



ECONOMIC PERFORMANCE OF YAM PRODUCTION AMONG SMALL-HOLDER FARMERS IN OSUN STATE, NIGERIA

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Abstract

This study examined the economic performance of yam production among smallholder farmers in Ilesha West Local Government Area of Osun State, Nigeria. The study employed a multistage sampling procedure to select 120 smallholder yam farmers, and collected primary data using a pre-tested structured questionnaire. The data were analysed using descriptive statistics, gross margin analysis, profitability ratios and a multiple regression model. The results showed that 96.7% of the farmers were male, while 93.3% had formal education. The farmers had a mean age of 51 years, an average household size of six persons and a mean farm size of 1.2 hectares. Gross margin and profitability analyses showed that yam production was profitable, with a net farm income of ₦91,711.23, equivalent to US\$220.60 at the March 2022 average exchange rate of ₦415.72/US\$1. The analysis also indicated a return of 30 kobo for every naira invested in yam production. The multiple regression results identified education, household size, farm size and access to credit as significant factors influencing income from yam production. The study therefore recommends improved access to affordable agricultural credit to enable farmers to expand their farm operations, acquire production inputs and improve their income from yam production.

Keywords

Economic performance, yam production, profitability, smallholder farmers, Osun State, Nigeria

Introduction

Yam (*Dioscorea* spp.) is one of the most important root and tuber crops globally and is particularly significant to food security, income generation and livelihoods in West Africa. The crop is cultivated extensively in tropical regions of Africa, Latin America, the Caribbean and parts of Asia, although West Africa accounts for the

overwhelming majority of global production. Nigeria remains the world's leading yam-producing country, contributing about 70% of global production in recent years (FAO, 2025). Recent evidence also indicates that yam production in Nigeria remains substantial; the 2022/2023 National Agricultural Sample Survey reported 18.70 million tonnes of yam harvested during the major agricultural season, making yam the country's second-largest

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major-season crop after cassava (NBS, 2025). Yam is represented by several species, among which white yam (*Dioscorea rotundata*), yellow yam (*D. cayenensis*), water yam (*D. alata*), trifoliate yam (*D. dumetorum*), aerial yam (*D. bulbifera*) and Chinese yam (*D. esculenta*) are among the most economically important. The crop is an important source of dietary energy and contributes to household income and employment throughout its value chain. In Nigeria, yam is consumed in several forms, including boiled, fried, roasted and pounded yam, while it is also processed into flour, chips and other products. Its cultural importance is equally notable, as yam features prominently in traditional festivals, ceremonies and social activities in many parts of the country. Beyond its contribution to food consumption, yam provides an important source of livelihood for farmers, traders, processors and other actors in the agricultural value chain.

Despite its importance, yam production remains constrained by several technical and economic challenges. Yam cultivation is highly labour-intensive, while the availability and affordability of quality seed yam remain major constraints to productivity. Farmers commonly depend on farmer-saved tubers or informal seed sources, which can limit access to healthy and improved planting materials. Recent evidence shows that average yam yields in Nigeria remain considerably below attainable yields, indicating substantial scope for improving productivity through better seed systems, production technologies and resource management (Kalu et al., 2023). Rising costs of labour, planting materials, fertilizers, agrochemicals and transportation have further increased the cost of yam production. Studies in Nigeria have identified high input costs, inadequate capital, labour requirements, pest and disease infestation, poor transportation and market-related problems among the major constraints affecting yam farmers (Olatunji et al., 2024; Adikwu et al., 2025). These constraints are particularly important because increasing production costs may reduce farmers' profit margins even where yam production remains technically feasible and commercially attractive.

Several studies (Adejoh et al., 2023; Edem & Oniah, 2024; Olatunji et al., 2024) have examined the economics of yam production in Nigeria and identified factors such as farm size, education, farming experience, labour, seed yam, access to capital and input prices as important determinants of production and income. However, changes in input prices, production conditions and market dynamics make periodic assessment of the economic performance of yam production necessary. Osun State is one of the important yam-producing areas in southwestern Nigeria, where yam contributes to household food

supply and farm income. However, increasing production costs and growing consumer demand may affect the profitability and economic performance of yam farmers. Understanding the current cost structure, returns and factors influencing income is therefore important for improving resource allocation and supporting policies aimed at strengthening yam production in the state. To this end, this study analysed the economic performance of yam production in Osun State, Nigeria. Specifically, the study described the socio-economic characteristics of yam farmers, estimated the costs and returns to yam production, determined the economic performance of yam farmers and analysed the factors influencing income from yam production in the study area.

Materials and methods

Study Area

This study was conducted in Ilesa West Local Government Area of Osun state, Nigeria. The headquarter is in the town of Oja Oba (Ereja Square) on the outskirts of the city of Ilesa. It is located on coordinates 7°39'N and 4°43'E. It has an area of 63km² (24sqm) and a population of 103,555 at the 2006 census while the Osun State Government population projections indicate substantial subsequent population growth. The major occupation of the people in the area is farming. Crops cultivated include maize, yam, cassava, cocoyam, cocoa, kolanut, citrus and vegetables. Livestock like sheep, cattle, pig, goat, rabbit and poultry are additionally raised for sales and consumption..

Sampling Procedure and Sample Size

Multistage sampling technique was used to select the respondents for this study. First stage involved the purposive selection of two zones out of the three zones in the study area due to the presence of large yam farmers. The second stage was the random selection of two villages each from the two selected zones making a total of four villages. In the third stage, simple random sampling techniques was employed to select two communities from each of the villages making a total of 8 communities while the last stage involved the random selection of 15 households from the selected communities making a total of 120 respondents..

Data Collection and Analysis

The study used primary data collected from the selected yam farmers in March 2022 through a pre-tested structured questionnaire. The questionnaire obtained information on the farmers' socioeconomic characteris-

tics, production inputs and costs, output, revenue, access to credit and other factors relevant to yam production.

*100 (8)

Rate of return on fixed (RRFC) = $\frac{TR - TVC}{TFC} \times 100$ (9)

Descriptive statistics were used to summarise the socio-economic characteristics of the respondents. Gross margin analysis and profitability ratios were used to estimate the costs, returns and economic performance of yam production. A multiple regression model was estimated to determine the socioeconomic factors influencing farm income from yam production.

Gross Margin Analysis

This was used to estimate the costs and returns to yam production in the study area. Gross margin analysis is defined as the difference between total revenue and total variable cost. Total revenue (TR) is the product of price and output of yam while the total variable cost (TVC) is the aggregation of the cost of land preparation, planting materials, yam seeds, planting, weeding, mulching and harvesting.

Mathematically,

$$a. GM = TR - TVC \quad (1)$$

Where; TR = total revenue expressed as $P \times Q$ (2)

TVC = Total variable cost expressed as $TC - TFC$ (3)

P = price/unit of yam Q = number of yam sold

TC = Total cost expressed as $TFC + TVC$ (4)

TFC = Total Fixed Cost expressed as $TC - TVC$ (5)

b. Net Farm Income:

The net farm income (NFI) is the difference between the gross margin (GM) and total fixed cost (TFC)

Mathematically, $NFI = GM - TFC$ (6)

Economic performance analysis

The profitability ratios were used to determine the economic performance of the yam farmers in the study area. According to Aminu and Hermanns (2021), profitability ratio is a class of financial metrics that helps investors assess a business's ability to generate earning compared with its expenses and other relevant costs incurred during a specific period. Following Ariyo *et al.*, (2020), Aminu and Hermanns (2021), the Profitability ratios are specified as:

Return per naira spent = $\frac{NFI}{TC}$ (7)

Rate of return on variable cost (RRVC) = $\frac{TR - TFC}{TVC}$

$$\text{Gross Ratio (GR)} = \frac{TC}{TR} \quad (10)$$

$$\text{Fixed Ratio} = \frac{TFC}{TR} \quad (11)$$

$$\text{Operating Ratio (OR)} = \frac{TVC}{TR} \quad (12)$$

Multiple Regression Analysis

This was used to analyse the factors influencing income from yam production in the study area. The implicit form of the model is as follows;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \mu \dots \quad (13)$$

Where, Y = Income (₦); X_1 = Sex of farmer (1 if male, 0 otherwise); X_2 = Age (years); X_3 = Educational Status (years of formal schooling); X_4 = Household size (No of people); X_5 = Farming Experience (years); X_6 = Farm size (hectares); X_7 = Type of labour Used; X_8 = Access to Loan (dummy); X_9 = Cooperative Membership (dummy); X_{10} = Extension contact (dummy); b_0 = Constant term; $\beta_1 - \beta_{10}$ Regression coefficient to be estimated; μ = Error term.

Different functions, linear, semi-log, double-log and exponential were tried and the linear function was chosen for the analysis based on goodness of fit (economic, econometric and statistical criteria).

Results

Result of the socioeconomic characteristics of the smallholder farmers presented in Table 1 shows that 96.7% of the yam farmers were male, indicating a strong male dominance in yam production in the study area. The predominance of men in the present study may therefore reflect the labour-intensive nature of yam cultivation and the gendered allocation of farm production activities in the region. A recent study of yam farmers across four Nigerian regions by Kalu *et al.* (2023) reported male participation ranging from 76.9% in Southeast to 91.3% in Southwest Nigeria.

The results further show that 57.5% of the farmers were between 41 and 60 years old, with a mean age of approximately 51 years. This indicates that yam production in the study area was largely undertaken by middle-aged farmers. The relatively high mean age may reflect the experience accumulated through years

of farming, which can support farmers' knowledge of local production conditions and management practices. This is in line with the findings of Adejoh et al. (2023) who reported a mean age of 47 years among yam farmers in Kabba-Bunu, Kogi State,, confirming the predominance of middle-aged farmers in the enterprise. The age structure, however, highlights the need to encourage younger farmers to participate in yam production to support continuity and the future supply of the crop.

Educational attainment was relatively high among the respondents, as only 6.7% had no formal education. This suggests that most farmers possessed some level of formal education, which may facilitate their ability to access and understand agricultural information,

evaluate production alternatives and respond to extension recommendations. The mean household size was

Table 1. Selected socio-economic characteristics of the yam farmers ($n = 120$)

Variable	Frequency	Percentage (%)	Mean
Sex			
Female	4	3.3	
Male	116	96.7	
Age (years)			
≤40	22	18.3	51.43 (±10.813)
41-60	69	57.5	
> 60	29	24.2	
Educational Qualification			
No Formal Education	8	6.7	
Formal Education	112	93.3	
Household Size (no)			
1-5	54	45.0	6 (±2.792)
>5	66	55.0	
Farm size (ha)			
0.1-0.6	69	57.5	1.2 (±0.855)
>0.6	51	42.5	
Cooperative Membership			

six persons, indicating that the farmers generally operated households with a relatively substantial number of members. Household members may contribute to farm activities and consequently reduce dependence on hired labour, particularly during labour-demanding operations.

The farm-size distribution shows that 57.5% of the farmers cultivated between 0.1 and 0.6 ha, while the mean farm size was 1.2 ha. This indicates that yam production in the study area was predominantly small-scale. The relatively small farm holdings may limit the scale at which farmers can expand production and benefit from economies of scale. Farm size also remains an important consideration in yam production because land availability affects farmers' capacity to allocate resources to the enterprise and increase output.

Yes	79	84.0	
Access to Bank Loan			
Yes	23	24.5	
Extension Contact			
Yes	18	19.1	
Yam Output			
≤5,000	98	81.7	3,646
>5,000	22	18.3	

The finding agrees broadly with study from Kabba-Bunu, where yam farmers cultivated an average of about 1 ha (Adejoh et al., 2023), although Kalu et al. (2023) reported a wider range of farm sizes among yam farmers across Nigeria .

The results also reveal limited access to formal credit and agricultural extension services among the farmers. The limited access to credit may constrain farmers' ability to purchase improved planting materials and other inputs and to finance labour-intensive production activities. Similarly, inadequate extension contact may restrict farmers' exposure to improved production practices, technologies and management information. This is in consonance with the findings of Ilemobayo and Ijigbade (2019) that inadequate extension contacts lead to lack of access to recent technologies on good agronomic practices resulting to lower output. Also, Yakubu et al. (2025) found that extension contact and access to credit were important socioeconomic factors associated with farmers' extension needs among yam farmers in Nigeria.

Average Costs and Returns to Yam Production in the Study Area

Table 2 presents the average costs and returns to yam production among the sampled farmers. The farmers incurred an average total production cost of ₦308,157.27 (US\$741.26) during the 2021 production season, of which ₦291,084.27 (US\$700.19), representing 94.46%, constituted variable costs. Fixed costs accounted for the remaining ₦17,073.00 (US\$41.07),

representing 5.54% of total production cost. The dominance of variable costs indicates that short-run operating expenses constituted the major financial commitment in yam production. This is consistent with the findings of Adejoh et al., (2023) who reported that variable costs constitute a substantial proportion of yam production costs in Nigeria.

Labour represented the largest single component of variable cost, accounting for 56.85% of total production cost. The high labour expenditure reflects the labour-intensive nature of yam production, particularly for land clearing, planting, staking, weeding, agrochemical application and harvesting. This is in tandem with the findings of Ariyo *et al.* (2020) that cost of labour was the major important single cost item associated with yam production in Ekiti State, Nigeria. Idris et al. (2023) also reported that labour was the largest component of variable production costs among yam farmers in the Federal Capital Territory, accounting for 48.8% of total variable cost. Similarly, Agbachom et al. (2024) reported labour expenditure of ₦210,285.91 per hectare among yam producers in South-South Nigeria, further demonstrating the importance of labour in the cost structure of yam production. These findings suggest that access to labour-saving technologies could reduce production costs and improve farmers' returns.

The farmers realised an average total revenue of ₦399,868.50 (US\$961.87) from yam sales. This generated a gross margin of ₦108,784.23 (US\$261.68) and a net farm income of ₦91,711.23 (US\$220.61). The positive gross margin and net farm income indicate that revenue from yam production exceeded both variable and total production costs, respectively, confirming the profitability of the enterprise during the study period. Adejoh et al. (2023) similarly found yam production to

be profitable among smallholder farmers in Kogi State.

Table 2. Average Costs and Return to Yam Production in the Study Area

Cost items	Amount	% of TC
Variable costs		
Planting material	52,708.33	17.10
Land clearing	80,708.30	26.19
Cost of planting	17,026.21	5.53
Transportation cost	8,848.33	2.87
Cost of agrochemicals	53,233.33	17.27
Cost of weeding	32,250.00	10.46
Cost of staking	23,912.50	7.76
Cost agrochemical application	7,684.77	2.49
Cost of harvesting	11,595.83	3.76
Miscellaneous	3,116.67	1.01
Total Variable Cost (TVC)	291,084.27	94.46
Fixed Costs (depreciated)		
Rent on land	5,573.25	1.81
Cutlass	977.61	0.32
Hoe	1,227.45	0.40
Boot	3,565.25	1.16
Basket	621.55	0.20
Bowl	936.42	0.30
Wheel barrow	2,085.22	0.68
Yam ban	1,865.45	0.61
Others	220.80	0.07
Total Fixed Cost (TFC)	17,073.00	5.54
Total Cost	308,157.27	
Returns		
Total Revenue (TR)	399,868.5	48063.106
Gross Margin (TR - TVC)	108,784.23	
Net Farm Income (GM - TFC)	91,711.23	

Economic Performance of the Yam Farmers in the Study Area

The profitability ratios presented in Table 3 indicate that yam production generated positive returns for farmers in the study area. The return per naira invested was 0.30, implying that farmers realised an additional 30 kobo for every ₦1 invested in yam production. The positive return indicates that the revenue generated

from yam production exceeded the production costs incurred by the farmers. Adejoh et al. (2023) similarly reported that yam production was profitable among smallholder farmers in Kogi State, while Agbachom et al. (2024) found positive economic returns among yam farmers in South-South Nigeria. These findings reinforce the economic importance of yam production as an income-generating enterprise for smallholder farmers in Nigeria.

Table 3. Economic Performance of the Yam Farmers in the Study Area

Performance Measures	Ratios
Return per naira spent	0.30
Rate of return on variable cost (RRVC)	131.51
Rate of return on fixed cost (RRFC)	637.17
Gross ratio (GR)	0.77
Fixed ratio (FR)	0.04
Operating ratio (OR)	0.73

Source: Field survey data, 2022

The rate of return on variable cost (RRVC) was 131.51%, indicating that the return relative to variable production costs was greater than the amount invested in variable inputs. Similarly, the rate of return on fixed cost (RRFC) was 637.17%, indicating a substantially higher return relative to expenditure on fixed inputs. The considerably higher RRFC compared with RRVC reflects the relatively smaller share of total production cost attributable to fixed inputs. The results suggest that farmers could improve the economic performance of the enterprise by paying particular attention to the efficient management of variable inputs, especially those that constitute major components of production expenditure.

The gross ratio was 0.77, indicating that total production cost represented approximately 77% of the total revenue generated from yam production. Thus, about 23% of revenue remained after accounting for total production costs. A gross ratio below unity indicates that the revenue generated was sufficient to cover the total cost of production, thereby confirming the profitability of the enterprise. The fixed ratio of 0.04 further shows that fixed costs accounted for approximately 4% of total revenue, while the operating ratio of 0.73 indicates that variable or operating expenses accounted for about 73% of total revenue. The relatively large share of revenue committed to operating expenses highlights the importance of controlling variable production costs to sustain and improve profitability. Overall, the profitability indicators demonstrate that yam production was economically viable for the farmers during the study

period. The positive return per naira invested, favourable rates of return and gross ratio below unity indicate that the enterprise generated sufficient revenue to cover its production costs and provide a positive economic return. This finding agrees with recent evidence that yam production remains a profitable smallholder enterprise in different parts of Nigeria, although rising input and labour costs can substantially affect farmers' profit margins (Adejoh et al., 2023; Agbachom et al., 2024). Improving access to affordable production inputs, credit and relevant extension information could therefore help farmers manage production costs and sustain the profitability of yam production.

Factors Influencing Farm Income from Yam Production in the Study Area

The linear functional form was selected as the lead equation because it provided the best fit among the estimated functional forms based on the magnitude of the coefficient of multiple determination, statistical significance of the estimated parameters, significance of the F-statistic and conformity with the a priori expectations (Table 4). The model produced an R^2 of 0.896, indicating that the explanatory variables jointly accounted for approximately 90% of the variation in farm income from yam production in the study area. The significant F-statistic further indicates that the model adequately explained variations in farm income. The results showed that education, household size, farm size and access to loans significantly influenced farm income from yam production.

Education had a positive and statistically significant coefficient at the 5% level, indicating that farmers with

higher educational attainment tended to earn higher income from yam production. Education can enhance farmers' ability to access, understand and apply technical information, evaluate alternative production practices and respond to market opportunities. The positive effect of education observed in this study suggests that improving farmers' access to relevant technical training and production information could contribute to increased farm income. Yakubu et al. (2025) similarly identified education as an important socioeconomic characteristic associated with agricultural extension needs among yam farmers in Nigeria.

Household size had a positive and statistically significant coefficient at the 10% level, indicating that farmers with larger households tended to obtain higher income from yam production. The positive relationship may be associated with the availability of family labour for labour-intensive operations such as land preparation, planting, staking, weeding and harvesting. The use of family labour can reduce expenditure on hired labour and consequently improve the returns from yam production.

Table 4. Factors Influencing Economic Returns of Yam Production in the Study Area

Variables	Coefficient	t-ratio	Sig.
(Constant)	-18485.899	-2.143	0.034
Educational Status	3253.884**	2.151	0.034
Household Size	1263.842*	1.736	0.085
Farming Experience	264.423	0.759	0.449
Farm size	43831.240***	20.065	0.000
Type of Labour Used	853.386	0.297	0.767
Access to Loan	8320.382**	2.136	0.032
Cooperative Membership	2216.599	0.726	0.470
Extension contact	-1033.321	-0.317	0.752
R ²	0.896		
Adj. R ²	0.888		
F value	116.360		

*** and ** indicate significance at 1% and 5%

Agbachom et al. (2024) similarly reported household size as one of the socioeconomic characteristics associated with the profitability of yam production among smallholder farmers in South-South Nigeria. Farm size had a positive and statistically significant coefficient at the 1% level, indicating that farmers who cultivated larger areas generated higher income from yam production. Holding other factors constant, a one-hectare increase in farm size increased farm income by ₦43,821.24. The positive relationship is expected because expansion of cultivated area provides farmers with greater capacity to allocate productive resources to yam production and increase the quantity marketed, thereby increasing farm revenue and income. Edem and Oniah (2024) found farm size to be a significant determinant of yam output, while Agbachom et al. (2024) reported farm size as an important factor associated with profitability among yam farmers.

Access to loans had a positive and statistically significant coefficient at the 5% level. This indicates that farmers who had access to credit tended to earn higher income from yam production than those without access to loans. Credit enables farmers to finance the purchase of seed yam, labour and other production inputs at the appropriate time and reduces liquidity constraints that may limit the scale of farm operations. This result agrees with the findings of Edem and Oniah (2024) who identified access to credit as a significant factor affecting yam production. The positive relationship observed in this study therefore underscores the importance of improving farmers' access to affordable and timely agricultural credit to enable them to expand production and increase farm income.

Conclusions

The study concludes that yam production remains a

profitable smallholder enterprise in Ilesha West Local Government Area of Osun State, although farmers operate predominantly on a small scale whose production were mainly influenced by educational status, family size, farm size and access to loan facilities. Yam production was also found to be an economically viable enterprise in the study area with a net return of 0.30. Therefore, agricultural development programmes should strengthen access to affordable and timely credit for yam farmers, particularly through low-interest agricultural loan schemes with flexible repayment conditions. Extension services should also provide farmers with practical information on improved yam production and efficient input management. In addition, policies that facilitate access to improved production technologies and labour-saving machinery should be prioritised to reduce the labour burden associated with yam production. Finally, targeted programmes that provide young people with access to land, production technologies, finance and technical training should be implemented to encourage youth participation and sustain yam production in Osun State.

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