

## Research Application Summary

### **Assessment of sweet potato production and processing among farming households in Nigeria**

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#### **Abstract**

Sweet potato is one of the most important root crops in developing countries. This study assessed the production and processing of sweet potato among farming households in Kwara State, Nigeria. Primary data were collected from 120 sweet potato farmers for the study using a structured questionnaire. The specific objectives were to assess the level of production and processing among sweet potato farmers, determine the costs and returns to sweet potato cultivation and processing, ascertain the determinants of sweet potato processing and examine the constraints of sweet potato production and processing among the farmers in the study area. Analytical tools employed for this study include; Gross Margin, Binary logistic regression, and Likert-type scale. The result showed that the mean age of farmers was 45.4 implying that they were agile and in their working age. The average revenue generated by the farmers in sweet potato production was ₦113,250 with a mean gross margin of ₦87,185.83 and the average cost of sweet potato processing was ₦3,355.00 with a gross margin of ₦10,726. Marital status and Output were found to be determinant factors of sweet potato processing at 5% level of significance. The major constraints to sweet potato processing include inadequate storage facilities for processed sweet potato, inadequate extension services, and high cost of packaging.

**Keywords:** Binary Logistic Regression, Gross Margin, Nigeria, sweet potato processing, sweet potato production

#### **Résumé**

La patate douce est l'une des plantes-racines les plus importantes dans les pays en développement. Cette étude a évalué la production et la transformation de la patate douce chez les ménages agricoles de l'État de Kwara, au Nigeria. Les données primaires ont été recueillies auprès de 120 producteurs de patates douces pour l'étude à l'aide d'un questionnaire structuré. Les objectifs spécifiques étaient d'évaluer le niveau de production et de transformation chez les producteurs de patates douces, de déterminer les coûts et les rendements de la culture et de la transformation de la patate douce, de déterminer les déterminants de la transformation de la patate douce et d'examiner les contraintes de la production et de la transformation de la patate douce chez les agriculteurs dans la zone d'étude. Les outils analytiques employés pour cette étude comprennent; Marge brute, régression logistique binaire et échelle de type Likert. Le résultat a montré que l'âge moyen des

agriculteurs était de 45,4 ans, ce qui implique qu'ils étaient agiles et en âge de travailler. Le revenu moyen généré par les agriculteurs dans la production de patates douces était de 113 250 ₦ avec une marge brute moyenne de 87 185,83 ₦ et le coût moyen de la transformation de la patate douce était de 3 355 ₦ avec une marge brute de 10 726 ₦. L'état civil et la production se sont révélés être des facteurs déterminants de la transformation de la patate douce à un niveau de signification de 5 %. Les principales contraintes à la transformation de la patate douce comprennent des installations de stockage inadéquates pour la patate douce transformée, des services de vulgarisation inadéquats et le coût élevé de l'emballage.

Mots-clés: Régression Logistique Binaire, Marge Brute, Nigéria, transformation de la patate douce, production de la patate douce

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## Introduction

Sweet potato botanically known as *Ipomoea batatas* is a perennial crop cultivated annually across different continents of the world (Kassali, 2011). The higher yield and nutritive benefit of sweet potato make it one of the world's most essential food sources; specifically ranked as the 7th most important food commodity in the world with a total yield of 103 million tonnes as of 2013 (Sugri *et al.*, 2017). It has high economic importance and on this basis, it is ranked second among the world's most essential food commodities. Sweet potato is cultivated in several sub-regions of developing countries (Aneneokeakwa *et al.*, 2021).

In Africa, sweet potato is cultivated in about 1.5 million hectares and the average yield is about 10.8 t ha<sup>-1</sup> (Muhinyuza *et al.*, 2012). It is one of the most essential sources of carbohydrate in sub-Saharan Africa and is known for its ability to withstand adverse environmental conditions and it has high energy-fixing capability to produce high dry matter within a short time interval. It can easily adapt to poor soils condition and can withstand irregular rainfall (Mbanaso *et al.*, 2011). Due to its nutritional qualities, the crop is an integral component of the diets of most people in the regions where it is produced. It has been utilized in Africa to fight vitamin A deficiency that normally lead to loss of sight and even death in children (Anyaeibunam and Nto, 2011).

Nigeria comes second after China as the world's leading producers of sweet potatoes. The country currently produces about 3.69 million metric tonnes of sweet potato annually (Aneneokeakwa *et al.*, 2021). There has been an upsurge in the production of sweet potatoes in Nigeria despite the pressure of increasing population on land. Production increased from 2.5 million metric tonnes in 2006 to 3.4 million metric tonnes in 2007. This numerical increase in production was ascribed to the contribution of research and development at the national and international level and also the contribution of enhanced technological inputs (Anyaeibunam and Nto, 2011).

The world sweet potato agricultural subsector is going through a key transformation. The production and consumption of sweet potatoes is huge however, there are constraints to the processing of sweet potatoes. Only a few producers undertake processing into other forms which is probably due to inadequate processing inputs and financial hurdles (Ahmad *et al.*, 2014).

Related studies have been done on sweet potato production. Ezin *et al.* (2018) assessed the production and marketing challenges in the sweet potato value chain in Benin; Bose *et al.* (2020) examined the factors affecting gross revenue from sweet potato production in Bauchi State,

Nigeria; Ngailo *et al.* (2016) assessed the production constraints, breeding priorities and farming systems in Tanzania; Kassali (2011) analyzed the economics of the production of sweet potato in Oyo State, Nigeria; Tolno *et al.* (2016) carried out a study on the economic analysis of the production and supply of sweet potato among smallholder farmers in Guinea. However, none of these studies assessed the level of production and processing among farming households. The level of processing particularly in Kwara State, Nigeria remains largely unknown.

Hence the main aim of this study was to assess the level of production and processing among sweet potato farming households in Kwara State, Nigeria. The specific objectives were to: determine the costs and returns to sweet potato production and processing among sweet potato farming households; assess the determinants of sweet potato processing among sweet potato farmers; and examine the constraints to sweet potato processing among sweet potato farmers.

### Data and Methods

**The study area.** The study was conducted in Kwara State in the North Central part of Nigeria which is located between latitude 7°45' North and 9°37' North and longitude 2°30' East and 6°25' East. The study area has a total landmass of about 3,682,500 hectares. Kwara State has a population of about 2,365,353 as of 2006 according to the National Population Census (NPC, 2006). The town is centrally located and is bounded by many neighboring towns; it is bounded by Igosun and Ipee in the east, Ilemona Erin Ile in the south, Irra, Ikotun and Ojoku in the west, and Ijagbo in the north. The major occupation of residents in these areas is farming and they cultivate both cash crops and food crops.

**Source of Data.** Data were collected through the use of a structured questionnaire which was administered to the sweet potato farmers in Kwara State. The questionnaire was structured and designed to collect information about the socio-economic characteristics (such as age, gender, level of education, household size, years of experience). The questionnaire involved both close and open-ended questions. Direct observation was also used to get information related to the study.

A two-stage sampling technique was used for the study. The first stage involved the purposive selection of two local governments in the State namely; Offa and Oyun Local Government due to the predominance of sweet potato farmers in those areas. The second stage involved the random selection of 60 farmers from each of the two local governments giving a total of 120 sweet potato farmers assessed.

Gross margin analysis, Binary logistic regression analysis, and Likert scale were employed in analyzing the data.

Gross margin analysis was employed to estimate the costs and returns to the production and processing of sweet potato among the respondents. It is mathematically expressed as;

$$GM = TR - TVC$$

Where; **GM (Gross Margin)**: represents the total amount of money left after total variable costs have been deducted from the total revenue generated.

**TR (Total Revenue)**: this refers to the total income generated from the sales of a given quantity of goods or services.

**TVC (Total Variable Cost):** refers to the costs that vary with the level of output, and examples are the cost of inputs such as planting materials and fertilizers, labor cost, transportation cost, etc.

Binary logistic regression analysis was used to ascertain the determinants of processing among sweet potato farmers in the study area. The model is mathematically expressed as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{10} X_{10} + U \quad \text{----- (i)}$$

Where:

Y= Processing (1= processing, 0=not processing)

X<sub>1</sub>= age

X<sub>2</sub>= gender

X<sub>3</sub>= marital status

X<sub>4</sub>= level of technology

X<sub>5</sub>= level of output

X<sub>6</sub>= labour usage

X<sub>7</sub>= access to extension services

X<sub>8</sub>= farm size

X<sub>9</sub>= income

X<sub>10</sub>= membership of cooperative

= constant

$\beta_1$ - $\beta_{10}$ = regression coefficients

U= error term.

**Likert-type scale** was used to examine the constraints to sweet potato processing among farmers. The 5-point rating scale was graded as Strongly Severe = 5, Severe = 4, Moderately Severe = 3, Rarely Severe = 2, and Not a Problem = 1. The mean score of respondents based on the 5-point rating scale was computed and the items ranked.

## Results and Discussion

**Socio-economic characteristics of sweet potato farmers.** The results of the demographic distribution of the respondent in Table 1 showed that most (33.3%) of the respondents' age fell in the range (46-55) with a mean of 45.4. It also showed that the majority (70.8%) were males which indicate the dominance of men in the sweet potato production sector of farming. This contrast the findings of Tolno *et al.* (2016) who reported that majority (60.0%) of the sweet potato farmers were female in Guinea. Most (73.3%) of farmers were married with high family sizes (mean household size of 5.12). The predominance of married farmers is most likely due to the necessity to fend for their household. This corroborates the findings of Mbanaso *et al.* (2011) who reported that 72.59% of the farmers were married in south eastern Nigeria.

The results indicated further that sweet potato cultivation in Kwara State was an enterprise for the educated farmers; 82.0% of the respondents had at least formal education with most of them (44.2%) having secondary education. The farmers, on the average, had many years of experience (mean years of experience of 10.17) in sweet potato farming. This is similar to the findings of Egwuonwu and Ozor (2020) who reported that majority (51.6%) of the farmers had secondary education.

**Table 1. Socio economic and demographic characteristics of respondents**

Characteristics	Frequency	Percentage	Mean
<b>Age</b>			
25-35	15	12.5	45.4
36-45	32	26.7	
46-55	40	33.3	
>56	33	27.5	
<b>Gender</b>			
Male	75	70.8	
Female	35	29.2	
<b>Marital status</b>			
Single	23	19.17	
Married	88	73.3	
Widow/Widower	9	7.5	
<b>Educational level</b>			
Primary	20	17.2	
Secondary	58	44.2	
Tertiary	21	17.5	
No formal	21	18.0	
<b>Household size</b>			
1-4	17	15.2	5.12
5-7	54	56.7	
8 and above	39	29.1	
<b>Occupation</b>			
Farming	69	57.5	
Trading	23	19.2	
Civil servant	28	23.3	
<b>Years of experience</b>			
<5	18	15.0	10.17
5-10	35	28.3	
11-15	23	19.2	
>15			
<b>Land Tenure System</b>			
Purchased	14	11.6	
Rented	77	64.2	
Inherited	29	24.2	
<b>Method of Planting</b>			
Intercropping	77	64.2	
Sole cropping	43	35.8	
<b>Farm size (Acres)</b>			
0.1-1	32	26.7	
1-3	54	45	
3-5	20	16.7	
6-25	14	11.7	

Source: Field survey 2019

**Costs and returns to sweet potato production and processing.** The result from Table 2 show that the average revenue generated by the respondents was ₦113,250 while the average total variable cost was ₦26,064.17 which gives a gross margin of ₦87,185.83 implying that sweet potato production in the study area was highly profitable. A gross margin analysis carried out by Sugri *et al.* (2017) also revealed that sweet potato production was profitable. The present results also agreed with the findings of Ahmad *et al.* (2014) that despite its high cost of production, sweet potato production needs to be encouraged among farmers as it tends to be profitable.

Further analysis revealed that the average cost of sweet potato processing is ₦3,355.00 and the output generated was ₦14,081.00 giving a gross margin of ₦10,726 which indicated that the few of the farmers that processed their sweet potato made good profits. This concurs with the findings of Mkani (2013) who reported that sweet potato processing was profitable.

**Table 2. Average costs and returns to sweet potato production and processing in the study area**

Production (N = 120)		Processing (N = 40)	
Items	Amount (₦)	Items	Amount (₦)
Total Revenue	113,250	Cost of processing	3,355.00
Total output/price	20.2kg/₦5500		
Inputs used		Output generated	14,081
Cost of vines	614.17		
Labour cost	25,141.67		
Cost of fertilizer	308.33		
Total variable cost	26,064.17		
Gross margin	87,185.83	Gross margin	10,726

Source: Field survey 2019

**Determinants of sweet potato processing.** In Table 3 below, Marital status and Output are determinant factors of sweet potato processing in the study area. The two factors are significant at the 5% level. Output as a determining factor might imply that the more the output from sweet potato production, the more likely they will process the sweet potato into flour and chips. This is in line with the findings of Adeyonu *et al.* (2017) who reported that quantity of output, access to credit and training were determinants of sweet potato value addition. The influence of marital status on the other hand might mean that sweet potato processing was done by married couples where the family members provide labour thereby increasing the gross margin of the produce.

**Table 3. Binary logit regression showing the determinant of sweet potato processing in the study area**

Variables	Coefficient	P value
Age	0.086	0.127
Marital status	-4.012**	0.002
Gender	-0.063	0.944
Household size	-0.364	0.112
Education	1.242	0.140
Income	0.000	0.405
Years of farming experience	0.070	0.259
Farm size	0.198	0.153
Output	1.000**	0.000

Source: Field survey 2019

\*\*Level of significance < 5%

**Table 4. Constraints to sweet potato processing in the study area**

Constraints	Strongly severe	Severe	Moderately severe	Rarely severe	Not a problem	Mean	Rank
No efficient means of storing processed sweet potato	21(17.5)	40(33.3)	45(37.5)	10(8.3)	4(3.3)	3.53	1 <sup>st</sup>
Inadequate extension services to help improve the level of sweet processing	39(32.5)	22(18.3)	25(20.8)	18(15.0)	16(13.3)	3.42	2 <sup>nd</sup>
High cost of packaging	27(22.5)	18(15.0)	37(30.8)	20(16.7)	18(15.0)	3.13	3 <sup>rd</sup>
Marketability of processed sweet potato is low	14(11.7)	34(28.3)	20(16.7)	46(38.3)	6(5.0)	3.03	4 <sup>th</sup>
Methods of processing sweet potato are complex	10(8.3)	18(15.0)	43(35.8)	38(31.7)	11(9.2)	2.82	5 <sup>th</sup>
Inadequate planting material	22(18.3)	22(18.3)	15(12.5)	27(22.5)	34(28.3)	2.76	6 <sup>th</sup>
Quality and quantity of sweet potato will reduce when processed	4(3.3)	19(15.8)	25(20.8)	55(45.8)	17(14.2)	2.48	7 <sup>th</sup>
Processing of sweet potato will reduce the purchasing power of the consumers	2(1.7)	14(11.7)	37(30.8)	48(40.0)	19(15.8)	2.43	8 <sup>th</sup>
Processing of sweet potato will reduce its shelf life	1(0.8)	20(16.7)	27(22.5)	43(35.8)	29(24.2)	2.34	9 <sup>th</sup>

Source: Field survey 2019

**Constraints to sweet potato processing in the study area.** Table 4 shows the challenges faced by sweet potato producers and processors in the study area. No efficient means of storing processed sweet potato was ranked 1st with a mean of 3.53 and was considered a key constraint amongst all other constraints. This was reported as a key constraint by Fawole (2017) where he examined the constraints to production, marketing and processing of sweet potato. “Inadequate extension services to help improve the level of sweet processing” was ranked 2nd with a mean of 3.42. This is in line with the findings of Omoare *et al.* (2014) who reported that lack of support from extension agents has an adverse effect on value addition of sweet potato. High cost of packaging was ranked 3rd with a mean of 3.13. “Marketability of processed sweet potato is low” was ranked 4th with a mean point of 3.03. The results also revealed that the least ranked constraint ‘Processing of sweet potato will reduce its shelf life’ was not regarded as a constraint to the production and processing of sweet potato in the study area.

## Conclusion

The findings show that sweet potato production in the study area was profitable and the processing was equally profitable although only 40 farmers out of the total respondents processed their produce. This was due to challenges such as lack of efficient means of storing processed sweet potatoes, inadequate extension services to help improve the level of sweet processing, and high cost of packaging. The level of output was also found to be a determinant of sweet potato farming in the study area.

Based on the study, the following should be undertaken;

- Extension agents should intensify efforts to enlighten farmers on numerous nutritive benefits of sweet potato; this can also serve as an additional source of income to the farmers; and,
- There is the need for the provision of efficient storage facilities for processed sweet potatoes; this will encourage and enable sweet potato farmers to carry out value addition through processing

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