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Resource Use Efficiency Andmisery of Sweet Potato Production Window into Financial Surplus for Households in Delta State, Nigeria

Gbigbi, Theophilus Miebi
Department of Agricultural Economics and Extension
Delta State University, Asaba Campus P.M.B 95074 Asaba, Nigeria
E-mail: gbigbitheophilusmiebi@yahoo.com

Abstract

This study was conceptualized to determine resource use efficiency and misery of sweet potato production window into financial surplus for farming households in Delta State, Nigeria. Multiple sampling technique was applied in picking the samples. One hundred and sixty (160) producers were erratically chosen and interviewed with structured questionnaire. The information gathered were evaluated with descriptive statistics, profitability index and double-log production model. The result indicated that they had average oldness of 38 years, 72.5% of respondents were female with mean family magnitude of 5 individuals and mean number of years spent on farming was 13 years and mean farm land of 0.81 ha and very many of them were educated. On the aspect of costs and returns, it was found that production of sweet potato was highly profitable as specified by the BCR (4.39). The double-log regression model result disclosed that labour, fertilizer, age of farmer, farm size, planting materials expenses and years of farming experience were significantly related with output at 1% and 5% probability levels. The results of resource use efficiency also showed that planting materials, fertilizer farm size and labour were underutilized. The constraints encountered were: inadequate fund, lack of storage and processing facilities and absence of extension visit. It is recommended that government intervention is needed to reduce cost and facilitate increased sweet potato production.

Keywords: Resource Use, Efficiency Sweet Potato, Production, Profitability and Farmers

1. Introduction

Sweet potato production (Ipomoea batatas) is a vibrant undertaking that has the capability to revitalize farmers from poverty to wealth by earning some income to take care of the family. Nzaro (2018) and Lim (2016) asserted that the world's most significant food crop is sweet potato owing to its high yield potential that may be realized within a relatively short planting season (3-4 months). This scenario may possibly contribute to quick turnover to the producers since the crop is planted and harvested for more than once a year. Sweet potato belongs to the convolvulaceae family originated from Central America and is extensively grown as essential food in Sub-saharan Africa (Abrokwah, 2017). Globally, Nigeria is the third leading producer (2.516 million metric ton) with china most outstanding (106,197 million metric ton) followed by Uganda (2.6 million metric ton).It can be consumed directly as fresh, processed food and indirectly as animal feed. According to FAO (2013) report, sweet potato production in Nigeria increased by 3,400,000 metric tons in 2013 compared to 2,468,000 in 2000. The cultivated area of land increased from 381,000ha to 1,115,000 ha over the same period. Sweet potato is a catalyst for food security to alleviate the high proportion of the worlds under privileged person sand make life significant. It also has prospective as a raw material for the manufacture of several industrial products El Sheikha and Ray (2017). Sweet potato combines has several advantages, which gives it substantial possibilities in solving the food shortage

and malnutrition problems resulting from population growth and pressure on land (Ocho et al., 2017).It is less susceptible to drought and heavy storms. Sweet potato requires low production inputs and labour (Ezin et al. 2018). It is an essential revenue earner for the nation and employment generation for rural people who involved in its production. Despite the significance of sweet potato over other root crops, the output of sweet potato for bumper income has not kept pace with the improved varieties and technologies available in Nigeria. Therefore, its production should be given an appropriate place in the agrarian system. Among the root and tuber crops, much attention has not been given to sweet potato as regard to boosting its cultivation and utilization. Nonetheless, it still has higher growth rate than other root crops like yam and cassava. Agricultural productivity can be well-defined as the ratio of farm output to the number of a farm input used in a specified farm production process. The foremost purpose of any production system is the realization of an optimum level of output with a given quantity of input. For this to be attained, the productivity of the resources used needs to be improved. Increasing productivity implies increase in output per unit input. The input-output relationship in farm production is imperative for the measurement of resource productivity. The measurement could either be in monetary or physical terms (Mohammed et al. 2010). The management of any agricultural enterprise entails the use of resources to achieve outputs and these resources were characterized as natural resources such as land, human resources like labour and non-human resources in the form of capital and management (Barclay et al. 2017). In order to attain optimal level of production, resources must be available and the available resources must be used efficiently (Maio et al., 2017). Sweet potato as an agricultural enterprise also needs to satisfy the above requirements for optimum production and profit maximization. According to Gona et al. (2009) efficiency of resource use is the ability to derive maximum output per unit of resource which is the key to effectively addressing the challenges of attaining food security and alleviating poverty by improving the livelihood of the farmers. Sweet potato is produced as a source of food, employment and income generation. A study needs to be undertaken to ascertain the resource productivity in sweet potato production which would go a long way in educating the farmers on the direction of adjustments in resource use for profit maximization. But to the best of my knowledge studies on resource use efficiency of sweet potato farmers and financial surplus has not been examined in Delta State, before now. This is a research gap that this study explored and filled. This study therefore will provide a new vista into sweet potato production and provoke more serious interest therein. The outcome will serve as a reference material for other studies. Furthermore, the result of this study will be of great benefits to farmers and policy makers. The specific objectives were; ascertain the socioeconomic characteristics of the potato farmers estimate the cost-effectiveness of sweet potato production and estimate the input-output relationship in sweet potato production in the study area.

2. Materials and methods

Sampling procedure and Data collection: A multistage selection procedure was used to hand-pick 160 respondents from the study area. Firstly, Delta central agricultural zone was purposively chosen from the State because bulk of the people took farming as their main occupation and chief source of income. Secondly, Ughelli North and Ughelli south LGAs were purposively selected because of high participation of farmers in potato production. The sampling frame comprise of all farmers involved in sweet potato farming. Thirdly, was the arbitrary selection of eighty (8) communities from the Local Government areas chosen. The fourth step involved random handpicking of twenty (20) potato farmers from the communities chosen. Finally, one hundred and sixty (160) sweet potato producers were used for the study. The instrument of data collection was the questionnaire used to elicit input and output data from the farmers.

Analytical Techniques

The tools applied for the analysis include descriptive statistics, cost and return analysis and ordinary least square model.

Gross margin

The gross margin gives easy and quick method of farm business analysis. Gross margin was work out by scrutinizing gross return and the total variable cost incurred.

$GM = [(P_y*Y) + (P_z*Z)] - \sum_{i=1}^{n} Pxi * Xi$

Where

GM = gross margin,

Py = output price

Y = total output,

Pz = price of byproduct, and

Z = total byproduct,

P_{Xi} = price of ith input

Xi = quantity of ith input

Benefit-cost ratio

Benefit-cost ratio is the ratio sandwiched between the total revenue and total cost of any business. In this study, benefit-cost ratio was computed as follows:

Benefit-cost ratio $=\frac{TR}{TC}$

Where,

B/C Ratio= Benefit-Cost ratio

TR= returns (it was obtained by adding income from sweet potato)

TC= total cost (it was obtained by adding all the expenditures in production process)

Net farm income

The differences between gross income and total cost of production gave the net farm income (NFI). It is specified as:

$NFI = TR - TC$

Where,

NFI = Net farm income

TR = Total revenue

TC= Total cost

TVC= Total variable cost

Regression model

To empirically determine sweet potato production, the production function was computed with the Cobb-Douglas function. The Cobb-Douglas function was chosen on the ground of fitness to agricultural production (Norhidayu et al. 2017; Husain and Islam 2016). The model is specified in logarithmic form as:

$\ln Y = b_0 + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + b_9\ln X_9 + + e$

Where

Y =Output of sweet potato (kg/ha)

X_1=labour(mandays/ha)

X_2 =fertilizer use (kg/ha)

X_3=age of farmers (years)

X_4=educational level of farmers(years)

X_5=farm size (ha)

X_6=planting materials (₦)

X_7=farmingexperience (years)

e = Error term

These variables were expected to positively influence the output of sweet potato farmers in the study area.

Resource use efficiency

Resource use is determined by calculating the ratio of the marginal value product (MVP) to the marginal factor cost (MFC) of inputs based on the estimated regression coefficients. Following Sarkeret al (2018) efficiency of resource, r, is given as:

$r = \frac{MVP}{MFC}$

r = efficiency ratio

The MPP and MVP for double- log functional forms were calculated as:

The marginal physical product (MPP) was given by:

$MPP = b_i \times APP_i$

Where b_i = elasticities of the various inputs

$APPi = \frac{Y}{Xi}$

Where Y is the mean of output and X is the mean of factor inputs, and b_0 and b_i are the constant and regression coefficients, respectively.

$MVP = MPP \times P_y$

Where:

P_y and MFC are the unit prices of output and input prices

The rule states that when r = 1, resources employed by the farmer are efficiently utilized, r > 1 indicates underutilization of resources while r < 1 shares overutilization of resources. Since all the inputs and outputs were expressed in monetary terms, the acquisition cost of the inputs was taken as one naira. The criteria used were adopted from Ahmed et al. (2015) on resource use efficiency of sweet potato in Bangladesh.

3. Results and discussion

Socioeconomic profile of farmers

The results on socio-economic status are shown in Table 1. The mean age of sweet potato farmers was 38 years. This is an indication that the respondents were mostly within the innovativeness and active labour force engaged in sweet potato production activity. This corroborates with Rahman, Ogungbile and Taba (2002) that farmers age influence adoption in several ways. Majority (72.5%) of the respondents were females, implying that more females were involved in sweet potato production than males in the area of study. The average household size of farmers was 5 persons. This implies that family labour is a vital source for farming operations and most of the sweet potato farmers have moderate family size (Barman, Islam and Hossain 2002). This could assist in the reduction of total cost of production through participation in labour operations. The result shows that 92.8% of sweet potato farmers were literate. This implies that education fastens understanding and adoption of improved technology, which will rapidly propel sweet potato production. The mean years farming experience was 13years. This means that majority of the farmers were well experienced in sweet potato production. This may lead to increase in production of the crop. The average farm size was 0.81hectare. This corroborate with result obtained by Tewe et al (2003) who reported in a survey conducted in Oyan that nearly every household cultivated sweet potato on an average farm size of 0.4ha. This implies that the production of sweet potato is on a small scale basis though excess is sold for cash and not necessarily for profit maximization but maximization of satisfaction (Ogbonna et al., 2009).

Table 1. Socioeconomic characteristics of sweet potato farmers

Variables	Frequency	Percentage	Average
Age (years)			
18-28	20	12.5	
29-39	76	47.5	38 years
40-50	54	33.8	
51-61	10	6.3	
>61	0	0	
Gender			
Male	44	27.5	
Female	116	72.5	
Household size			
1-3	38	23.8	
4-6	96	60	5 persons
7-9	26	16.3	
10-12	0	0	
Education			
No formal education	6	3.8	
Primary education	88	55.0	
Secondary education	52	33.0	
Tertiary education	14	8.8	
Farming experience (years)			
1-5	6	3.8	
5-9	28	17.5	
10-14	78	48.8	13 years
15-19	34	21.3	
>19	14	8.8	
Farm size (ha)			
0.1-1.0	124	77.5	0.81ha
1.1-2.0	30	18.8	
2.1-3.0	6	3.8	

Table 2. Costs and returns for sweet potato production.

Items	Cost (₦/ha)	Percentage
Returns from sweet potato	226,274.00	
Variable cost		
Planting materials	12 500.00	24.24
Fertilizer (₦/kg)	4660.00	9.04
Chemicals (litre)	1700.00	3.30
Labour(₦/man days)		
Land clearing	8000.00	15.52
Ridging/mound making	4000.00	7.76
Planting	4000.00	7.76
Fertilizer application	2500.00	4.85
Weeding	6000.00	11.64
Harvesting	4000.00	7.76
Total labour cost	28500.00	55.28
Total variable cost (TVC)	47360.00	91.85
Fixed cost		
Cost of land renting	2400.00	4.65
Depreciation of tools and equipment	1800.00	3.49
Total fixed cost	4200.00	8.15
Total cost (TVC +TFC)	51560.00	
Net farm income (NFI) = TR-TC	174714.00	
Benefit cost ratio (BCR) = TR/TC	4.39	
Gross margin	178914.00	
Return on every naira invested = NFI/TC	3.39	

Profitability of Sweet Potato Production

The overall production cost of sweet potato was N51, 560.00 (Table 2). Labour cost constituted the highest fraction of 55.28%, followed by cost of planting materials (stem cutting) which accounted for 24.24% of the total cost of production, while chemical had the least cost of 3.30%.This is the most important aspect of the production of sweet potato because without it production will not hold. The higher the planting material, the more output that may be obtained; other production constraints are held constant. Other costs item influencing the production of sweet potato were cost of fertilizer (9.04%), land use value and depreciation on tools and equipment stood at 4.65% and 3.49% respectively. The variable costs stood at N47,360 representing 91.85% of the total cost while the remaining 8.15% constituted the fixed cost. However, in spite of the level of production cost of sweet potato, the farmers realized an average gross and net return of N178,914.00 per ha and N174, 714.00 respectively. The findings imply that sweet potato is profitable. This result support the findings of Yusuf and Wuyah (2015) in northern Nigeria. This is because the returns on every naira invested was 3.39 and this was confirmed by the benefit cost ratio of 4.39. This implies that one naira (N1.00) invested in sweet potato production yields a profit of about N3. 39kobo.

Regression result on factors affecting sweet potato production

The double log (Cobb Douglas) production function was chosen as the lead equation because it gave the best fit with the coefficient of multiple determinations (R2) value of 0. 685 and F-ratio of 12.17 significant at 5% probability level. This implies that about 68.5% of the variation in total value of output is explained by inputs indicated in the regression model. The coefficients and estimated values of different parameters in the model are given in Table 3. The result showed that the coefficient of labour (0.407) was positive and significant at 5% probability level showing that an increase in the level of labour utilization will lead to a corresponding increase in sweet potato output, depicting that with 100% increase in labour cost in sweet potato production could be increased by 40.7%. The result revealed that fertilizer use was positively and significantly significant at 5% level of probability. This implies that increase in the quantity of fertilizer used will bring about corresponding increase in sweet potato output which depicts that fertilizer use if increased by 100% the production is increased by 89%. The result obtained showed that age was positive and highly significant at 1% probability level. The positive value of regression coefficient (0.266) implies that output of sweet potato increase with increase in the respondents age. The result showed that farm size was positive and significant at 5% level of probability. This means that a unit increase in farm size will lead to a corresponding increase in the output of sweet potato in the study area. Cost of planting materials was positive and highly significant at 5% probability level. The implication is that an increase in planting materials will bring about a corresponding increase in sweet potato output. The result indicated that farming experience was positive and significant at 5% probability level. This indicates that if years of farming is increased in sweet potato production by 100% there would be an increase in sweet potato output by 18.9%.

Double log production function also indicates the elasticity of production. The sum of the coefficients (output elasticity) of the variables of double log production function is 2.20. The value is more than unity which suggest that the production function exhibit increasing return to scale. This further indicates that if all the inputs included in the model are increased by 1% , output of sweet potato will increase by 2.20%. Planting materials recorded the highest value of elasticity which indicates that it is the most important input to which output of sweet potato would be most responsive. Furthermore, sweet potato production needs prudent use of resources to maximize profit in the study area.

Resource use efficiency of sweet potato production

The result of resource use efficiency for sweet potato as presented in Table 4 indicates that planting materials, fertilizer, farm size and labour were underutilized because their resource use efficiency ratios were greater than unity. This means that increasing the quantity of inputs will increase the quantity of sweet potato produced.

The result in Table 5 showed that inadequate fund (37.5%) was one of the major problems confronting sweet potato production in the study area. The respondents who faced the problem of storage and processing facilities accounted for 24.4% implying that the preservation of harvested output of sweet potato for income generation will be reduced as a result of spoilage. About 22.5% of the respondents affirmed that there was lack of extension visit by extension workers to acquire knowledge on modern technologies involved in sweet potato production. Other constraints were marketing problem (11.3%) and high cost of inputs (4.4%) respectively.

Table 3. Regression Result for Sweet Potato Production.

Variables	Coefficient	Standard error	t-value
Intercept	10.940	1.621	6.746***
Lnlabour cost	0.407	0.160	2.543**
Lnfertilizer use	0.890	0.408	2.181**
Lnage of farmer	0.266	0.072	3.694***
Lneducational level	-0.016	0.042	0.381
Lnfarm size	0.021	0.008	2.625**
Lnplanting material cost	0.441	0.064	6.891***
Lnfarming experience	0.189	0.079	2.403**
R square	0.685		
F – value	12.17***		
Return to scale	2.20		

*** Significant at 1% level, ** Significant at 5% level

Table 4. Resource Use Efficiency of Sweet Potato Production

Variable	Geometric mean (₦)	Coefficient	MVP	MFC	Efficiency ratio	Inference
Net farm income(NFI)	174714					
Planting materials	12500	0.441	6.1639	1	6.1639	Underutilization
Fertilizer	4660	0.890	33.3681	1	33.3681	Underutilization
Farm size cost	2400	0.021	1.5287	1	1.5287	Underutilization
labour	28500	0.407	2.4950	1	2.4950	Underutilization

Table 5. Constraints to sweet potato production and profitability.

Constraints	Frequency	Percentage
Inadequate fund	60	37.5
High cost of inputs	7	4.4
Marketing problem	18	11.3
Lack of storage & processing facilities	39	24.4
Lack of extension visit	36	22.5
Total	160	100.0

4. Conclusion and recommendations

The findings of the result on socio-economic characteristics of the farmers showed that the average age was 38 years with average household size of 5 persons. The farmers had 13 years of farming experience and they were literate. The average farm size was 0.81 hectare. The result shows that sweet potato production is highly profitable (BCR = 4.39). The regression result showed that labour, fertilizer, age of sweet potato farmer, farm size, cost of planting materials and farming experience were major factors contributing positively to increase sweet potato output. Farmers perceived that inadequate fund, lack of storage and processing facilities and lack of extension visit were the three major barriers to sweet potato production.

It is recommended that government intervention is needed to reduce cost and facilitate increase production of sweet potato. The study recommends that high yielding varieties should be developed and made accessible to farmers so as to boost sweet potato production. Furthermore, agro-processing industries should be established to enhance sweet potato utilization.

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