Global Academic Journal of Agriculture and Bio sciences

Available online at https://www.gajrc.com
DOI: https://doi.org/10.36348/gajab.2025.v07i06.001

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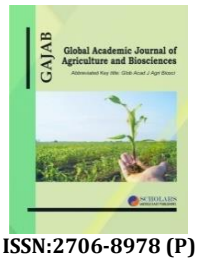

ISSN:2706-8978 (P)
ISSN: 2707-2568 (O)

Original Research Article

Analysis of Profitability and Resource use Efficiency in Yam Farming in Kwali Area Council of Abuja, Nigeria

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Article History
Received: 16.09.2025
Accepted: 13.11.2025
Published: 18.11.2025

Abstract: This study analyzed the profitability and resource use efficiency of yam farming in Kwali Area Council, Abuja, using data collected from 200 yam farmers through a structured questionnaire. The analysis employed descriptive statistics, farm budgeting, production function, and multiple regression models. Results on socio-economic characteristics revealed that the farmers had a mean age of 43.8 years, average farming experience of 11.7 years, mean household size of 6.9 persons, and an average farm size of 1.84 hectares. Most farmers (73%) were male and operated small-scale farms, with an average of 2.6 extension visits and 3.8 years of cooperative membership annually. Profitability analysis showed that yam production was unprofitable, with total cost ₦300,674.08/ha exceeding revenue ₦274,500/ha, yielding –₦26,174.08 Net Farm Income and –0.09 ROI, indicating a ₦0.09 loss per ₦1 invested. Resource use efficiency analysis indicated underutilization of farm size (R = 11.64) and seed yams (R = 64.30), but overutilization of labour (R = 0.39), fertilizer (R = –0.07), and agrochemicals (R = –56.94). Regression results (R^2 = 0.731, F = 23.41, $p < 0.01$) revealed that educational level, farming experience, farm size, extension contact, cooperative membership, and access to credit significantly influenced profitability ($p < 0.10$), while age, gender, and household size were not significant. Major constraints identified were high input costs (82.5%), inadequate credit access (71.0%), pests and diseases (65.0%), and poor storage facilities (48.0%). The study concludes that yam farming is profitable but constrained by resource inefficiencies and institutional challenges.

Keywords: Yam Production, Profitability, Resource Use Efficiency.

INTRODUCTION

Yam (*Dioscorea spp.*) is one of Nigeria's most culturally and economically significant staple crops, contributing substantially to food security, rural income, and employment. Nigeria produces about 67% of the world's yam, making it the leading global producer (FAO, 2024). Despite this, the profitability

Citation: Motunrayo Adetola Adebayo, Favour Obiageri Nwakodo, Funso Omolayo Alabuja, Beatrice Itoya Oyediji, Samson Olayemi Sennuga (2025). Analysis of Profitability and Resource use Efficiency in Yam Farming in Kwali Area Council of Abuja, Nigeria, Glob Acad J Agri Biosci; Vol-7, Iss- 6 pp- 100-111.

and productivity of yam farming remain constrained by inefficient resource utilization, limited access to capital, and low adoption of improved agronomic practices. According to Iroegbu, Benson & Okidim (2024), farm-level efficiency is critical in determining profitability since input combinations such as land, labour, fertilizer, and seed yam are often applied sub-optimally due to information gaps and credit limitations. The authors found that farmers in Rivers and Imo States recorded significant inefficiencies in allocating resources, which directly reduced gross margins per hectare. Similar patterns are reported across several Nigerian agro-ecological zones, where yam yields are less than 40% of potential output due to poor resource-use decisions and dependence on traditional technologies (Ezeaku & Asogwa, 2023; Olawunmi *et al.*, 2025). Moreover, Shokr *et al.*, (2025) emphasized that sustainable soil quality assessment and precision farming technologies could drastically enhance resource-use efficiency and profitability in root crop production systems if properly integrated into Nigeria's agricultural policy frameworks.

The profitability of yam farming in Nigeria is shaped by a combination of biophysical, socioeconomic, and institutional factors. Studies consistently show that profitability indices such as Gross Margin (GM), Benefit-Cost Ratio (BCR), and Return on Investment (ROI) are influenced by variable costs (fertilizer, labour, staking materials) and farm size (Adewuyi & Okuneye, 2022; Mato *et al.*, 2025). Using the Cobb–Douglas production function, Adepoju & Oyebanji (2021) revealed that labour and seed yam significantly affect yam output, while fertilizer and capital exhibit decreasing returns, indicating resource overutilization in certain regions. Similarly, Nwachukwu & Agwu (2020) found that most yam farmers operate under decreasing returns to scale, implying inefficiency in resource allocation. Profitability analyses from North Central Nigeria (Okoh & Olayemi, 2023; Alabuja *et al.*, 2025a) show that yam farming remains profitable with a BCR of 1.8 and ROI of 78%, yet resource-use inefficiency, particularly in fertilizer and labour application, remains a major constraint. Socioeconomic factors such as age, education, and access to extension services further influence farmers' technical and allocative efficiency (Onwumere *et al*., 2022; Alabuja *et al.*, 2025b). In many rural communities, inadequate access to mechanization and extension information reduces farmers' ability to optimize inputs, thereby limiting their potential profits despite favourable market conditions for yam (Oyediji *et al.*, 2025).

From a policy and sustainability perspective, improving profitability and efficiency in yam production requires targeted interventions that enhance input access, capacity building, and the adoption of innovative technologies (Akomolafe *et al.*, 2025). Precision agriculture tools—such as soil sensors, GIS mapping, and farm-level data analytics—are increasingly recognized for their potential to improve input efficiency and reduce production costs (Shokr *et al*., 2025). At the same time, promoting farmer cooperatives and credit schemes can help smallholders access quality seed yams and fertilizers at subsidized rates (Adesina & Ikuemonisan, 2021). Empirical studies suggest that efficient resource use could increase yam productivity by 25–40%, contributing to rural income growth and national food security (Ezeaku & Asogwa, 2023; Oyotombe *et al.*, 2025). Moreover, sustainable land management and post-harvest value chain integration could further enhance profitability by reducing losses and stabilizing prices. Therefore, the analysis of profitability and resource use efficiency in yam farming in Nigeria underscores the dual need for economic optimization and ecological sustainability (Olaitan *et al.*, 2025). Hence, this study aims to evaluate the profitability and resource use efficiency of yam farming in order to identify factors influencing productivity and suggest strategies for improving farmers' economic performance in Kwali Area Council, Abuja. To accomplish this, the following objectives are put forward:

i. describe the socio-economic characteristics of yam farmers in the study area;
ii. estimate the cost and return structure of yam production;
iii. analyze the resource use efficiency of major inputs in yam production;
iv. identify factors affecting resource use efficiency and profitability among yam farmers;
v. identify the challenges faced by yam farmers in the study area.

LITERATURE REVIEW

Theoretical Framework

The theoretical foundation of this study is rooted in the theory of resource use efficiency, which provide an analytical basis for evaluating how farmers allocate limited resources to achieve optimal output and profit. The theory of resource use efficiency complements production theory by emphasizing the optimal allocation of scarce inputs to maximize profit. According to Farrell (1957), efficiency in production has three components:

1. Technical efficiency – the ability of a farmer to obtain the maximum output from a given set of inputs.
2. Allocative efficiency – the ability to use inputs in optimal proportions given their prices.
3. Economic (overall) efficiency – a combination of technical and allocative efficiency, indicating cost minimization for a given level of output.

The efficiency of input use is often assessed through the ratio of the Marginal Value Product (MVP) of an input to its Marginal Factor Cost (MFC). The condition for efficient resource allocation is $\frac{MVP}{MFC} = 1$. When $\frac{MVP}{MFC} > 1$, the input is underutilized and should be increased; when $\frac{MVP}{MFC} < 1$, it is overutilized and should be reduced (Olayide & Heady, 1982).

Profitability analysis in this theoretical framework is based on microeconomic profit maximization theory, which assumes that a rational farmer aims to maximize profit where Marginal Cost (MC) = Marginal Revenue (MR). This study uses profitability indicators such as Gross Margin (GM), Net Farm Income (NFI), and Benefit–Cost Ratio (BCR) to quantify economic performance. According to Adepoju and Oyebanji (2021), positive gross margins and BCR values greater than one indicates that yam farming is profitable, while low ratios signal inefficiencies in cost management and input use.

This theoretical framework provides a comprehensive foundation for analyzing yam farming performance in Nigeria. It assumes that yam farmers seek to maximize output and profit subject to limited resources and institutional constraints.

Conceptual Framework

The conceptual framework for this study, exploring the relationship between the independent variables and the dependent variables being mediated by the intervening variables. The independent variables in this study are the primary production inputs that directly affect yam output and profitability, and these include land size (hectares), labour (man-days), seed yam quantity (kg or tubers), fertilizer use (kg), and capital inputs, as well as socio-economic characteristics of age, education level, household size, farming experience, access to extension services, access to credit membership of cooperative society. The intervening variables represent external or contextual factors that shape how efficiently farmers utilize their resources and achieve profitability. They include land tenure system, market access and climate variability. The dependent variables are the key performance outcomes that the study seeks to measure and explain. They include the profitability indicators (Gross Margin (GM) and Net Farm Income) as well as the resource use efficiency indicators, derived from the Cobb–Douglas production function and measured by comparing Marginal Value Product (MVP) and Marginal Factor Cost (MFC**)** for each input. Together, these dependent variables determine the economic performance of yam farming and reflect how well resources are being utilized to generate profit.

MATERIALS AND METHODS

Study Area

Kwali Area Council is one of the six administrative councils in the Federal Capital Territory (FCT) of Nigeria. It is located in the southwestern part of the FCT, lying between latitude 8°45'N and 9°00'N and longitude 6°45'E and 7°10'E. The area covers approximately 1,206 square kilometers and shares boundaries with Gwagwalada, Kuje, and Abaji Area Councils, and Niger State to the west (FCT-ADP, 2023). Kwali is predominantly rural and serves as one of the major agricultural zones in the FCT, where yam, maize, cassava, and groundnuts are widely cultivated.

The area lies within the Guinea Savannah agro-ecological zone, characterized by a tropical wet and dry climate. Rainfall averages between 1,100 mm and 1,600 mm annually, while temperatures range from 25°C to 32°C (NIMET, 2024). The soils are mainly sandy loam and loamy, fertile, and well-drained, making them suitable for yam cultivation. Vegetation consists of tall grasses and scattered trees such as shea (*Vitellaria paradoxa*), locust bean (*Parkia biglobosa*), and neem (*Azadirachta indica*), which enhance soil fertility and provide ecological balance (Adewumi & Fadare, 2022).

Kwali was selected as the study area because it represents a microcosm of Nigeria's smallholder agricultural systems, where yam farming plays a vital role in food security, income generation, and rural employment. The area exhibits significant variations in farmers' access to productive resources, providing a relevant context for analyzing both profitability and resource-use efficiency. The diversity of farming practices and institutional settings also offers valuable insights into how socio-economic and environmental factors mediate input utilization and output performance in yam production. Findings from this study in Kwali Area Council are expected to contribute to policy recommendations that can enhance efficiency and profitability not only within the FCT but also in similar yam-producing regions across Nigeria.

Population of the Study and Research Design

The study population comprises all yam farmers in Kwali Area Council, Abuja. These include smallholder male and female farmers cultivating 0.5–5 hectares of land, mainly in communities such as Pai, Dabi, and Yangoji.

A descriptive and analytical survey design was adopted to assess profitability and resource-use efficiency. Primary data were collected using structured questionnaires and interviews, while secondary data were sourced from FCT-ADP and NRCRI reports.

Sample Size and Sampling Techniques

A multistage sampling technique was adopted to ensure fair representation of yam farmers across different communities in Kwali Area Council. In the first stage, three major yam-producing wards—Pai, Dabi, and Yangoji—were purposively selected due to their high concentration of yam farmers and favorable production conditions (FCT-ADP, 2023).

In the second stage, two farming communities were randomly chosen from each ward, resulting in six communities: Pai Central, Ashara, Dabi, Kilankwa II, Yangoji, and Wako. This random selection provided geographical and production diversity within the study area.

In the third stage, individual yam farmers were randomly selected from lists obtained from the Federal Capital Territory Agricultural Development Project (FCT-ADP) and farmer cooperatives. A proportionate random sampling method was used to allocate respondents based on the number of farmers in each community. A total of 200 respondents were selected: Pai Ward (70), Dabi Ward (65), and Yangoji Ward (65). This distribution reflects the density of rice farmers in each area and ensures balanced representation across the council.

Data Collection

The main instrument for data collection in this study was a structured questionnaire designed to obtain detailed information from yam farmers in Kwali Area Council. The questionnaire was administered to a representative sample of 200 farmers, with each session lasting about one hour to allow for thoughtful and accurate responses. To ensure validity and reliability, a pilot study was conducted using a small group of yam farmers who were not part of the main survey. Their feedback helped refine ambiguous or unclear items, improving the clarity, relevance, and accuracy of the instrument. The final version effectively captured data on socio-economic characteristics, production inputs, output levels, and profitability indicators. Trained enumerators assisted in administering the questionnaire, ensuring that respondents clearly understood each question. This process enhanced the accuracy and consistency of responses, thereby strengthening the quality of data collected for the analysis of profitability and resource-use efficiency in yam farming.

Data Analysis

Data obtained from the yam farmers in Kwali Area Council were analyzed using a combination of descriptive and inferential statistical techniques in accordance with the stated research objectives. Descriptive statistics such as frequency counts, percentages, means, and standard deviations were applied to achieve objectives (i) and (v)—that is, to describe the socio-economic characteristics of yam farmers and to identify the challenges faced in yam production.

To achieve objective (ii), the Farm Budgeting Technique was employed to estimate the cost and return structure of yam production. This method was used to determine the profitability level of yam farming by computing total costs, total revenue, and net farm income.

For objective (iii), which sought to analyze resource-use efficiency in yam production, the Production Function Analysis was used. This method establishes the technical relationship between input variables (such as land, labour, capital, and seed yam) and output (yam yield).

Finally, objective (iv)—to identify factors influencing resource-use efficiency and profitability—was analyzed using Multiple Regression Analysis. This allowed the study to assess how socio-economic and farm-level factors such as age, education, farm size, credit access, and extension contact influence productivity and efficiency.

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 24, which provided a robust platform for both descriptive and inferential statistical computations.

Model Specification

Farm Budgeting Technique

The Farm Budgeting Technique was used to estimate the costs and returns from yam farming in the study area, addressing objective (ii). It evaluates total production expenses and revenue to determine profitability. The Net Farm Income (NFI) was used as an indicator of profitability and was computed as:

$$NFI = TR - TC$$

Where:

- NFI = Net Farm Income
- TR = Total Revenue (income from yam sales)
- TC = Total Cost (sum of fixed and variable costs)

A positive NFI indicates profitability, while a negative NFI implies losses.

Production Function Analysis

To evaluate the efficiency of resource utilization, the Marginal Value Product (MVP) of each input was derived and compared with its corresponding Marginal Factor Cost (MFC). The MVP for each resource was computed as:

$$MVP_{xi} = MPP_{xi} \times P_y$$

Where:

- MVP_{xi} = Marginal Value Product of input X_i
- MPP_{xi} = Marginal Physical Product of input X_i
- P_y = Unit price of output (yam)

The MPP and MVP values were derived from estimated production functions in the following forms:

- Linear: $MPP = b_i$; $MVP = b_i \times P_y$
- Semi-log: $MPP = \frac{b_i}{X_i}$; $MVP = \frac{b_i \times P_y}{X_i}$
- Double-log: $MPP = b_i \frac{\hat{Y}}{X_i}$; $MVP = b_i \frac{\hat{Y}}{X_i} \times P_y$

Resource-use efficiency (r) was calculated as:
$r = \frac{MVP}{MFC}$

Where:

- r = 1 indicates optimal resource utilization,
- r < 1 indicates over-utilization, and
- r > 1 indicates under-utilization of resources.

Multiple Regression Analysis

To identify the determinants of resource-use efficiency and profitability (objective iv), the following multiple regression model was specified:
Yi=β0 + β1X1 + β2X2 + β3X3 + β4X4 + β5X5 + β6X6 + β7X7 + β8X8 + μi

Where:
Y1 = Output of yam (tonnes),
b0 = Constant term
X1 = Age (years)
X2 = Sex (male/female)
X3 = Education level
X4 = Farming experience (years)
X5 = Cooperative membership (years)
X6 = Extension contact (number of visits)
X7 = Household size (members)
X8 = Credit obtained (₦)
ui = Error term

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Yam Farmers

The results in Table 1 show that the mean age of rice farmers was 43.8 years, indicating that most were in their economically active years. This suggests they possess adequate physical strength and farming experience essential for yam production. Similar age distribution was reported by Ezeaku and Asogwa (2023), who found that middle-aged farmers dominate yam production due to their adaptability and responsiveness to improved practices.

The gender distribution shows that 73% of the respondents were male, while 27% were female. This reflects the physically demanding nature of yam cultivation, which often requires more male labour. Adewumi and Ayinde (2020) observed a similar trend across Nigeria, where men perform field operations while women participate more in marketing and post-harvest handling, indicating gender-based labour specialization in agriculture.

The findings further indicate that the farmers had an average of 11.7 years of farming experience, showing a relatively high level of competence in yam production. This finding aligns with Okonkwo *et al*., (2022), who reported that experience contributes significantly to efficiency and sustainability in yam farming systems across southeastern Nigeria.

Regarding household size, most respondents (54%) had between 5 and 8 members, with a mean household size of 6.9 persons, indicating moderately large families. Such family size provides access to family labour, which is crucial for yam production where mechanization is minimal. Adenegan and Olorunsomo (2022) also highlighted that large households often contribute to higher labour availability enhancing overall production efficiency among smallholder farmers.

In terms of educational attainment, the majority (37%) of respondents had secondary education, while 28% had primary education, 19% had no formal education, and only 16% attained tertiary education. This reflects moderate literacy levels among the farmers, which facilitates adoption of modern farming techniques and better management decisions. Eze and Onwubuya (2020) noted that education plays a critical role in improving farmers' ability to interpret agricultural information and apply improved technologies effectively.

The analysis of farm size revealed that the majority (43%) of the respondents cultivated between 1.0 and 2.0 hectares, with an average farm size of 1.84 hectares, showing that yam production is mostly on a small scale. Ogunniyi *et al*., (2020) noted that land fragmentation and limited capital restrict farm expansion among smallholders, contributing to the persistence of small-scale production patterns in Nigerian yam farming communities.

The results further show that the average number of extension visits per year was 2.6, with 26% of respondents having no contact at all, showing limited access to agricultural advisory services. Insufficient extension contact hinders timely exposure to improved farming methods and productivity-enhancing innovations. Adekoya and Adepoju (2021) observed similar limitations, emphasizing that regular extension interactions are vital for transferring knowledge on input efficiency and sustainable yam production technologies.

Concerning access to credit, 36% of farmers reported not obtaining any loan, while the mean credit amount was ₦118,000. Limited access to credit restricts farmers' ability to procure quality inputs and expand operations. Adedokun *et al*., (2022) noted that financial constraints remain a major barrier to profitability and productivity among smallholder yam producers in Nigeria, often forcing reliance on personal savings or informal lenders.

The results show that the average membership duration in cooperative societies was 3.8 years, with 79% of farmers belonging to at least one cooperative group. Cooperatives play a vital role in facilitating collective marketing, input procurement, and access to credit. According to Ibrahim *et al*., (2021), participation in cooperatives enhances farmers' bargaining power and access to agricultural innovations.

Table 1: Socio-Economic Characteristics of Yam Farmers in Kwali Area Council (n = 200)

Variable	Freq (n = 200)	Percentage
Age (Mean = 43.8 years)		
20–30	34	17.0
31–40	58	29.0
41–50	66	33.0
Above 50	42	21.0
Gender		
Male	146	73.0
Female	54	27.0
Farming Experience (Mean = 11.7 years)		
1–5	28	14.0
6–10	62	31.0
11–15	72	36.0
Above 15	38	19.0
Household Size (Mean = 6.9 people)		
1–4	46	23.0
5–8	108	54.0
Above 8	46	23.0
Educational Level		
No formal education	38	19.0
Primary	56	28.0
Secondary	74	37.0
Tertiary	32	16.0
Farm Size (Mean = 1.84 ha)		
<1.0	48	24.0
1.0–2.0	86	43.0
2.1–3.0	42	21.0
>3.0	24	12.0
Number of Extension Visits per Year (Mean = 2.6 times)		
None	52	26.0
1–2 times	68	34.0
3–4 times	56	28.0
Above 4	24	12.0
Amount of Credit Obtained (Mean = ₦118,000)		
None	72	36.0
≤ 100,000	52	26.0
101,000–200,000	48	24.0
> 200,000	28	14.0
Years in Cooperative Membership (Mean = 3.8 years)		
None	42	21.0
1–3	78	39.0
4–6	54	27.0
Above 6	26	13.0

Source: Field Survey, 2025

Costs and Returns of Yam Production per Hectare

The cost and return analysis presented in Table 2 reveals that yam production in Kwali Area Council is characterized by high production costs relative to revenue generated. The total cost of production per hectare amounted to ₦300,674.08, comprising ₦290,518.60 (96.6%) in variable costs and ₦10,155.48 (3.4%) in fixed costs. The predominance of variable costs suggests that yam production in the area is highly dependent on operational inputs, with profitability strongly influenced by changes in input prices and labour availability. This finding aligns with Ezeaku and Asogwa (2023), who observed that yam cultivation in Nigeria remains input-intensive with low mechanization levels.

Among the variable cost components, labour accounted for the highest share (56.08%), confirming the labour-intensive nature of yam farming. Activities such as land preparation, staking, weeding, and harvesting require substantial human effort, often supplied through a mix of family and hired labour. Similar findings by Olayemi and Adebayo (2020) indicated that labour remains the single largest cost factor in yam production across smallholder farms in Nigeria. Seed yams were the second-largest cost item (29.64%), reflecting the high price and scarcity of quality planting materials. According to Bamire *et al*., (2022), seed yam acquisition challenges significantly constrain yam farmers' profitability and productivity in sub-Saharan Africa.

The fixed costs, which include land rent (₦8,000) and farm tools depreciation (₦2,155.48), formed a small portion of total costs, suggesting that most farmers operate on family-owned land and use traditional implements. The total revenue per hectare, estimated at ₦274,500 from an average yield of 9.15 tonnes, was lower than total production costs, resulting in a Net Farm Income (NFI) of –₦26,174.08. The Return on Investment (ROI) of –0.09 further indicates unprofitability, showing that yam farmers lost ₦0.09 for every ₦1 invested. This outcome corroborates Mbanasor *et al*., (2022), who reported declining profitability among yam producers due to high input costs and fluctuating output prices.

Table 2: Costs and Returns of Yam Production per Hectare

Cost/Return Components	Average Quantity/ha	Unit Price (₦)	Value (₦/ha)	Percentage (%)
(A) Variable Costs				
Seed Yams (kg)	144.00	598.00	86,112.00	29.64
Labour (man-days)	232.62	700.00	162,834.00	56.08
Fertilizer (kg)	439.27	80.00	35,141.60	12.10
Agrochemicals (litres)	7.46	850.00	6,431.00	2.18
Total Variable Costs			**290,518.60**	**100.00**
(B) Fixed Costs				
Land Rent			8,000.00	
Farm Tools (hoe, cutlass, sprayer, wheelbarrow)			2,155.48	
Total Fixed Costs			**10,155.48**	
(C) Total Production Cost			**300,674.08**	
(D) Total Revenue (Output)	9.15 tonnes	30,000.00	**274,500.00**	
(E) Net Farm Income (NFI)			**–26,174.08**	
(F) Return on Investment (ROI)			**–0.09**	

Source: Field Survey, 2025

Resource Use Efficiency in Yam Production

The resource use efficiency analysis in Table 3 reveals varied utilization levels of key production inputs among yam farmers in Kwali Area Council. The efficiency ratios (R = MVP/MFC) show that farm size and seed yams were underutilized, while labour, fertilizer, and agrochemicals were overutilized. This implies that farmers could achieve higher productivity by adjusting their input use patterns.

Farm size (R = 11.64) exhibited an efficiency ratio greater than one, indicating that land was underutilized. The high marginal value product (₦58,217.60) relative to its cost (₦5,000.00) suggests that expanding cultivated area could increase output. This supports the findings of Adepoju and Oyebanji (2021), who noted that land expansion contributes significantly to higher yam yields when efficiently managed.

Seed yams (R = 64.30) also showed substantial underutilization, implying that farmers used fewer planting materials than optimal. The high MVP (₦385.80) compared to the cost (₦6.00) highlights the importance of quality seed tubers in productivity, consistent with Bamire *et al*., (2022), who emphasized that access to improved seed yams enhances profitability.

In contrast, labour (R = 0.39) was overutilized, indicating that too much labour was used relative to its productivity. The MVP of ₦276.40 being lower than its cost of ₦700.00 confirms diminishing returns to labour. This supports Olayemi and Adebayo (2020), who reported excessive labour use in yam production due to limited mechanization.

Similarly, fertilizer (R = −0.07) and agrochemicals (R = −56.94) recorded negative MVP values, showing that additional application reduced output. These negative values suggest inefficient or incorrect usage, aligning with Agboola and Ayoola (2021) and Obisesan and Afolayan (2020), who found that poor handling of fertilizers and pesticides lowers yield and soil quality.

Overall, the results indicate inefficiency in yam production, with underutilization of productive resources like land and seed yams and overutilization of costly inputs such as labour and chemicals, similar to findings by Ezeaku & Asogwa (2023) and Mbanasor *et al*., (2022).

Table 3: Resource Use Efficiency in Yam Production

Variable Input	MPP	MVP (₦)	MFC (₦)	R = MVP/MFC
Farm Size (X_1)	3150.82	58,217.60	5,000.00	**11.64**
Seed Yams (X_2)	64.35	385.80	6.00	**64.30**
Labour (X_3)	13.82	276.40	700.00	**0.39**
Fertilizer (X_4)	-14.72	-294.40	4,000.00	**-0.07**
Agrochemicals (X_5)	-2,420.10	-48,402.00	850.00	**-56.94**

Source: Field Survey, 2025

Factors Influencing Resource Use Efficiency and Profitability among Yam Farmers

The model summary in Table 4 indicates a strong explanatory power, with an R^2 of 0.731 and an adjusted R^2 of 0.700, implying that about 73% of the variation in resource use efficiency and profitability among yam farmers is explained by the independent variables. The F-statistic (23.41, $p < 0.01$) confirms the overall model's significance, showing a good fit and reliable explanatory capacity.

Age exhibited a negative but statistically insignificant relationship with resource use efficiency ($\beta = -0.019$, $p > 0.10$), suggesting that older farmers were slightly less efficient than younger ones. This implies that efficiency tends to decline with age, possibly due to reduced physical strength and lower adaptability to innovations. Similar findings were reported by Ezeaku and Asogwa (2023) and Olayemi and Adebayo (2020).

Gender was also insignificant ($\beta = 0.126$, $p > 0.10$), indicating that profitability and efficiency did not significantly differ between male and female farmers. This result suggests that both genders had comparable access to production resources. The finding aligns with Bamire *et al*., (2022), who observed no significant gender gap in yam productivity in Nigeria, reflecting growing inclusiveness in agricultural participation.

Education had a positive and significant effect at the 1% level ($\beta = 0.071$, $p < 0.01$). This indicates that more educated farmers were more efficient in resource use and achieved higher profitability. Education enhances management decisions, technology adoption, and cost control. This result corroborates Agboola and Ayoola (2021) and Mbanasor *et al*., (2022), who emphasized education as a driver of improved resource utilization in yam farming.

Household size showed a negative but insignificant influence ($\beta = -0.017$, $p > 0.10$), suggesting that family size did not significantly affect profitability. Larger households may not guarantee efficient labour use due to possible underemployment or dependence. This outcome agrees with Adepoju and Oyebanji (2021), who found household size often uncorrelated with farm efficiency when labour is not optimally engaged.

Farming experience was positively significant at 5% ($\beta = 0.054$, $p < 0.05$), indicating that experienced farmers achieved higher efficiency levels. Experienced farmers tend to make better input-output decisions, adapt to climatic variability, and reduce production risks. This aligns with Ezeaku and Asogwa (2023), who reported a strong link between experience and profitability among root crop producers in Nigeria.

Farm size had a positive and highly significant effect at 1% ($\beta = 0.291$, $p < 0.01$), meaning that larger farms were associated with greater resource efficiency and profitability. This result highlights economies of scale in yam production. It aligns with Obisesan and Afolayan (2020), who observed that expanding farm size enhances productivity through better input allocation and mechanization potential.

Years of cooperative membership were positive and significant at the 10% level ($\beta = 0.038$, p

< 0.10). Membership promotes access to shared resources, input discounts, and market information, improving production efficiency. This agrees with Bamire *et al*., (2022), who emphasized that cooperative participation enhances farmers' decision-making and collective bargaining power in root crop farming.

Contact with extension agents had a positive and significant effect at the 5% level (β = 0.049, p < 0.05), indicating that regular extension visits improved farmers' efficiency. Frequent technical advice promotes improved agronomic practices and resource management. The result aligns with Agboola and Ayoola (2021) and Ezeaku and Asogwa (2023), who found that extension interactions significantly raise crop productivity.

Access to credit was highly significant at 1% (β = 0.108, p < 0.01), showing that financial access enhanced profitability and efficient resource utilization. Credit availability allows timely input purchase and technology adoption. This finding corroborates Olayemi and Adebayo (2020) and Mbanasor *et al*., (2022), who identified credit as a major determinant of smallholder productivity and efficiency in yam production.

Table 4: Multiple Regression Estimates of Factors Influencing Resource Use Efficiency and Profitability among Yam Farmers

Variable	Coefficient (β)	Standard Error	t-value	p-value	Significance
Constant	1.768	0.538	3.29	0.0014	***
Age (years)	-0.019	0.013	-1.48	0.142	ns
Gender (1 = Male, 0 = Female)	0.126	0.091	1.38	0.170	ns
Educational Level (years)	0.071	0.023	3.09	0.002	***
Household Size (number)	-0.017	0.019	-0.89	0.376	ns
Farming Experience (years)	0.054	0.021	2.57	0.011	**
Farm Size (hectares)	0.291	0.085	3.42	0.001	***
Years of Cooperative Membership	0.038	0.020	1.90	0.060	*
Contact with Extension Agents (visits/year)	0.049	0.022	2.22	0.028	**
Access to Credit (₦)	0.108	0.041	2.63	0.009	***

Model Summary:

R^2 = 0.731 Adjusted R^2 = 0.700 F-statistic = 23.41 Prob (F-stat) = 0.000

Note: ***, ** and * indicate significance at 1%, 5% and 10% probability level respectively; ns = Not Significant

Source: Field Survey, 2025

Constraints to Yam Production among Farmers

The findings in Table 5 reveal that yam farmers in Kwali Area Council faced several production constraints that limited efficiency and profitability. The high cost of inputs (82.5%) ranked as the most severe challenge. Rising prices of seed yams, fertilizer, and labour significantly increased production costs, reducing profit margins. This aligns with Adepoju and Oyebanji (2021), who identified high input costs as a major impediment to root crop productivity in Nigeria.

Inadequate access to credit facilities (71.0%) was the second most reported constraint. Many farmers lacked collateral or formal financial inclusion, restricting their ability to purchase inputs or expand production. This result supports Mbanasor *et al*., (2022), who noted that credit scarcity hinders timely input acquisition and technological adoption among smallholders.

Pest and disease infestation (65.0%) and poor access to improved planting materials (59.0%) were also critical issues. Farmers often relied on traditional seed yams susceptible to pests and pathogens, reducing yield and quality. Similar challenges were documented by Ezeaku and Asogwa (2023), who emphasized the need for resistant yam varieties in Nigeria.

Inadequate extension services (51.0%) limited farmers' exposure to improved agronomic practices, while poor storage and post-harvest losses (48.0%) led to significant spoilage and income reduction. Lastly, poor road and market access (42.5%) constrained the efficient transportation and marketing of produce. These structural and institutional constraints collectively affect productivity, echoing the observations of Olayemi and Adebayo (2020**)** regarding yam production challenges in Nigeria's middle belt.

Table 5: Constraints to Yam Production among Farmers

Constraints	Frequency	Percentage (%)
High cost of inputs (seed yams, fertilizer, labour)	165	82.5
Inadequate access to credit facilities	142	71.0
Pest and disease infestation	130	65.0
Poor access to improved planting materials	118	59.0
Inadequate extension services	102	51.0
Poor storage and post-harvest losses	96	48.0
Poor road and market access	85	42.5

Multiple Responses Allowed
Source: Field Survey, 2025

CONCLUSION AND RECOMENDATIONS

The study on the profitability and resource use efficiency of yam farming in Kwali Area Council of Abuja provided an in-depth understanding of farmers' socio-economic characteristics, cost structure, resource utilization, influencing factors, and major production constraints.

Findings on the socio-economic characteristics of yam farmers (n = 200) revealed that the average age was 43.8 years, indicating a predominance of active, middle-aged farmers. The majority (73%) were male, reflecting the gendered nature of yam cultivation. The farmers had an average of 11.7 years of farming experience, a mean household size of 6.9 members, and an average farm size of 1.84 hectares. The mean years of cooperative membership and extension visits were 3.8 and 2.6 per year, respectively. These statistics highlight an experienced farming population with limited but essential institutional support systems.

The cost and returns analysis showed that yam production is profitable. The total variable cost per hectare was ₦290,518.60, while total fixed costs amounted to ₦10,155.48, resulting in a total cost of ₦300,674.08/ha. The total revenue per hectare, estimated at ₦274,500 from an average yield of 9.15 tonnes, was lower than total production costs, resulting in a Net Farm Income (NFI) of –₦26,174.08. The Return on Investment (ROI) of –0.09 further indicates unprofitability, showing that yam farmers lost ₦0.09 for every ₦1 invested.

In analyzing resource use efficiency, the efficiency ratios (R = MVP/MFC) showed that farm size (R = 11.64) and seed yams (R = 64.30) were underutilized, suggesting potential for higher returns through increased use. Conversely, labour (R = 0.39), fertilizer (R = –0.07), and agrochemicals (R = –56.94) were overutilized, indicating inefficiency in their application. This pattern underscores the imbalance in input use that can affect productivity and profitability.

From the multiple regression analysis, the model (R^2 = 0.731, F = 23.41, $p < 0.01$) showed that educational level ($p < 0.01$), farming experience ($p < 0.05$), farm size ($p < 0.01$), cooperative membership ($p < 0.10$), extension contact ($p < 0.05$), and access to credit ($p < 0.01$) were significant predictors of profitability and efficiency. However, age ($p = 0.142$), gender ($p = 0.170$), and household size ($p = 0.376$) were not significant, indicating that demographic characteristics had limited influence compared to institutional and economic factors.

Finally, the constraints to yam production revealed multiple challenges. The most critical was the high cost of inputs (82.5%), followed by inadequate access to credit (71.0%), pest and disease infestation (65.0%), and poor access to improved planting materials (59.0%). Other notable constraints included inadequate extension services (51.0%), poor storage and post-harvest losses (48.0%), and poor road and market access (42.5%).

Based on the findings of this study on the profitability and resource use efficiency of yam farming in Kwali Area Council, Abuja, the following seven recommendations are proposed to enhance productivity, efficiency, and sustainability in yam production:

1. Financial institutions and agricultural development programs should design flexible credit schemes tailored to smallholder yam farmers. Low-interest loans and microcredit facilities will enable timely acquisition of quality inputs, including seed yams, fertilizers, and agrochemicals.
2. Research institutes such as the National Root Crops Research Institute (NRCRI) should intensify the multiplication and dissemination of improved, pest-resistant yam varieties. Access to certified planting materials will reduce disease incidence and increase yield efficiency.
3. Farmers should be trained on optimal resource allocation, especially in the use of labour, fertilizer, and agrochemicals. Demonstration farms and capacity-building workshops can guide farmers toward

achieving technical efficiency in yam production.

4. Investment in rural roads and market facilities will reduce transportation costs and post-harvest losses, ensuring better market access and profitability for yam producers.
5. Government agencies should implement input subsidy programs and establish mechanisms to regulate input prices, particularly during planting seasons, to minimize production costs and stabilize farmers' income levels.

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