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ANALYSIS OF PROFITABILITY OF ORANGE FLESH SWEET POTATO (*Ipomea batata*) IN OSUN STATE, NIGERIA

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ABSTRACT

Nigeria is a major producer of sweet potato in Sub-Saharan Africa (SSA). This study looked at resource use efficiency and profitability of Orange Flesh Sweet Potato (OFSP) in Osun State, Nigeria. Two out of the three zones in Osun State were randomly selected from which six blocks were selected; and thirty cells were randomly selected from the six blocks. Two Hundred and Fifty (250) respondents were randomly selected across the thirty cells for the study. Data were analyzed using linear regression and Pearson Product Moment Correlation (PPMC). Results of the study showed that respondents are agile and active in orange flesh sweet potato production, with mean age of 38.8 years and had wealth of experience (12.6 years). Most (82.4%) of the respondents cultivated orange flesh sweet potato on ridges, 78.8% used hired labour and 92.4% used personal savings for orange flesh sweet potato farming. The average yield of orange flesh sweet potato was 6.20 tonnes/ha, the Total Revenue (TR) was ₦127,999.93/ha while the profit was ₦46,841.93/ha. Major limitations to orange flesh sweet potato production are inadequate finance (83.2%), poor extension service support (80.45), and inadequate market information (74%). Results of linear regression showed that land ($t = 3.146$, $p = 0.001$), labour ($t = -3.105$, $p = 0.003$), agrochemicals ($t = 8.499$, $p = 0.000$), and seeds ($t = 3.928$, $p = 0.004$) were determinants of orange flesh sweet potato production ($p < 0.05$). In addition, correlation revealed negative relationship between constraints faced by the respondents and profit realized from orange flesh sweet potato production ($r = -0.72$, $p = 0.01$). The study concluded that orange flesh sweet potato production was profitable. It was recommended that soft credits should be extended to sweet potato farmers by the banks in the study area.

Keywords: profitability, resource use, efficiency, orange flesh, orange flesh sweet potato

INTRODUCTION

Orange flesh sweet potato is a major crop that suffered serious neglect in the past but now occupies global position as a source of food and industrial raw material (Njoku, 2007). The crop has moved up from the minor status to an enviable position of being the fourth most important root and tuber crop in Nigeria after cassava, yam and cocoyam. It is a major food crop in Sub-Saharan African. It has a high yield potential that may be realized within a relatively short growing season and it can adapt to a wide range of ecological conditions. The high nutritive value of sweet potato makes it desirable to rural farmers in Nigeria. However, sweet potato is a bulky and a highly perishable root crop, hence the most economical way to deal with this challenge is through adding value to the crop by processing it into different products such as orange flesh sweet potato flour, sparri, sweet potato bread and

sweet potato chips. These products provide a better income to the farmers and increase consumers' consumption and acceptability. Also, it makes its transportation over a long distance easier and also increases the shelf life of the crop. Currently, orange flesh sweet potato is being utilized in various forms in other parts of the world. It can be boiled, fried or roasted. In the semi-arid zone, its flour is popularly used for sweetening local food and beverages (*kunu, burukutu*) while in the urban markets of the humid south, the fried chips are produced and marketed as snacks (Odebode, 2004). The various uses can be adapted in the country to boost production and consumption of the crop (Egeonu, 2004). Sweet potato has a long history targeted at lower and higher income groups and promoted with value addition and brand identification would help break the image of sweet potato as a poor man's food. Sweet potato is marketed both in the rural and urban areas of Nigeria for livelihood sustainability (Ikwelle *et al*., 2001). Intensive production of sweet potato demands high levels of investment in agricultural inputs such as seed, chemical fertilizers and pesticides (Fuglie, 2003). In addition, farmers of developing nations have high transaction and financial costs to buy inputs and services as well as to store and market their products. Moreover subsidies to agriculture, a common practice in developed countries, are rarely seen in the developing world (Ezeta, 2002). High production costs and low productivity per unit of surface area result in extremely high cost per unit of product and lower profit which is the main reason of the low competitive capacity of farmers in developing countries (Ezeta, 2002). Orange flesh sweet potato farmers particularly subsistence farmers are vulnerable to price risk and frequently are forced to minimize costs by reducing inputs which in turn affects yields and income of the farmers.

It is in view of this background that this study becomes necessary to analyze profitability and resource use efficiency in orange flesh sweet potato (OFSP) in Osun State, Nigeria.

Specific objectives are to:

i. describe the socio-economic characteristics of the respondents in the study area
ii. identify resource use in the production of orange flesh sweet potato in the study area
iii. estimate the profit realized from processed orange flesh sweet potato production in the study area
iv. identify the constraints militating against orange flesh sweet potato production in the study area

Hypotheses of the Study

H_{01}: There is no significant relationship between resource-use and profit realized from orange flesh sweet potato production

H_{02}: There are no significant relationship between constraints faced by the respondents and profit realized from orange flesh sweet potato production

RESEARCH METHODOLOGY

Osun State, the study area

Osun State was carved out of Oyo State on the 27th of August 1991. It lies between Latitude 4°30'E and Longitude 7°30'N. The population of Osun State is estimated at 3.4 million (NPC, 2006). Osun State is bounded in the West by Oyo State, in the South by Ogun State, in the North by Kwara State and in the East by Ondo and Ekiti States of Nigeria as indicated in Figure 1. The state occupies a land mass of approximately 8,602km^2.

The major ethnic group in Osun State is the Yorubas with sub-ethnic groups such as Ife, Ijesha, Oyo, Ibolo and Igbomina. The State is divided into 30 Local Government Areas (LGAs). There are three agricultural zones (Iwo, Osogbo, and Ife/Ijesha). For ease of extension administration by Osun State Agricultural Development Programme (OSSADEP) which is the agency responsible for agricultural extension activities in the State, the zones are further sub-divided into 30 blocks and 248 cells. The study area has a bimodal rainfall pattern which reaches its peak in July and September; it comprises mostly agrarian communities which engage in farming activities including the production of both cash crop and food crops in order to meet the livelihood needs of the farmers in addition to being a foreign exchange earner. It is also a very important source of raw materials for some industries in the State. The State is blessed with mineral resources such as gold, clay, limestone and granite. Crops grown in Osun State include yam, sweet potato, maize, cassava, cocoyam and cowpea. The cash crops include tobacco and palm produce. The artisans make hand woven textiles, tie and dye clothes, leather work, calabash carving and mat weaving.

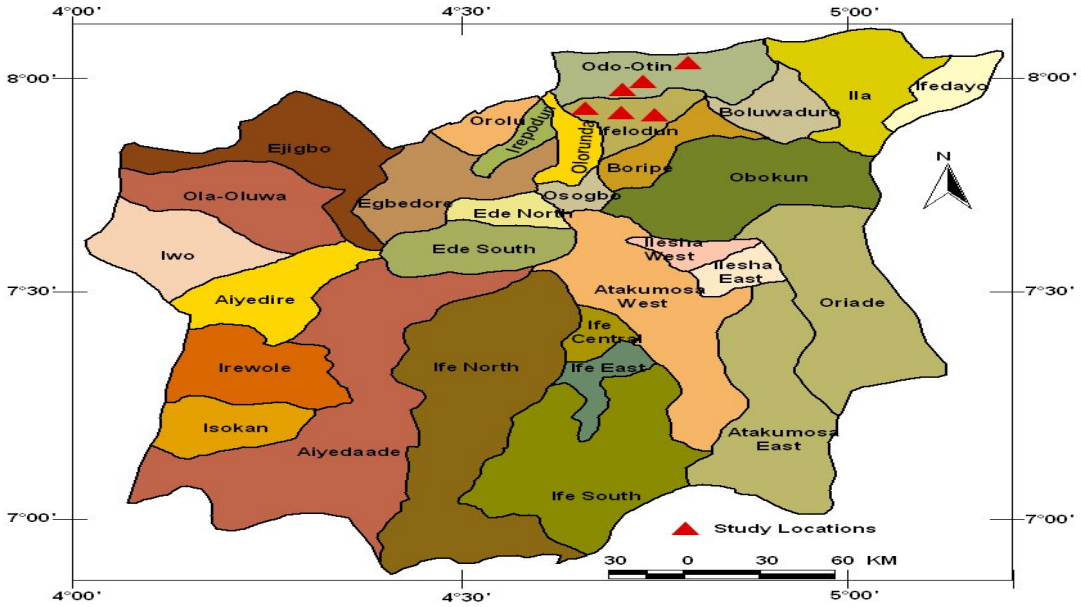

Figure 1: Map of Osun State showing the study area

Sampling procedure and sample size for the study

Multistage sampling procedure was used in the selection of respondents for this study. The first stage involved random selection of two zones from the three zones in Osun State, that is, Osogbo and Ife/Ijesa. There is evidence of orange flesh sweet potato production in the selected communities. In second stage, three blocks were randomly selected from the zones making six blocks. The third stage involved the selection of thirty cells from the six blocks. The final stage involved the selection of 10% of the registered orange flesh sweet potato farmers from the chosen cells. A total of 250 re-

spondents were interviewed for this study.

Validity and reliability of the instrument for Data collection

Data for this study were collected with the aid of interview guide using face to face interview methods. The instrument was subjected to face validity involving assessment by the experts in Agricultural Extension and Rural Development, their criticisms and suggestions were positively utilized for a more valid instrument. The reliability test for the instrument was conducted using test re-test method at interval of two weeks for twenty orange flesh sweet potato farmers who were not included in the actual study sample. Scores were assigned to the responses of the selected respondents. Pearson Product Moment Correlation (PPMC) was used to estimate reliability coefficient. The instrument was considered reliable with a reliability coefficient of 0.76.

Measurement of Variables

Age, household size, farm size and farming experience were measured at interval level while sex, educational level and marital status were measured at nominal level. Profit was estimated in naira at ratio level. Constraints to orange flesh sweet potato production were measured as Very serious (3), Moderately serious (2) and Not serious (1).

Method of Data analysis

Data collected were subjected to descriptive statistics such as frequency distribution, percentages and mean were used for objectives of this study. PPMC and linear regression analysis were used to test the hypotheses of this study. Koutsoyiannis (2001) stated that primary objective of regression analysis is to determine the various factors which cause variations of the dependent variable. It was assumed that Profit Y, is a function of costs of land preparation, labour, credit, fertilizer, seeds and agrochemicals (Tijani, 2006; Onoja and Achike, 2008).

Thus the explicit model is:

Profit: $Y = \alpha + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \ldots\ldots + b_nX_n + ei$

Where;

Y = Profit (Naira/ha);
X_1 = Land preparation (Naira);
X_2 = Labour (manday);
X_3 = Fertilizer (Naira/kg/ha);
X_4 = Agrochemicals (Naira/litre/ha);
X_5 = Seeds (Naira/ha);
X_6 = Credit (Naira/ha)
α = Constant; and
e = error term

RESULTS AND DISCUSSION

Personal characteristics of the respondents

The results showed that 72.8% of the respondents were between 31 - 50 years of age while 6.4% were older than 51 years. The mean age of the respondents was 38.8 years. The respondents were agile and active in orange flesh sweet potato production. About 71.2% of the respondents were males while 28.8% were females which reveal the dominance of males in orange flesh sweet potato production. This is due to tedious

nature of farming activities in Nigeria. Oyediran *et al*. (2017) reported similar findings in a study conducted in Katsina State, Nigeria that farming is tedious and energy demanding. Majority (79.20%) of the respondents were married while 12.8% were single. Results also showed that 44.0% of the respondents had primary education, 38.4% had secondary education and 25.6% had tertiary education. This is an indication that orange flesh sweet potato farmers were literate and could easily adopt innovation and improved farming practices. It was also found that 50.4% of the respondents had less than five people in their household while 29.6% had 6 - 10 people. The average household size was six people. Respondents had relatively large household size. The large household size would be an opportunity for sweet potato farmers in term of manpower supply especially during the peak of farming season. The cost of hiring labour will also reduce. The results showed that 52% of the respondents had spent 11 - 20 years in sweet potato farming and 9.60% had spent 21 - 30 years. The average experience for sweet potato farming was 12.6 years in the study area. It can be inferred that farmers have spent appreciable number of years in sweet potato production in the study area. Similar report of Fawole (2007) showed that farmers were not new in sweet potato farming in Nigeria. Abiona (2010) opined that years of farming experience usually play a vital role in any farming enterprise.

Table 1: Distribution based on Personal characteristics of the respondents (n = 250)

Variables	Frequency	Percentage	Mean
Age (yrs.)			
≤ 30	52	20.8	38.8
31 – 40	68	27.2	
41 – 50	114	45.6	
≥ 51	16	6.4	
Sex			
Male	178	71.2	
Female	72	28.8	
Marital status			
Single	32	12.8	
Married	198	79.2	
Separated	20	8.0	
Educational status			
Primary education	110	44.0	
Secondary education	96	38.4	
Tertiary education	64	25.6	
Household size			
≤ 5	126	50.4	6.0
6 – 10	74	29.6	
11 – 15	50	20.0	
Farming Experience (yrs.)			
≤ 10	96	38.4	
11 – 20	130	52.0	12.6
21 – 30	24	9.6	

Source: Field Survey, 2017

Resources used in the production of sweet potato

The results Table 2 revealed that 82.4% of the respondents cultivated sweet potato on ridges while 17.6% planted sweet potato on flat surface. The reason for making ridges for sweet potato is to have big tubers and high yield compare to flat surface that does not give adequate room for root expansion. Moreover, 78.8% of the respondents used hired labour for their farm operations while 21.2% depend on self and family labour. It concise with findings of Enete *et al*. (2003) cited in Oyediran (2013) that farmers hired labour for farm operations when the family labour is not available. The tasks performed by hired labour include weeding (50.4%), harvesting (22%) and post-harvest operations (27.6%). This shows that sweet potato farmers predominantly used hired labour compared to the family labour. Most (92.4%) of the respondents used their personal savings for sweet potato farming and 7.6% got credit from cooperatives to do farming. Sweet potato farmers were however not getting credit from the banks. This result corroborates previous findings of Oyediran (2013) and Omoare *et al*. (2015).

Table 2: Distribution of respondents according to resource use (n = 250)

Resource use	Frequency	Percentage (%)
Land preparation pattern		
Ridges	206	82.4
Flat surface	44	17.6
Sources of Labour		
Hired	197	78.8
Self/Family	53	21.2
Tasks		
Weeding	126	50.4
Harvesting	55	22.0
Post-harvest operations	69	27.6
Sources of capital		
Personal savings	231	92.4
Cooperatives	19	7.6
Banks	0	0.0

Source: Field Survey, 2017

Estimation of profit from orange flesh sweet potato production

Results from Table 3 showed the estimated profit from sweet potato production. The mean farm size was 2.3 hectares. The average yield of sweet potato was 6.20 tonnes/ha while the Total Revenue (TR) was ₦127,999.93/ha. The estimated Total Variable Cost (TVC) was ₦81,158.00/ha. The profit (GM) was ₦46,841.93/ha. The percentage of GM (57.72) implies that for every ₦1.00 invested on a hectare of sweet potato, the gross profit will be ₦57.72k which is an

indication of high profitability of sweet potato production in Osun State, Nigeria. Sweet potato has been reported to have a high yield potential, nutritional value, and resistance to production stress (Ikwelle *et al*., 2001 and Kays, 2004).

Table 3: Estimation of profit for orange flesh sweet potato using Gross Margin method

Items	**Price (₦)**
Revenue (₦/ha)	
Average yield (tonnes/ha)	6.20
Price (₦/tonnes)	20,645.15
Total revenue (TR) (₦/ha)	**127,999.93**
Variable cost (₦/ha)	
Farm size(ha)	2.3
Rent (for hired land)	21,255.00
Land preparation	15,000.00
Labour	18,600.00
Credit	0.00
Fertilizer	7,093.00
Agrochemicals	0.00
Seed	13,030.00
Transportation	6,180.00
Total variable cost (TVC) (₦)	**81,158.00**
Gross Margin (GM)=TR-TVC	46,841.93
%GM=GM/TVC x100/1	**(57.72)**

Source: Field Survey, 2017.

Constraints to orange flesh sweet potato production

Findings from the study in Table 4 showed that inadequate finance was very serious constraints (83.2%) and ranked 1st. This constraint affected expansion of orange flesh sweet potato production into a medium to large scale therefore limiting sweet potato farmers' productivity and income. This result is in tandem with report of Oyediran (2013) that credit is very crucial for expansion of agriculture in Oyo State, Nigeria. Also, 80.4% of the respondents identified inadequate extension service support as 2nd most serious to sweet potato production. Majority (74%) of the respondents stated that inadequate market information on orange flesh sweet potato production was a serious problem while 73.2% reported that low consumer preference for sweet potato

affected its production. In a similar vein, it was found that non availability and accessibility of planting materials (70%), pest and diseases problems (68%) and high cost of farm labour were serious problems militating against orange flesh sweet potato production in the study area. Findings from a study conducted in Offa Kwara State by Fawole (2007) revealed that orange flesh sweet potato farmers were confronted with pest and diseases and inadequate extension training.

Table 4: Distribution based on constraints to orange flesh sweet potato production (n = 250)

Constraints	Very serious	Moderately serious	Not serious	Rank
Inadequate finance for orange flesh sweet potato production	208(83.2)	30(12.0)	12(4.8)	1st
Inadequate extension service support	201(80.4)	26(10.4)	23(9.2)	2nd
Inadequate market information on orange flesh sweet potato production	185(74.0)	47(18.8)	18(7.2)	3rd
Low consumer preference for orange flesh sweet potato	183(73.2)	42(16.8)	25(10.0)	4th
Non availability and accessibility of planting materials	175(70.0)	44(17.6)	31(12.4)	5th
High cost of farm labour	80(57.2)	52(20.8)	28(11.2)	7th
Pest and diseases problems	78(68.0)	44(17.6)	28(11.2)	6th

Source: Field Survey, 2017. Values in parenthesis are in percentages

Hypotheses testing

Relationship between resource use and profit realized from orange flesh sweet potato production

The coefficient of land was significant at 1% level of significance and positively signed (t = 3.146, p = 0.001). The positive relationship implies that land had positive effect on the profitability of orange flesh sweet potato. Also, labour was significant at 1% level of significance but negatively signed (t = -3.105, p = 0.003). This means that the higher the cost of labour the lesser the profit that would be realized from the orange flesh sweet potato production. Agrochemicals (t = 8.499, p = 0.000), and seeds (t = 3.928, p = 0.004) were positively significant at 1% level of significance. This indicates that quality of seeds and agrochemicals is very important in orange flesh sweet potato farming in order to get high productivity and profit. It can be inferred that land, labour, agrochemicals and seeds influence the profitability in orange flesh sweet production. Meanwhile, credit was not significant. This is because respondents did not have access to credits from financial institutions rather they relied on personal savings. The co-efficient of R^2 indicated that 63.1% of the variation in orange flesh sweet potato profit-

ability was as a result of explanatory variables used in the model. The significant F-statistic affirmed that the null hypothesis (H_{01}) in the sample remained rejected at 1% level of significance. That is, alternate hypothesis (Ha_1) that "*there is significant relationship between resource use and profit realized from orange flesh sweet potato production*" is accepted.

Table 5: Linear regression of relationship between resource use and profit realized from orange flesh sweet potato production

Resource use	Unstandardized Coefficient		Standardized Coefficient	t	Significance
	β	Std. Error	Beta		
Constant	18.92	0.75		25.41	0.000
Land	0.129	0.041	0.109	3.146	0.001
Labour	-1.288	0.415	0.311	-3.105	0.003*
Agrochemicals	0.815	0.096	0.029	8.499	0.000*
Seeds	0.666	0.170	0.545	3.928	0.004*
Credit	0.099	0.063	0.183	1.571	0.120 NS
F – statistics	46.23				
R^2	63.10				
Adjusted R	62.09				
Durbin-Watson	0.22				
Prob(F-Statistics)	0.000				

Source: Field Survey, 2017. *= Significant at 0.01 level; NS = Not-significant at 0.05 level

Relationship between constraints faced by the respondents and profit realized from orange flesh sweet potato production

Results of correlation in Table 6 showed that there is an inverse but significant relationship between constraints faced by the respondents and profit realized from orange flesh sweet potato production ($r = -0.72$, $p = 0.01$) at $p < 0.05$ level of significance. The implication for the study is that the more severe the constraints the lesser the profit realized, that is, for every 1% increase in constraints there would be 72% reduction in profit to be realized by the orange flesh sweet potato farmers. Hence, the null hypothesis that "*there are no significant relationships between constraints faced by the respondents and profit realized from orange flesh sweet potato production*" is rejected.

Table 6: Relationship between constraints faced by the respondents and profit realized from sweet potato production

Variables	r	p-value	Decision
Constraints	-0.72	0.01	S

Source: Field Survey, 2017
S - Significant at $p < 0.05$ level of significance

CONCLUSION

This study established that the respondents were agile, active and experienced in orange flesh sweet potato production. Orange flesh sweet potato was predominantly cultivated on ridges with an average yield of 6.20 tonnes/ha. Orange flesh sweet potato is profitable with estimated profit of about ₦46,841.93/ha. Land, labour, agrochemicals, and seeds had positive effect on profit realized from orange flesh sweet potato production. However, inadequate finance, poor extension service support, and inadequate market information were most serious constraints to orange flesh sweet potato production.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are hereby suggested:

i. Orange flesh sweet potato farmers should optimally use production factors (land, seeds, fertilizers and labour) to enhance productivity and profit.
ii. Cultivation of orange flesh sweet potato on ridges should be encouraged among the farmers in order to increase and sustain high yield.
iii. Orange flesh sweet potato farmers should form themselves to cooperatives to be able to access bank loans instead of relying personal savings.
iv. effective and efficient extension teaching/training should be regularly organized for the orange flesh sweet potato farmers to improve their farming skills.

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