their years of experience ranging between 1 – 5 years, 13.3% of the respondents had their years of experience ranging between 6 – 10 years, 7.1% had 11 – 15years experience while 1.0% of the farmers had16 – 20years experience. The results showed that majority don't have enough experience in sweet potato production which may affect their productivity.

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Table 2: Linear Regression Result

Unstandardized coefficient and standardized coefficient

Variable	Co efficient	Std. error	Beta	t – value
Constant	935.298	304.401		3.073
Gender (X_1)	-126.514	86.519	-152	-1.462
Age of respondents (X_2)	-48.279	46.239	-1181	-1.044
Educational level (X_3)	-91.506	38.503	-271	-2.377 **
Farm size (X_4)	-1.166	23.101	-006	-005
Years of experience (X_5)	-6.502	11.603	-063	-560
Access to credit (X_6)	-6.733	93.236	-079	-072
Fertilizer application (X_7)	-140. 420	88.759	-179	1.582
Extension visit (X_8)	-68.764	88.211	-091	-780
Tillage practice (X_9)	-136.754	84.976	-181	-1.609 **

Source: Field Survey, 2019.

**Significant at 10%,

Dependent variable yield: Productivity

$R^2 = 0.587$

$R^{-2} = 0.371$

F value = 1.416

The result of the regression analysis for factors affecting sweet potato output is presented in table 2. The R^2 value of 0.587 indicates 58.7% variability in sweet potato output is explained by the independent variables. The coefficient of Educational level (X_3) was negatively signed and significant at 10% level of probability. The coefficient of quality of fertilizer (X_7) was positively signed and significant at 10% level of probability, also the coefficient of Improved tillage practice (X_9) was negatively signed and significant at 10% level of probability For fertilizer, the result implies that any increase in the amount of fertilizer will lead to a corresponding increase in sweet potato output. The result for educational level and improved tillage practice do not follow appropriate expectation as they were negative and an increase in their level will reduce output. The co efficient of Gender (X_1), Age (X_2), Farm size (X_4), Years of experience (X_5), access to credit (X_6), Extension visit (X_8) were all negatively signed and not significant at any level of probability. This indicates that any increase in the level of these variables will reduce sweet potato output in the study area.

Table 3: Allocative Efficiency Index

Resource	App (Kg)	Mpp (Kg)	MVP (N)	MFC(N)	MVP/MFC	Decision
Land	529.69	5855.21	23881.54	2200	10.85	Under utilized
Sweet potato vine	80.73	12.84	476.727	195	2.44	Under utilized
Fertilizer	21.25	2.54	241.889	82	2.949	Under utilized
Capital input	33.20	123.56	505.02	600	0.842	Over utilized
Labour	823.25	2.65	2658.01	1800	1.477	Under utilized

Source: Field Survey, 2019.

Table 3 shows the result of the estimated allocative efficiency index of the sweet potato production in the study area. The result indicated that land, sweet potato vine, fertilizer and labor were under-utilized resources as their allocative efficiency indexes were found to be greater than one. This means that the farmers should increase the level of quantities of these resources used in production. Capital input was over utilized as the allocative efficiency index was found to be less than one. This means that the farmers should reduce the level of capital input used in production in order to maximize output level.

Table 4: Cobb Douglas Stochastic Frontier Production Function

Production factors	parameter	Co efficient	Standard error	t. value
Constant term	β_O	5228	0.6248	11.6412
Labor	β_1	0.0549	0.0211	4.0537
Sweet potato vine	β_2	0.1337	0.0597	2.4317
Fertilizer	β_3	0.0279	0.0139	2.6145
Capital inputs	β_4	0.0627	0.0505	1.237
Farm size	β_5	0.5101	0.0356	12.4271
Diagnostic statistics				
Log – livelihood function		36.5761		
Total variance	σ	0.1223	0.0592	2.2849**
Variance ratio	γ	0.8492	0.0308	31.7151
LR Test		61.3101		
Sigma squared	σ	0.46		

Significant at 10%, 5%, and 1% respectively

The maximum likelihood parameter estimates of the stochastic frontier Cobb Douglas production function were presented in Table 4 for the production function. The sigma squared (0 = 0.46) was statistically significant at 5% indicating goodness of stand the correctness of the specified distribution assumption of the composite error term.

Gamme was estimated at 0.85 and is highly statistically at 1% indicating that only 0.5% of the total variation in sweet potato output was due to technical efficiency.

The co efficient of labor and farm size was statistically significant at 1% level of probability showing direct relationship with output. This implies that a 1% increase in labor and farm size would increase output by 0.0549% and 0.5101% respectively. The co efficient for sweet potato vines and fertilizer were also statistically significant at 5% level of probability. This implies that 0.1% increase in sweet potato and fertilizer would lead to a 0.1337% and 0.0279% increase in output respectively. The coefficient of capital input was not significant.

IV. CONCLUSION

Findings from the study reveals the following, the farmers are young and energetic, they have the energy to carry out farming activities. The studies revealed that majority of the sweet potato farmers are married and have family responsibilities. Capital inputs were over utilized in the study area so farmers can reduce the level of capital input. The farmers should be encouraged to take advantage of the various private and government farm credit schemes to enable them acquire production resources necessary to expand the farm land.

RECOMMENDATIONS

Based on the findings, the following recommendations are made

i. Government should revisit the land use act which will make land ready available for the sweet potato farmers.

ii. Farmers should apply pesticide in other to reduce pest infestation and increase the production yield

iii. Farmers should organize themselves into agricultural cooperative to pull their resources together and purchase inputs for their farming activities.

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