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Profitability of orange fleshed sweetpotato (OFSP) (*Ipomea batata*) production in Kwara State, Nigeria

Amos Abiodun Olasore, Emmanuel David*, Ambrose Asagba, Salihu Yakubu, Abdullahi Mohammed
Agriculture and Rural Management Training Institute, Ilorin, Kwara State, Nigeria

Abstract
This study analyzed the profitability of OFSP production in Ilorin metropolis, Kwara State, Nigeria. Multistage sampling method was used to collect data from 120 OFSP farmers. Data collected were analyzed using descriptive statistics, linear regression and Pearson Product Moment Correlation (PPMC). Results of the study showed that OFSP farmers (51.67%) in the study area were active and experienced in OFSP production. Most of the OFSP farmers (88.33%) predominantly cultivated on ridges with an average yield of 5.20 tonnes/ha. More so, 84.17% hired labour for cultivation and 90% used personal savings for OFSP farming Orange flesh sweet potato is relatively profitable with estimated profit of ₦30,720/ha. Land, labour, agrochemicals, and seeds had positive effect on profit realized from OFSP production. However, low consumer preference and high cost of labour were most serious constraints to OFSP production. Finally, it was recommended that OFSP farmers should strengthen their social capital by forming cooperative groups to combat the constraints faced and enjoy the benefit of economies of scale. Strategies that lower the costs of production should be vigorously pursued to enhance better profitability.

Keywords: OFSP, production, profitability and Ilorin metropolis

Introduction

Orange-fleshed varieties of sweetpotato are excellent sources of vitamin A because they contain naturally high beta-carotene levels. The human body can easily transform beta-carotene, a natural pre-cursor for vitamin A, into vitamin A as needed. One small-to-medium boiled root (125g) of most orange-fleshed sweetpotato (OFSP) varieties can supply the recommended daily vitamin A requirement for young children and breastfeeding women. This is particularly important in sub-Saharan Africa and Asia where vitamin A deficiency is among the leading causes of blindness, disease and premature death among children under five years and pregnant women (Stevens et al., 2015) [3]. Different sweetpotato varieties have different concentrations of beta-carotene. Orange-fleshed sweetpotato roots have a nutritional advantage over white- or cream-fleshed sweetpotato roots because their beta-carotene, and therefore vitamin A, content is higher. This is evidenced by the deep orange colour of the sweetpotato flesh, which is related to the higher beta-carotene and vitamin A content. The highest beta-carotene and vitamin A content is found in the deepest or most bright orange-fleshed varieties. Orange-fleshed sweetpotato roots are also a recommended source of vitamin A because they are inexpensive. Low et al., (2017) [2], found orange-fleshed sweetpotato to be one of the cheapest source of vitamin. It costs less than one cent per day to meet the recommended daily allowance of vitamin A for a child under six years through the consumption of orange-fleshed sweetpotato. In addition to providing high levels of vitamin A, orange-fleshed sweetpotato roots contain high levels of vitamins B, C, E and K, all of which help protect our bodies and assist in the illness recovery process (Hotz et al., 2012) [3]. Orange-fleshed sweetpotato roots also have high carbohydrate content, allowing them to produce more edible energy per hectare per day than other common sources of carbohydrates such as rice and maize.

Orange-fleshed sweetpotato has 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, 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.

Intensive production of sweet potato demands high levels of investment in agricultural inputs. Agricultural inputs required in the production of OFSP include, clean seed, chemical fertilizers and pesticides. Also, farmers in the study area have high transaction and financial costs to buy inputs and services as well as to store and market their products. 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 the study area. 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. Consequently, this study aimed to analyse profitability and resource use efficiency in orange flesh sweet potato (OFSP) in Kwara State, Nigeria.

Specific objectives are to:

1. Describe the socio-economic characteristics of the respondents in the study area
2. Identify resource use in the production of OFSP in the study area
3. Estimate the profit realized from OFSP production in the study area; and
4. Identify the constraints militating against orange flesh sweet potato production in the study area.

Hypotheses of the Study

$H0_1$: There is no significant relationship between resource-use and profit realized from OFSP production

$H0_2$: There are no significant relationship between constraints faced by the respondents and profit realized from OFSP production

Materials and Methods

The Study Area

This study was carried out within Ilorin metropolis. Ilorin is the capital of Kwara State, Nigeria. The metropolis comprises of three 3 Local government areas namely; Ilorin West, Ilorin East and Ilorin South. The choice of Ilorin metropolis for this study was deemed to be appropriate given its antecedent in sweet potatoes production and marketing.

Kwara state has a population of about 2,371,089 with a total landmass of 32,500square kilometres, most of which is arable (NPC, 2010) [4].

The State has bimodal climatic seasons, the dry season and wet season with annual rainfall ranging between 1,000 and 1,500 mm while the average temperature lies between 30ºC and 35ºC. The climate is conducive for fish farming, (Kwara State Diary, 2002) [5]. The rainy season lasts between April and October while the dry season starts in November and ends in March of the following year.

Data Collection and Sampling Methods

Primary data were used for the study. Multi stage sampling procedure was used to select respondents for this study. The three local governments within Ilorin metropolis was purposively selected because of the evidence of OFSP production.

Two communities were further selected randomly from each of the local government in the study area. In each of the six (6) communities selected, 20 OFSP farmers were randomly selected, given a total of 120 respondents used for the study and this represents 70.58% of the study population of 170 of registered OFSP farmers in the study area according to KWADP (2015) [11]. This is in line with method of sampling reported by Yakasai (2010) [6] who explained that to ensure fair representation of 20% up to a thousand and 10% up to 5 thousand of a population is adequate.

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).

Analytical Framework

The research is based on primary data which was collected through intensive field surveys, using structured questionnaires.

Data collected were analysed using both, the descriptive statistics such as frequency and percentage (for socio – economic characteristics), Pearson Product Moment Correlation (PPMC) and linear regression analysis were used to test the hypotheses of this study. It was assumed that Profit Y, is a function of costs of land preparation, labour, credit, fertilizer, seeds and agrochemicals thus the explicit model is:

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

Where;

Y = Profit (Naira/ha);
X1 = Land preparation (Naira);
X2 = Labour (manday);
X3 = Fertilizer (Naira/kg/ha);
X4 = Agrochemicals (Naira/litre/ha);
X5 = Seeds (Naira/ha);
X6 = Credit (Naira/ha)
α = Constant; and
e = error term

Budgetary Techniques:
Analysis of costs and returns was used to estimate the profitability of and rate of return on investment to OFSP production in the study area.
Gross Margin (GM) = Total Revenue (TR) – Total Variable Cost (TVC)
Rate of Returns (ROI) = (TR/TC) Rate of Return on Investment (RRI)

Results and Discussion
Socio – economic Characteristics of OFSP famers in Ilorin, Kwara State.
The socio-economic characteristics of the OFSP farmers in the study area was explored under the following sub headings: Age, Sex, Marital status, Level of education, Household size, and Years of experience. These were presented in Table 1.

Table 1: Socio-economic Characteristics of OFSP famers in Ilorin, Kwara state

Parameter	Frequency	Percentage
Age		
20-35	20	16.67
36-50	62	51.67
51-65	27	22.5
>65	11	9.17
Sex		
Male	81	67.50
Female	39	32.50
Marital Status		
Married	74	61.67
Single	46	38.33
Level of Education		
No formal	10	2.33
Adult Edu.	12	10
Primary Edu.	25	20.83
Secondary Edu.	56	46.67
Tertiary	17	14.17
Household size		
1-5	113	94.16
6-10	04	3.33
11-15	03	2.50
Years of experience		
1-5	86	71.67
6-10	18	15
11-15	11	09.17
>15	05	4.17

Field survey 2021

Age is one of the important determinants of human reasoning, decision- making and responsibilities. Age also refers to the stage of development of an individual and is measured in years. Table 1 shows that, 22.5% of the respondents are within the age range of 51 to 65 % .while majority of the respondents (51.67%) have an age range between 36 and 50 years. The OFSP farmers as indicated were in their prime age and hence, economically active. They could increase their productivity if they are disposed to necessary resources. They are also in the age where they could take risks that could increase output as well as income. Alabi, and Aruna, (2006) [7] also concur that farmers' age may influence his resources allocation, reasoning and management ability. However, middle aged people are loaded with societal responsibilities with high expectations of life. Also, the dependant population relies significantly on the working population, therefore, they are forced to engage in economic activities to live up to expectation. The percentage of the male that are involved in the production of OFSP is 67.50% while that of their female counterpart is 32.50%. The dominance of the male gender could be attributed to drudgery and tediousness of the activities in OFSP production. This result is in line with Oyediran et al. (2017) [8], reported similar findings in a study conducted in Katsina State, Nigeria that farming is tedious and energy demanding. The marital status of respondents indicates that 61.67% of the respondents were married while 38.33% of the respondents are single. Education connotes the formal training an individual obtained. This is represented by the number of years a person spent in formal school. Only 2.33% of the respondents in the study area have no formal education, while 46.67% of the respondents had secondary education. This is an indication that orange flesh sweet potato farmers were literate and could easily adopt innovation and improved farming practices. Years of experience in this study is measured in years which an individual has had in

engaging in farming in the study area. Evidence from the descriptive analysis of socio economic characteristics of respondents in the study area, indicates that, 71.67% of the respondents had between 1-5 years of experience while only 4.17 % of the respondents have experience above 15 years. The above results corroborate the finding of Abiona (2010) [9] who reported a positive relationship between farming experience and technical efficiency.
It was also found that 94.16% of the respondents had less than five people in their household while 3.33% had 6 - 10 people. The 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.

Resources used in the production of OFSP

Table 2 shows the distribution of respondents according to resource use. The result indicates that 88.33% of the respondents cultivated OFSP on ridges while 11.66% planted OFSP on flat surface. Experiences have shown that, making ridges for OFSP production increase the chances of harvesting big tubers and high yield compare to flat surface that does not give adequate room for root expansion. Moreover, 84.17% of the respondents used hired labour for their farm operations while 15.83% depend on self and family labour. Oyediran (2013) [10] noted that, farmers hired labour for farm operations when the family labour is not available. The hired labour were used for tasks such as weeding (50%), harvesting (20.83%) and post-harvest operations (29.17%). It can be inferred that, OFSP farmers predominantly require hired labour for on farm acuities compared to the family labour. Most (90%) of the respondents used their personal savings for OFSP farming and 10% got credit from cooperatives for OFSP farming. The farmers were however not getting credit from the banks.

Table 2: Distribution of respondents according to resource use (n = 120)

Resource use	Frequency	Percentage (%)
Land preparation pattern		
Ridges	106	88.33
Flat surface	14	11.66
Sources of Labour		
Hired	101	84.17
Self/Family	19	15.83
Tasks		
Weeding	60	50
Harvesting	25	20.83
Post-harvest operations	35	29.17
Sources of capital		
Personal savings	108	90
Cooperatives	12	10
Banks	0	

Source: Field Survey, 2021

Estimation of Profit from OFSP Production

Table 3 shows the estimated profit from OFSP production. The mean farm size was 1.5 hectares. The average yield of sweet potato was 5.20 tonnes/ ha while the Total Revenue (TR) was ₦200,720/ha. The estimated Total Variable Cost (TVC) was ₦180,000/ha. The profit (GM) was ₦30,720/ha. The percentage of GM (17.06) implies that for every ₦1.00 invested on a hectare of sweet potato, the gross profit will be ₦17.06k. The total yield and the total cost of production are the major factors that determine the profitability of OFSP production in Kwara State.

Table 3: Estimation of profit for OFSP using Gross Margin method

Items	Price (₦)
Revenue (₦/ha)	
Average yield (tonnes/ha)	5.2tone/hac
Price (₦/tonnes)	38,600
Total revenue (TR) (₦/ha)	200,720
Variable cost (₦/ha)	
Farm size(ha)	1.5
Rent (for hired land)	15,000
Land preparation	20.000
Labour	50,000
Credit	00
Fertilizer	35,000
Agrochemicals	00
Seeds	35,000

Transportation	15,000
Total variable cost (TVC) (₦)	180,000
Gross Margin (GM)=TR-TVC	30720
%GM=GM/TVC x100/1	17.07

Source: Field survey, 2021

Constraints to orange flesh sweet potato production

Table 4: Distribution of constraints of OFSP production in the study area. (n = 120)

Constraints	Very serious	Moderately seriously	Not serious	Rank
Low consumer preference for OFSP	109(90.83)	08(6.67)	03(2.5)	1st
High cost of farm labour	102 (85)	12(10)	06(5)	2nd
Inadequate market information on OFSP	96(80)	14(11.67)	10(8.33)	3rd
Inadequate finance for OFSP	85(70,83)	20(16.67)	15(12.5)	4th
Non-availability and accessibility of planting materials	72(60)	38(31.67)	10(8.33)	5th
Inadequate extension service support	60(50)	39(32.5)	21(17.5)	6th
Pest and diseases problems	55(45.83)	45(37.5)	20(16.67)	7th

Source: Field Survey, 2021. Values in parenthesis are in percentages

Table 4 shows the distribution of constraints of OFSP production in the study area. Low consumer preference for OFSP was very serious constraints (90.83%) and it ranked 1st. This constraint affected expansion of OFSP production thereby limiting farmers' production and income. Low consumer preference for OFSP was also responsible for the low acceptance of the crop among farmers and consumers. High cost of farm labour was ranked second most serious constraints faced by OFSP farmers in the study area. Inadequate market information on OFSP ranked third (80%) while Inadequate finance for OFSP ranked fourth (70.83). In a similar vein, it was found that non-availability and accessibility of planting materials (60%), inadequate extension service support (50%) and pest and diseases problems (45.83%) were serious problems militating against OFSP production in the study area.

Relationship Between Resource Use and Profit Realized from OFSP Production.

The coefficient of land was significant at 1% level of significance and positively signed (t = 2.146, p = 0.001). The positive relationship implies that land had positive effect on the profitability of OFSP. Also, labour was significant at 1% level of significance (t = -2.105, p = 0.003). This implies that, the higher the cost of labour the lesser the profit that would be realized from the OFSP production. Agrochemicals (t=6.499, p=0.000) and seeds (t = 2.928, p = 0.004) were positively significant at 1% level of significance. This indicates that, quality of seeds and agrochemicals are very important in OFSP farming in order to get high productivity and profit. It can be inferred that land, labour, agrochemicals and seeds influence the profitability in OFSP production. Meanwhile, credit was not significant. This could be because respondents majorly relied on personal savings rather than credit facilities from financial institution. The co-efficient of R^2 indicated that 53.1% of the variation in OFSP profitability was as a result of explanatory variables used in the model. The significant Fstatistic affirmed that the null hypothesis ($H0_1$) in the sample remained rejected at 1% level of significance. Alternate hypothesis (Ha_1) which shows that " there is significant relationship between resources use and profit realized from OFSP production" is accepted

Table 5: Linear regression of relationship between resource use and profit realized from OFSP production

Resource use	Unstandardized Coefficient β	Std. Error	Standardized Coefficient Beta	T	Significance
Constant	11.92	0.55		15.41	0.000
Land	0.129	0.041	0.109	2.146	0.001
Labour	-1.288	0.415	0.311	-2.105	0.003*
Agrochemicals	0.815	0.096	0.029	6.499	0.000*
Seeds	0.66	0.170	0.545	2.928	0.004*
Credit	0.099	0.063	0.183	1.571	0.120NS
F	46.23				
R^2	53.10				
Adjusted R	52.09				
Prob(FStatistics)	0.000				

Source: Field Survey, 2021.

*= Significant at 0.01 level; NS = Not-significant at 0.05 level

Relationship between Constraints Faced by OFSP Farmers and Profit Realized from OFSP Production

Table 6 shows the results of relationship between constraints faced by OFSP farmers and profit realized from OFSP production. The result indicates that, there is an inverse but significant relationship between constraints faced by OFSP farmers and profit realized from OFSP production ($r = -0.72$, $p = 0.01$) at $p < 0.05$ level of significance. This signifies 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 OFSP farmers. Hence, the null hypothesis that " there are no significant relationships between constraints faced by the respondents and profit realized from OFSP production" is rejected.

Table 6: Relationship between constraints faced by OFSP farmers and profit realized from OFSP production

Variables	r	P-value	Decision
Constraints	-0.72	0.01	S

Source: Field Survey, 2021

S - Significant at $p < 0.05$ level of significance

Conclusion

This study analysed the profitability of OFSP in Kwara State. The results established that the OFSP farmers in the study area were active and experienced in OFSP production. Orange flesh sweet potato was predominantly cultivated on ridges with an average yield of 5.20 tonnes/ha. Orange flesh sweet potato is relatively profitable with estimated profit of ₦30,720/ha. Land, labour, agrochemicals, and seeds had positive effect on profit realized from OFSP production. However, low consumer preference and high cost of labour were most serious constraints to OFSP production. Finally, it is recommended that OFSP farmers should strengthen their social capital by forming cooperative groups to combat the constraints faced and enjoy the benefit of economies of scale. Strategies that lower the costs of production should be vigorously pursued to enhance better profitability.

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