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Economic Viability and Determinants of Orange Flesh Sweet Potato (OFSP) Production in Anambra State

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ABSTRACT **Original Research Article**

This study was on economic viability and determinants of orange flesh sweet potato production in Anambra state. Majority of the farmers are male (75.0%), with average age of 52.03 years. Marital status, farming experience, education qualifications, household size, and farm size further characterize the demographic landscape, emphasizing the prevalence of smallholding practices. The study's financial analysis reveals a positive Return on Investment (ROI) of 79%, affirming the profitability of sweet flesh orange potato production. This cost and returns analysis provide valuable insights into the financial performance, serving as a foundation for informed decision-making among farmers and policymakers. Regression results uncover significant factors affecting orange flesh sweet potato production, including farm size, age, household size, education, and access to credit, all contributing positively to production. The study also identifies socioeconomic characteristics positively impacting output, including education, farm size, and extension contacts. The model's strength, which explained 79% of profit variability, showed how important these factors are in determining economic outcomes. Overall, this research provides a comprehensive understanding of orange flesh sweet production dynamics, offering actionable insights for sustainable agricultural development in the study area.

The study recommended that there is need to improve soil fertility by using blended fertilizer or organic manure to ensure sufficient N, P, and K. And also to establish or support vine multiplication schemes locally to reduce cost and improve profitability.

Keywords: Cucumber, Economics, Smallholder, Farmers, Production.

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1. Introduction

For all intents and purposes, agriculture is still the backbone of Nigeria's economy. You can't ignore the incalculable value of this industry to the country's coffers. Millions of employment, tons of food, and priceless raw resources are annually produced by the agricultural sector, which in turn contributes to economic development and progress. In 2020, the agricultural industry would account for 48% of the labor force in Nigeria and provide 25% of the country's GDP, according to recent figures (World Bank, 2021).A dicotyledonous plant from the morning glory family (Convolvulaceae), orange flesh sweet potatoes (Ipomea batatas) were initially created as a bio-fortified crop as part of a worldwide initiative to control vitamin A deficiency. Ascorbic acid and the amino acid lysine, which is often lacking in grain diets, are found in this starch staple crop. Tropical and subtropical regions are ideal for growing this cultivar. Iheonu and Sennuga (2023) found that this root crop outperforms many others in terms of food production per unit of time and area when it rains, and it even does better when it's dry. What's more, it grows well in less fertile soil. Nigeria has released three different kinds of orange flesh sweet potatoes (OFSPs), the most recent of which is UMU SP 002, sometimes called King J, which came out in December 2012. Both UMU SP 003 (Mother's Delight) and UMU SP 004 (Solo Gold) were released in June of 2013 and 2018,

respectively. Beta carotene is a common organic pigment that appears in many fruits and vegetables as a reddish-orange hue. The orange color of OFSP comes from beta-carotene, a chemical that, when taken, the body transforms into vitamin A. Bio-fortification refers to the practice of using biotechnology, agronomic methods, or conventional plant breeding to increase the concentration of vitamins and minerals in staple food crops, hence improving their nutritional value. Oyewole and Sennuga (2020) state that bio-fortification can enhance the levels of many minerals and vitamins, such as zinc, iron, carotenoids, and pro vitamin A.

The orange-fleshed potato is a starchy, tuberous vegetable that has a sweet, carrot-like flavor. Soils that are light, well-drained, sandy loam or silt loam produce superior results. A temperature between 21 and 60 degrees Celsius is ideal. In order to maximize both land and profit, it can be sown alone or intercropped with other crops like maize and orchard crops, and it needs an evenly distributed 75-150 cm of rainfall. Water logging is too much for it to handle, yet it can handle drought to a certain degree. Sweet potatoes thrive in loam and clay soils that drain well. Sandy soil promotes the growth of long, cylindrical, pencil-like roots, whereas heavy, compacted clayey soil inhibits storage root development. Because they are susceptible to aluminum poisoning at low pH levels and pox and scurf disease at high PH levels, sweet potatoes are acidic soil plants that do best in soils with a pH of 5.5 to 6.5. While organic fertilizer is preferable to inorganic fertilizer for soils that aren't nutrient rich, OFSP doesn't need much fertilizer to flourish. Vine cutting is the planting material utilized for OFSP. Producing 3.46 million metric tons per year, Nigeria is the world's second-largest producer of sweet potatoes, behind only China (Udemezue, 2019).Several researchers have studied orange flesh sweet potato production. One study, Gender participation of orange flesh sweet potato production activities in FCT, Abuja, Nigeria, by Barnabas, Sennuga, Ajah, and Fadiji2023, indicated that the main obstacles to production in the study area were a lack of funding, conflicts with herdsmen, expensive labor, expensive vine, inadequate storage facilities, and expensive transportation. According to a study conducted by Ume, Onunka, Ochiaka, and Achebe in 2020 titled "Economic Efficiency of Orange Flesh Sweet Potato (OFSP) Varieties by Farmers in Anambra state, Nigeria," the main factors limiting the production of OFFSP in that region include farmers' limited access to credit and extension services, as well as the high costs of labor, fertilizer, pesticide adulteration, and improved potato vines. Despite a mountain of research, no one in Anambra State's Awka South Local Government Area has been able to demonstrate that growing sweet potatoes with orange flesh is economically feasible. The purpose of this research is to address that knowledge vacuum by calculating the potential financial benefits of growing sweet potatoes with orange flesh in Anambra state's Awka South LGR. In particular, the study aimed to describe the socioeconomic features of farmers, estimate the costs and returns of production, and identify the variables effecting the production of orange flesh sweet potatoes.

2. Methodology

2.1 The Study Area

Anambra State's Awka South Local Government Area has been selected as the site of this inquiry. The LGA called Awka South is located in Nigeria's Anambra State. Situated in the southeast of the country, it is one of twenty-one Local Government Areas (LGAs) of Anambra State. This site serves as the administrative and governmental hub of Anambra State, establishing it as the capital of the state. The Awka South LGA is made up of the following towns: Amawbia, Awka, Ezinato, Isiagu, Mbaukwu, Nibo, Nise, Okpuno, and Umuawulu. The three major roads that run through this area are Zik Avenue, Works Road, and Arthur Eze Avenue. The inhabitants of Awka South LGA were once renowned for their exceptional blacksmithing skills. The Igbo people of modern-day Nigeria hold them in high esteem due to their technological expertise and economic savvy.

There are two different seasons in the Awka South local government region, and a total of about 2,950 millimeters of precipitation falls during each. In Awka South, you can expect an average humidity of 70% and a temperature of 27 °C. You may find it in the coordinates 6.2069°N and 7.0678°E. The seat of government and capital of Anambra State is Awka South. The Governor's Office, the State Secretariat, and other state government departments are housed there. There are a number of schools, colleges, and universities in Awka South. Awka South is home to the Nnamdi Azikiwe University, a top federal university in Nigeria. Academic and intellectual life in the region are boosted by the presence of these schools. There are many different types of businesses in Awka South. Many different types of businesses, from manufacturing to retail to service provision, call this region home. Businesses and commerce flourish in some places, such as marketplaces, retail malls, and commercial areas. Culturally and historically, Awka South is significant. The area's historical sites, cultural festivals, and traditional festivities highlight the Igbo people's illustrious past and present. There are chances to learn about and appreciate other cultures at these activities and locations. There are many different types of businesses in Awka South. Many different types of businesses, from manufacturing to retail to service provision, call this region home. Businesses and commerce flourish in some places, such as marketplaces, retail malls, and commercial areas.

2.2 Population of the Study

The study's population comprised all registered orange-fleshed sweet potato farmers in the designated area, totaling 1,003 persons.

2.3 Sampling Technique and Sample Size

The study used a multistage sampling method to choose the people who would answer the questions.

In the first stage, The study specifically chose Awka South Local Government Area since it has a lot of farmers that grow orange-fleshed sweet potatoes.

In the second stage, Five communities from the local government area were chosen at random: Awka, Amawbia, Nibo, Nise, and Okpuno.

In the third stage, Twenty orange-fleshed sweet potato growers were randomly chosen from each of the five chosen communities. This made a total of 100 responders for the study.

2.4 Method of Data Collection

Data for this study were obtained from primary sources, including structured questionnaires, personal interviews, field observations, and informal discussions. Structured questionnaires were administered to literate farmers, while interview schedules were used for farmers who were not literate. All questionnaires and interview schedules were personally administered to the respondents to ensure accurate data collection.

2.5 Method of Data Analysis

Objective (i) was analyzed using descriptive statistical tools such as frequencies, means, and standard deviations. Objective (ii) was addressed through the use of gross margin analysis, while Objective (iii) was examined using multiple regression analysis.

2.6 Mathematical Expression

Model 1

Cost Function

Cost function is specified as:

$$\boldsymbol{Tc = \sum X_i P_i + Fc}$$

Where:

Tc = Total cost X_i. $P_i$expenditure on *i*th

Input…, Fc=fixed costs.

Model 2

Profit Function

Profit function is specified as:

$$\pi = TR - TC$$

$$\pi = Q.P_q - (\sum X_i P_i - FC)$$

Where:

π = Net profit

TR = Total Revenue

TC = Total cost

Q = Quantity of output

P_q= Unit Price of Output.

2.7 Model Specification

To find out what factors affect the production of orange-fleshed sweet potatoes, researchers used a multiple regression model. Age, sex, marital status, household size, farming experience, education level, and labor cost were the explanatory variables.

Y= f (AGE, SE, MAS, HOS, FE, EDU, LAC + e)

Where:

AGE = Age of orange-fleshed sweet potato farmers (in years)

SE = Sex of orange-fleshed sweet potato farmers

MAS = Marital status of orange-fleshed sweet potato farmers

HOS = Household size (number of persons in the household)

FE = Farming experience

EDU = Educational level of orange-fleshed sweet potato farmers (years of schooling attained)

LAC = Labor cost

e = stochastic error term

2.8 Factors influencing production

In this study, the factors influencing production were analysed using multiple regression analysis. The model was implicitly specified as follows:

Y = β0+ β1X1+ β2X2+.....+ βnXn+e

Where:

Y = dependent variable

β0 = constant intercept

β1 – βn = parameter estimates (coefficients) X1 –Xn = independent variable

e = error term

3. Results and Discussions

3.1 Socio-economic Characteristics of Small-Scale Orange-Fleshed Sweet Potato Farmers

Sex: The distribution of farmers by sex shows that males constituted 75.0% of orange-fleshed sweet potato producers, whereas females accounted for 25.0%. This indicates that production activities in the study area involve both genders, although male participation is more dominant. The higher proportion of male farmers may be explained by prevailing cultural norms and traditional beliefs that regard farming as physically demanding work more suitable for men. This outcome supports the findings of Oyediran et al. (2017), who reported male dominance in orange-fleshed sweet potato production.

Age: The age profile of the respondents reveals that 52.0% of the farmers were within the age bracket of 30–49 years, while 23.0% were aged 50 years and above, and 25.0% were below 30 years, with a mean age of 52 years. This age structure suggests that most farmers were within their economically productive years. The implication of this trend is significant for innovation, as older farmers may be less inclined to adopt new orange-fleshed sweet potato varieties compared to younger farmers. This observation aligns with the findings of Nwankwo and Bassey (2019), who noted that younger farmers tend to have longer planning horizons and better access to production-enhancing information.

Marital status: Analysis of marital status indicates that 63.0% of the farmers were married, while 15.0% were widowed, 19.0% were single, and 3.0% were separated. This distribution suggests that most farmers had family units that could contribute to farm labour. Additionally, married farmers are more likely to appreciate the nutritional value of orange-fleshed sweet potato, particularly as an important source of vitamin A for household members. This result is consistent with Akinbile (2021), who observed that married individuals constitute the majority of participants in farming activities. The high involvement of couples in production may also be attributed to the labour-intensive nature of agronomic practices, which often require combined family and hired labour, as reported by Olasunkami et al. (2020).

Farming experience: The results show that 46.0% of the farmers had 16 years or more of farming experience, while 26.0% had between 11 and 15 years, 24.0% had 6–10 years, and only 4.0% had less than six years of experience. The average farming experience was 16.02 years, indicating that the farmers were relatively experienced in orange-fleshed sweet potato production. Such extensive experience is likely to enhance farmers' capacity to apply technical knowledge and improve production efficiency. This finding is in agreement with Fawole (2018), who reported that sweet potato farmers in Nigeria are generally experienced, and with Abiona (2020), who emphasized the importance of farming experience in the success of agricultural enterprises.

Level of education: The educational attainment of the respondents varied, with the largest proportion (35.0%) having secondary education. Farmers with tertiary education accounted for 28.0%, those with primary education constituted 18.0%, and 14.0% possessed postgraduate qualifications, while only 5.0% had no formal education. Overall, the results indicate a relatively high level of literacy among the farmers, which may explain their willingness to adopt orange-fleshed sweet potato varieties that differ from traditional cultivars. This finding supports Adeola et al. (2019), who reported that formal education enhances farmers' adoption of improved sweet potato varieties in Nigeria.

Household size: Household size distribution shows that 42.0% of the farmers had between 6 and 10 household members, while 35.0% had fewer than six members and 23.0% had more than ten members, with an average household size of 7.02 persons. This suggests that most farmers had access to family labour, which is particularly valuable during peak farming periods when the cost of hired labour is high. The availability of household labour can therefore help reduce production costs and improve operational efficiency, as observed by Ume, Onuh, Jiwuba, and Onunka (2016).

Farm size: The findings indicate that orange-fleshed sweet potato production in the study area is predominantly small-scale in nature. Farm size was measured in plots, a unit commonly used by the farmers. The majority of respondents (63.0%) cultivated 11 plots or more, while 28.0% operated between 6 and 10 plots, and 9.0% cultivated fewer than six plots. The mean farm size was 12.45 plots, with a conversion rate of 15 plots equivalent to one hectare. This result confirms the smallholder nature of orange-fleshed sweet potato farming in the area.

Table 1: Socioeconomic characteristics of orange sweet flesh potato farmers

Socioeconomic characteristics	Frequency	Percentage (%)	Mean
Sex:			
Female	25	25.0	
Male	75	75.0	
Age:			
Less than 30	25	25.0	
30 – 49	52	52.0	52.00
50 and above	23	23.0	
Marital status:			
Single	19.0	19.0	
Separated	3.0	3.0	
Widow/widower	15.0	15.0	
Married	63.0	63.0	
Farming experience (years):			
Less than 6	4	4.0	
6 - 10 years	24	24.0	16.02
11 - 15 years	26	26.0	
16 years and above	46	46.0	
Level of education:			
No formal education	5	5.0	
Primary	18	18.0	
Secondary	35	35.0	
Tertiary	28	28.0	
Postgraduate	14	14.0	
Household size:			
Less than 6 people	35	35.0	
6 - 10 people	48	42.0	7.02
Above 10 people	17	23.0	
Farm size (15 plot/ha):			
Less 6	9	9.0	
6 - 10 plots	28	28.0	12.45
11 plots and above	63	63.0	

Field survey: 2025

3.2 Cost and Returns Analysis of Orange Sweet Flesh Potato Production

The cost and returns of orange flesh sweet potato production in the study area is presented in Table 4.2. The Table indicates that the observed yield is 18.09 tons per hectare, with a unit price of N65, 213.54 per ton, resulting in total revenue of N1, 179,943.48.Vine cuttings, fertilizer, agrochemicals, and labor contribute to the variable costs, totaling N645, 227.81. These costs are directly associated with production and vary with the level of output. The variable costs, including inputs like vine cuttings, fertilizer, agrochemicals, and labour, constitute a significant portion of the total costs. Effective management of these costs is essential for maximizing profitability. The revenue generated from orange flesh sweet potato production appears substantial, with a gross margin of N534, 715.67 indicating a positive financial outcome before accounting for fixed costs. On the other hand, the depreciation on fixed assets is N46, 671.10, rent on landholding is N51,870.23, which total fixed cost amounts to N98,541.32.The sum of variable costs and fixed costs results in a total cost of N743, 769.14. However, the gross margin is the revenue minus the variable costs (N1,179,943.48 - N645,227.81), resulting in N534,715.67. Furthermore, the Net Returns represent the revenue minus the total cost (N1,179,943.48 - N743,769.14), yielding N436,174.34.Again, the Return on Investment (ROI) is calculated by dividing the Net Returns by the Total Cost (N436,174.34 / N743,769.14), resulting in an ROI of 0.59 or 59%, which indicates that, for every N1 invested, there is a return of N0.59, which is an indication of high profitability of orange flesh sweet potato.

Table 2: Cost and Returns Analysis of Orange Flesh Sweet Potato Production

Item description	Quantity	Unit price (N)	Amount (N)
Revenue:			
Output (ton/ha)	18.09	65213.54	**1,179,943.48**
Vine cuttings	44.60	2471.42	110,237.40
Fertilizer (kg)	351.18	585.97	205,783.75
Agrochemical (litre)	18.85	3977.24	74,967.64
Labour (man-day)	48	5296.65	254,239.02
Total VC			**645,227.81**
Fixed asset			
Depreciation on fixed assets			46,671.10
Rent on Landholding	0.83	62494.25	51,870.23
Total Fixed cost			98,541.32
TC			743,769.14
Gross Margin			**534,715.67**
Net Returns			436,174.34
ROI			**0.79**

Source: Field Survey, 2025

3.3 Factors Affecting Sweet Flesh Potato Production

Table 4.3 displays the factors influencing the production of orange flesh sweet potatoes in the research region. Overall, the regression model is statistically significant, with an F-statistic of 14.99(***) at the 1% level of probability. So, it seems like one of the independent variables is influencing the area's orange flesh sweet potato production. Both the R-squared value (0.569) and the Adjusted R-squared value (0.531) indicate how well the regression model fits the data. The included variables explain around 56.9% of the variability in orange flesh sweet potato production, according to an R-squared value of 0.569.

A positive and statistically significant coefficient (1.048) for farm size at the 55th percentile indicates a 1.048-unit positive association between farm size and orange flesh sweet potato yield. This suggests that there is a positive correlation between farm size and production.

At the 1% level of probability, age has a positive influence on orange flesh sweet potato output, as indicated by the positive coefficient of age (0.043). It is possible that older farmers have greater knowledge or experience, which leads to 0.043 units of higher productivity.

Household size significantly affects orange flesh sweet potato production by 0.178 units, according to a positive coefficient of 0.178 at a 1% level of probability. During the farming season, when wages are high, farmers often rely on family members to help out. This allows them to have access to labor.

With a 1% level of probability, an education coefficient of 0.128 indicates that there is a 0.128 unit increase in orange flesh sweet potato production for every level of formal education. Higher levels of education may lead to more informed decision-making and the use of cutting-edge farming techniques.

Increased availability of credit boosts orange flesh sweet potato output by 0.011 units, according to the positive coefficient of credit access at the 1% level of probability. Increased output and improved enterprise profitability are the results of farmers having access to loans.

Furthermore, additional variables with a significant influence on orange flesh sweet potato production in the study area were revealed by the regression results. Produced orange flesh sweet potatoes are positively affected by factors such farm size, age, household size, years of formal education, and access to financing, all of which have positive coefficients. These results corroborated those of Okeke and Mbah (2021), who found that sweet potatoes with orange flesh are more likely to be produced when farmers are older, have more education, have more agricultural experience, are more involved in organizations, and have easier access to extension services.

Table 3: Factors affecting orange flesh sweet potato production in the area

Covariates	Coefficients	Standard Error	t-Statistics
Intercept	6.698	1.148	5.84
Farm size	1.048	0.423	2.48**
Age	0.043	0.015	2.85***
Household size	0.178	0.034	5.26***
Years of formal education	0.128	0.029	4.43***
Farming experience	0.053	0.046	1.15
Extension contacts	0.103	0.069	1.49
Fertilizer usage	-0.499	0.414	-1.20
Access to Credit	0.011	0.002	5.63***
F-statistics	14.99***		
R-square	0.569		
Adjusted R-square	0.531		
Obs.	100		

Source: Field Survey, 2025. Sig. @ 10% (*), 5% (**), 1% (***)

4. Conclusion

The study on the economic analysis of orange-fleshed sweet potato production in Awka South Local Government Area of Anambra State offers important insights into the nature and performance of the enterprise. The demographic characteristics of the respondents indicate that production is largely dominated by male farmers, with the average age reflecting a workforce that is physically active and capable of adopting improved production technologies. Married farmers with considerable farming experience and varying education levels operate smallholdings characterized by an average farm size of 12.45 plots. Despite challenges such as low capital, accessibility issues, and high cost of labour, the study identifies a positive Return on Investment (ROI) of 59%, indicating a financially viable venture. The regression analysis further elucidates the factors influencing yellow cassava production, including farm size, age, household size, education, and access to credit.

5. Recommendations

1. Research institutions should prioritize the development of labour-saving technologies and ensure their effective dissemination to farmers in order to reduce labour requirements and the high cost associated with farm operations.
2. Relevant government agencies and stakeholders should support the multiplication of orange-fleshed sweet potato vines through the establishment of vine multiplication centres in all communities within the study area, thereby improving farmers' access to quality planting materials.
3. It is necessary to enhance pest and disease management measures, as these factors were found to be significant productivity restrictions. To achieve this goal, it may be necessary to educate farmers on disease-resistant varieties, teach them how to employ integrated pest management techniques, and give them up-to-date information on how to keep their crops healthy.

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