



Optimizing Resource-Use Efficiency of Yam Producers in Ondo State, Nigeria: A Path to Enhanced Food Production

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ABSTRACT

Resource utilization inefficiency poses a significant barrier to enhancing food production in Nigeria. This research assessed the efficiency of resource use among yam cultivators in the Irele Local Government Area of Ondo State, Nigeria, through a study involving 100 yam farmers chosen at random. Information was gathered using interview schedules and a systematically organized questionnaire. The analysis employed descriptive statistics, gross margin analysis, and multiple regression models. Findings indicate that the mean age of the farmers surveyed was 55.35 years, with 60% boasting over 30 years of agricultural experience. A majority (84%) were male heads of households, and 85% were married. Approximately 63% of the participants reported having households of 6 to 10 members, indicating relatively large family sizes. Around 79% had received primary education or had no formal schooling. The average farm size was found to be 0.70 hectares, with 79% managing no more than 1 hectare, categorizing them as small-scale farmers. The research also uncovered that yam cultivation is financially viable, yielding an average gross margin and net income per hectare of N94,636.13 and N83,491.60, respectively. The primary challenges faced by these farmers include insufficient funding, inadequate storage facilities, and the elevated costs of planting materials. Consequently, the study suggests that the government should formulate and implement agricultural policies aimed at ameliorating these challenges to boost yam production in the region

INTRODUCTION

Agriculture is crucial for the sustenance of nations, providing food, employment, export revenues, and a substantial contribution to the Gross Domestic Product (GDP) (Fatuase et al., 2015; Olutumise, 2020). Nigeria's agriculture benefits from diverse agro-ecological conditions, enabling a wide range of agricultural products (Manyong et al., 2003; Olubunmi-Ajayi et al., 2023). The sector is significant for its employment generation and its contributions to GDP and export revenue (Olutumise, 2022). In Nigeria, smallholder farmers are the backbone of the agricultural sector, contributing significantly to the production of food and fiber. These farmers, who utilize traditional farming tools, constitute 80% of farm holdings in the country but face challenges such as limited capital, poor education, and traditional low-productivity technologies (Murray et al., 2016; Parid, 2016; Adegoroye et al., 2021; Ogunyemi et al., 2022).

Yam, a staple food that can be grown in almost all tropical countries with sufficient water, is extensively cultivated in Nigeria's coastal regions up to Latitude 12°N, an area characterized by its rainforest, wood savanna, and southern savanna belts (Ene and Okoli, 1985; Olutumise, 2020). In Nigeria, traditional hoe and cutlass techniques dominate yam cultivation, requiring significant labour inputs. However, the scarcity and rising cost of rural labour, along with increasing input prices, have made yam increasingly expensive, transforming it from a staple to a luxury food (Hahn et al., 1993; Olutumise, 2020). The yam tuber, primarily valued for its carbohydrate content, is a significant source of energy, low in fat and protein, and contains Vitamin C (Nanbol and Namu, 2019).

Despite the agricultural sector's potential, Nigeria struggles to meet its growing food demand, with food production growing at only about 1.5% per annum against a demand growth rate of more than 3.2%, leading to food deficits, rising prices, and increasing import bills (FAO, 2002; Fatuase et al., 2015; Olubunmi-Ajayi et al., 2023). This situation has raised concerns among government officials, researchers, policymakers, and farmers, highlighting the need for increased agricultural productivity through efficient resource allocation. Efficient use of land, labour, and capital is essential for achieving farmers' objectives within the limits of available resources.

Rationale for the Study

Enhancing agricultural productivity often involves a dual approach: boosting farm resource levels and optimizing the use of existing resources. However, the uncertainty in productivity, especially noted in yam production compared to other crops, is not due to a lack of resources but rather their inefficient utilization. Understanding resource efficiency is crucial, as it can guide improvements in yam production through better resource use and allocation. In Nigeria, where most arable land is already in use and the potential for expanding cultivation is limited by physical and technological barriers, increasing food production to close the gap between supply and demand necessitates a shift in agricultural practices. This study aims to shed light on resource availability and efficient use, specifically in the context of yam production. The findings are intended to

address food security challenges by enhancing yam availability, lowering production costs, and overcoming other production constraints, thereby contributing to the overall goal of improved agricultural productivity in Nigeria.

LITERATURE REVIEW

Recent observations indicate a decline in the production of yam, a critical food crop (Olutumise, 2020). While the production of other crops, like cassava, has significantly increased, yam production has remained stagnant over the past decades, despite its high demand and potential (IITA, 2003). The increasing cost of inputs and low yield are major challenges to yam production. This study aims to examine the efficiency of farm resource utilization and its impact on yam output, including an analysis of the socioeconomic characteristics of farmers, the profitability of yam production, factors influencing yam output levels, the efficiency of resource use among yam producers, and the challenges faced in yam production.

METHODOLOGY

This research was conducted in Ondo State, Nigeria, which is bordered by Osun and Ogun States to the west, Ekiti and Kogi States to the north, Edo and Delta States to the east, and the Atlantic Ocean to the south. Ondo State is home to approximately 3,441,024 individuals (according to the National Population Commission, 2006) and spans an area of 15,500 square kilometers, as reported by the Ondo State Ministry of Finance, Economic Planning and Budget in 2007. The state comprises 18 Local Government Areas (LGAs) and is situated entirely within the tropics, between longitudes 4°31' and 6° east of the Greenwich meridian, and latitudes 5°4'51" and 7°2'01" north of the equator. It experiences a tropical climate with high temperatures throughout the year, significant rainfall from April to October, and dry winds from November to March. These climatic conditions support the agricultural engagement of about 75% of the state's population, who cultivate both cash and food crops (Oladoyin et al., 2023; Olutumise, 2023). The principal cash crops include cocoa, palm products, and timber, with rubber, cashew, kola nut, and coffee also significant. Food crops grown in the region encompass yam, cocoyam, rice, cassava, plantain, maize, beans, tomatoes, fruits, and a variety of green vegetables (Amos, 2007).

The study utilized primary data collected through structured questionnaires and interviews to gather information on various aspects, including the socio-economic profiles of yam farmers and their farming practices. A multi-stage sampling method was employed, starting with the purposive selection of Irele LGA in Ondo State due to its significant yam consumption and production. Within Irele LGA, ten communities were chosen at random, from each of which ten yam farmers were also randomly selected, resulting in a total sample size of one hundred yam farmers. The analysis incorporated descriptive statistics, budgetary analysis, and production function models. Descriptive statistics such as frequency distributions, percentages, means, and standard deviations provided insight into the socio-economic characteristics of the participants. Budgetary analysis was applied to assess the profitability of yam

farming, while production function models helped identify the factors affecting yam output levels and the efficiency of resource use among farmers in the selected area.

Budgeting Analysis: Budget analysis is an important farm planning analysis tool because it can be used to calculate overall performance. It measures the profitability of the farm. Existing types of budgeting include complete or whole farm budgeting, partial budgeting, breakeven budgeting, partial cash flow, parametric profit budgeting, and risk budgeting. Whole farm profit budgets are prepared in gross margin terms. Farm activity levels are used to calculate the total gross margin (TGM) to show the farm's net income (Dillon and Hardaker 1993; Oseni et al., 2018; Bobola et al., 2019). The main statistics commonly derived from budget analysis are gross margin and profit or net revenues. The budgetary analysis includes gross margin and net income to analyze the profitability of yam businesses by farmers in the study area. The gross margin (GM) of a business is the difference between the total value of production (total revenue) and the total variable cost of production (TVC), that is,

$$GM = TR - TVC \dots \dots \dots (1)$$

$$= \sum_{i=1} P_i Q_i - \sum_{j=1} C_j X_j$$

Where subscript i refers to the i-th respondents while j represents observation of the j-th variable costs and

- TR = Total value of output of yam production (N)
 - TVC = Total Variable Cost of yam production/ha
 - Pi = Unit price of yam produced from the i-th enterprise in (N)
 - Qi = Quantity of yam produced in kg/ha
 - Cj = Unit price of input used (N)
 - Xj = Quantity of Variable input used in number
- If GM > 0, then the farm enterprise is profitable
 If GM < 0, then the farm enterprise is not profitable

The Net Revenue (NR) represents the difference between total revenue and total cost.

The Net Revenue can be represented as:

$$NR = TR - (TVC + TFC) \dots \dots \dots (2)$$

$$= TR - TC$$

$$= PQ - TC$$

Where;

- TFC = Total fixed cost (land rent and depreciation cost of implement such as cutlass, hoes and so on)
- TC = Total cost of production
- TVC = Total variable cost. The variable cost items that were used in this study include; the costs of labour, agro-chemicals, fertilizer, planting material, and transportation.

Production Function Analysis: Production function analysis was to determine the productivity and efficiency of inputs involved in the farm enterprise. Following Fatuase et al. (2015) and Oladoyin et al. (2023), the

Ordinary Least Square (OLS) multiple regression techniques were used to estimate the parameters of the production function equation. The implicit form of the regression model is specified as:

$$Y_i = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, U) \dots \dots \dots (3)$$

The linear, Double log, Semi log, and Exponential production function options were used to estimate the parameters of the production function equation. In each of the functional equations, the output of yam was regressed on the input data described below and each function was then statistically evaluated based on t-ratio, F-value, R2, Adjusted R2, signs and magnitude of estimated coefficients, and the significance of the estimated coefficients. The Double log function was chosen for being superior in value to the linear, semi-log, and exponential functions based on the above parameters, though it has the second highest value of R2. The explicit linear function in linear form is specified as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + U \dots \dots \dots (4)$$

The Double log production function is specified as:

$$\text{Log } Y = \text{Log } b_0 + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + b_3 \text{Log } X_3 + b_4 \text{Log } X_4 + b_5 \text{Log } X_5 + b_6 \text{Log } X_6 + b_7 \text{Log } X_7 + b_8 \text{Log } X_8 + U \dots \dots \dots (5)$$

The semi-log production function is specified as:

$$Y = b_0 + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + b_3 \text{Log } X_3 + b_4 \text{Log } X_4 + b_5 \text{Log } X_5 + b_6 \text{Log } X_6 + b_7 \text{Log } X_7 + b_8 \text{Log } X_8 + U \dots \dots \dots (6)$$

The Exponential production function is specified as:

$$Y = e^{b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + U} \dots \dots \dots (7)$$

Where Y_i = Total output of the farmer measured in kilograms

Log = Logarithm

X_1 = Age of farmers in years

X_2 = Education of farmers measured in years of schooling

X_3 = Household Size (number)

X_4 = Farm Size in hectares

X_5 = Cost of Labour in Naira

X_6 = Cost of agrochemicals in Naira

X_7 = Cost of planting materials valued in Naira

X_8 = Cost of implements/tools in Naira

$b_1 - b_8$ = regression coefficients

U = Error term

The efficiency of resource use was determined by the ratio of marginal value product (MVP) to marginal factor cost (MFC) of inputs based on the estimated regression coefficients. Following Rahman and Lawal (2003) and Iheanacho et al (2000) efficiency of a resource, r , is given as:

$$r = \frac{\text{MVP}}{\text{MFC}} \dots \dots \dots (8)$$

The rule provides that when $r = 1$, there is an efficient use of a resource; $r > 1$ indicates underutilization of a resource; while $r < 1$ shows overutilization of a resource. The values of MVP and MFC were estimated as follows:

$$\text{MVP} = \text{MPP} \cdot \text{PQ}$$

$$\text{MFC} = \text{Pxi}$$

Where r = Efficiency ratio

MVP = Marginal value product

MFC = Marginal factor cost, $\text{Pxi} = (\text{unit price of input } \text{Xi})$

PQ = Unit price of output

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

According to Table 1, a large proportion (65%) of respondents were in the age group of 51 and above, while only 35% were under 51 years of age. The mean age and standard deviation were 55.35 and 11.95 years, respectively. This implies that older people were more involved in yam production than young people. Thus, yam production is dominated by old farmers, which has a major impact on the level of production, as it will reduce their rate of adoption of new technologies (Olutumise, 2020; Olagunju et al., 2020). About 19% had a household size between 1 and 5 people, 63.0% had a household size between 6 and 10 people, 17.0% had a household size between 10 and 15 people, and 1.0% had a household size of 16 and above. The results agreed with Badamosi et al. (2023), Oladoyin et al. (2023). From the above analysis, it can be seen that the majority of respondents (81.1%) had a household size of over 6 years. The result shows that the level of education of the farmers was low. The majority of farmers had no formal education, 28% attended primary school, 14% had secondary education, and the remaining 7% of respondents attended tertiary institutions. Therefore, about 79% had primary education or no formal education. This result will encourage the adoption of new ideas and innovations from farmers as most of the respondents in the study area had basic or no formal education (Adegoroye et al., 2023). The majority of the respondents (84.0%) were male while 16% were female, which means that males were more involved in yam production than females in the study area. The reason for the low percentage of women involved in yam production is the fact that yam production is rigorous and labor intensive. This means that most women may not be able to participate like men. In addition, men have better access to productive resources such as land, labor, and capital than women. The result also shows that 85.0% of the respondents were married, 7.0% were single, 5.0% and 3.0% were widowed and divorced. The result further shows that married people engaged in yam production more than unmarried, widowed, and divorced. Implicitly, this may be the result of more hands-on work on family responsibilities such as feeding, clothing, and children. The result of

the respondents' occupation shows that about 72% considered agriculture as their main occupation, while 28% had agriculture as their secondary occupation. The result shows that most of the respondents (72%) were full-time farmers by occupation. 15% were engaged in trade, 8% in crafts (carpentry, masonry, etc.), and 5% in civil service. This explains why this area is referred to as an agrarian state. The effect of this is that full-time farmers could concentrate on their farms. This would increase their productivity as well as their income level if some of the yarn was sold. The result of agricultural experience shows that 60% of the respondents had more than 30 years of experience. This means that farmers in the study area have more years of experience. This will enable them to gain more knowledge and understanding about yarn production, which will increase their production. The result of the respondents' farm size shows that 79% had farms under one hectare, and 21% had one or two hectares. This means that small farmers made up a large part of the total population in the area. The result shows that 21% of the respondents used only family work, 17% only hired work, and a total of 62% used both family and hired work. Here, it is clear that the main sources of labor in the researched area were family and wage labor. This means that even though most farmers have a large family, hired labor is still very important in yarn production, practically where many family members are of school age. As shown, 75% of respondents depended on personal savings as a source of finance, 16% on cooperative societies (Ajo/Esusu), 8% on friends and relatives, and 2% on bank loans. The result shows that the percentage of farmers who depended on bank credit as a source of financing was relatively low. The reason for the above may be the fact that they do not have the required security for obtaining loans from banks, associated with high-interest rates on the loan. Also, most of them may not have access to loans from NGOs, NGOs, and other lending agencies. The consequence of this is that large-scale production will not be encouraged due to the unavailability of bank credit for farmers. As shown in the table, the majority (92%) of respondents inherited their land. This result shows that farmers in the study area have been using certain inherited farmland for a long time. The consequence is that there will be low productivity due to continuous cropping and insufficient expansion. The table shows that 33% of the respondents obtained their yarn from friends/family, 7% obtained it from the market 54% obtained input from the previous harvest, and 6% obtained it from the Agricultural Development Project (ADP). This may be a result of low income to purchase yarn. It may also be a result of respondents not having access to ADP. The consequence of this is that farmers will have low productivity because farmers need to be treated and improved yarn settings to have a crop.

Table 1. Socioeconomic Characteristics of the Respondents

Variable	Frequency	Percentage	Mean/SD
Age of the Respondents (Years)			
≤ 30	4	4	
31 – 40	9	9	
41 – 50	22	22	
51 – 60	27	27	55.35/11.95
61 – 70	30	30	
71 ≥	8	8	
Household size (Numbers)			
1 – 5	19	19.0	
6 – 10	63	63.0	8.23/3.25
11 – 15	17	17.0	
≥ 16	1	1.0	
Level of Education			
No formal education	51	51.0	
Primary Education	28	28.0	
Secondary education	14	14.0	
Tertiary education	7	7.0	
Gender			
Male	84	84.0	
Female	16	16.0	
Marital Status			
Single	7	7.0	
Married	85	85.0	
Widowed	5	5.0	
Divorced	3	3.0	
Major Occupation			
Farming	72	72.0	
Trading	15	15.0	
Craftwork	8	8.0	
Civil servant	5	5.0	
Yam Farming Experience (Years)			
21	10		
21 – 30	30	30.0	
31 – 40	45	45.0	32.26/8.88
41 – 50	14	14.0	
51	1	1.0	
Farm Size (ha)			
< 1	79	79.00	
1 – 2	21	21.00	
Labour Source			
Family Labour only	21	21.0	
Hired Labour	17	17.0	
Family and Hired	62	62.0	
Source of Finance			
Personal Saving	74	74.0	
Co-operative society	16	16.0	
Friends and relative	8	8.0	
Bank loan	2	2.0	
Source of Yam Setts			
Friends/Relative	33	33.0	
Market	7	7.0	
Previous Harvest	54	54.0	
ADP	6	6.0	
Total	100	100.0	

Profitability of Yam Production in the Study Area

1. Cost and Returns Analysis of Sampled Yam Farmers

The budgetary analysis presented in Table 2 highlights that the majority of the total costs (93.0%) are variable, with fixed costs constituting only a minor portion (7.0%). This distribution aligns with findings from numerous studies on smallholder farming in Nigeria, suggesting that for farmers to achieve cost efficiency, a significant reduction in variable costs, particularly labour costs – which represent approximately two-thirds (64.6%) of the total costs – is crucial. The breakdown of costs further includes fertilizer (10.3%), agrochemicals (5.9%), planting materials (8.0%), and transportation (4.2%). The combined costs of land and farming implements contribute a minimal percentage to the total costs, with fixed costs being notably low (7.0%), and attributed largely to the minimal land rent costs (1.1%) in the study area. Depreciation of farming tools or implements accounts for 5.9% of the total costs, or about 84% of the fixed costs. These findings reflect the characteristics of core rural communities in southwestern Nigeria, where land is predominantly inherited. This observation is consistent with the research conducted by Adeyemo et al. (2010), Bobola et al. (2019), Oseni et al. (2018), Olutumise et al. (2022) and Ijigbade et al. (2023) on the economic efficiency of small-scale farmers in Ogun State, Nigeria.

Table 2. Distribution by Production Costs of Respondents

Variables (items)	Mean (N)	Percentage
A. Variable costs		
Cost of labour	72,220.11	64.6
Cost of fertilizer	11,470.00	10.3
Cost of agrochemical	6,570.00	5.9
Cost of planting material	8,937.60	8.0
Cost of transportation	4,720.00	4.2
Total Variable Cost	103,917.71	93.0
B. Fixed Cost		
Depreciation cost on implements /tools	6,551.07	5.9
Land rent	1,250.10	1.1
Total Fixed Cost	7,801.17	7.0
Total Cost of Production	111,718.88	100.0

2. Returns from Yam Farming

Table 3 outlines the earnings distribution among farmers from their yam sales. It was found that a significant portion of the farmers (45%) generated annual revenues ranging from N150,001 to N200,000 through yam farming. A solitary farmer (1%) earned N100,000 or less annually, while 38% of the participants saw incomes between N100,000 and N150,000. Additionally, 12% of the farmers earned between N200,001 and N250,000, and a smaller group (4%) exceeded N250,000 in annual earnings from yam cultivation. The mean revenue for farmers within the surveyed area stood at N170,163.00, with individual earnings varying from N100,000 to N270,000 and a standard deviation of N37,956.07683.

Table 3. Distribution of Respondents According to Accrued Total Revenue Realized from Yam Production Enterprise

Household income	Frequency	Percentage
≤ 100,000	1	1
100,001 – 150,000	38	38
150,001 – 200,000	45	45
200,001 – 250,000	12	12
> 250,000	4	4
Total	100	100

Mean = N170,163.00, Standard deviation = 37,956.08

3. Gross Margin and Net Returns Analysis

This section discusses the profitability indicators of yarn production concerning gross margin and net returns obtained from the study area. The gross margin of yarn production was calculated as shown in Table 4, the cost elements include total variable cost (TVC) and total fixed cost (TFC). The costs of labor, fertilizers, agrochemicals, planting material, and transport constitute the TVC, while the fixed costs in this study were the cost of land rental and depreciation of tools or implements such as a hoe, saber, spray pump, and others. Revenues represent sales accrued from yam tubers per year. An average total income (TR) of N170,163 per annum was obtained from the study. TVC generated by yarn producers in the study area was N103,917.71 while gross (GM) was N66,245.29. the total revenue (TR) obtained from the study was N243,090 per ha while the total cost (TC) was N159,598.40 per ha. The Net Income (NR) earned from the study was N58,444.12. Based on the findings, it was therefore concluded that yarn production was a profitable business in the study area. A total profit (net income) of N83,491.60 per ha and a percentage profit of about 75% indicated that yam cultivation is a highly profitable business in the study area. Under the same conditions, farmers should be able to repay loans even at the commercial banks' interest rate of at least 37% per year. The cost ratio showed that a farmer who invested N1.52 as income gained N50,000 for every naira spent. This therefore reconfirmed the profitability of yarn production in the study area.

Table 4. Net-Revenue Analysis for Yam Production in the Study Area

Variables	Calculated values (N)
TVC	103,917.71
TFC	7,801.17
TC	111,718.88
TR	170,163.00
GM	66,245.29
NR	58,444.12
TR/ha	243,090.00
TC/ha	159,598.40
TVC/ha	147,610.38
TFC/ha	11,081.21
GM/ha	94,636.13
NR/ha	83,491.60
Cost ratio (TR/TC)	1.52
Gross ratio (TC/TR)	0.66
Percent profit (NR/TC *100)	74.7%

Determinant Factors Affecting the Level of Output in Yam Production in the Study Area

Table 5 presents the analysis of factors influencing yam production levels, utilizing linear, double-log, semi-log, and exponential models to estimate the production function's parameters. These models were evaluated based on criteria such as the t-ratio, F-value, R-squared (R^2), adjusted R^2 , and the significance of estimated coefficients. The double log model was selected for its superiority in these metrics, despite having the second highest R^2 value. The R^2 value of 0.721 indicates that 72.1% of the variation in yam output levels can be explained by the included explanatory variables. The F-value of 45.27, significant at $P < 0.05$, suggests that the explanatory variables collectively have a significant impact on yam production levels. According to the results, five variables – age, years of education, farm size, cost of planting materials, and cost of implements – showed positive coefficients, indicating a direct correlation with yam output. Increases in these factors are associated with higher production levels. Conversely, household size, labour costs, and agrochemical costs had negative coefficients. Among the eight variables in the double log model, only four – years of education, farm size, labour cost, and cost of planting materials – were statistically significant at the 5% level, highlighting their role in affecting yam production levels in the area under study. The results shared a similar view with the findings of Fatuase et al. (2015), Olutumise (2020), Olagunju and Akinbile (2020) on yam production.

Table 5. Results of Determinant Factors Affecting Level of Yam Output Using Double-Log Multiple Regression Models

Explanatory Variables	Coefficient	T-ratio
Constant	4.526	3.665
Age of the farmer	0.0871	0.570
Year of Education	0.0196*	1.985
Household Size	-0.143	0.001
Farm Size	1.360*	3.914
Cost of Labour	-0.215*	20.511
Cost of Agrochemicals	-0.0816*	1.652
Cost of Planting Materials	0.109*	2.095
Cost of Implement	0.508	1.789
R ²	0.721	
Adjusted R ²	0.704	
F-ratio	45.27*	

Note: * means significant at 5% level of probability.

Resource-use Efficiency of the Yam Production

The resource use efficiency of each variable used was shown in Table 6 with their scale coefficients in terms of yarn production in the study area. MVP, MFC, and their ratios were calculated and also tabulated. The data revealed that all production inputs were overutilized because the efficiency coefficients of all inputs are less than 1. This means that increased use of these inputs will lead to a decrease in output. Specifically, for each amount spent on labor, agrochemicals, planting material, and tools, yarn yields decrease by N-0.0819, N-0.0166, N0.6641, and N0.2211, respectively. Therefore, not all inputs were used effectively. To increase the output, it would be necessary to reduce the use of all inputs. The use of labor and agrochemicals was not rational due to the negative ratio and therefore there is gross inefficiency in their allocation.

Table 6. Ratios of the Marginal Value Product (MVP) to Marginal Factor Cost (MFC)

Inputs	MVP	MFC	MVP/MFC
Farm Size	414.293	-	-
Cost of Labour	-65.495	800	-0.0819
Cost of Agrochemical	-24.858	1500	-0.0166
Cost of Planting Materials	33.204	50	0.6641
Cost of Implements	154.751	700	0.2211

Source: Field Survey, 2012.

Analysis of Production Elasticity (EP) and Returns to Scale (RTS) in Yam Production

The output elasticity for each of the variable inputs showed that each had positive diminishing marginal returns, while the total returns to scale (RTS) were calculated as 1.6804 (Table 7). The number is greater than 1, which means that the yarn production in the area is in the region of increasing returns or the first stage or in the irrational zone of the production surface. Thus, farmers in the area can get more output or increase their productivity by further increasing inputs with existing technology.

Table 7. Production Elasticity (EP) and Returns to Scale (RTS) in Yam Production

Inputs	Production Elasticity (EP)
Farm Size	1.360
Cost of Labour	-0.215
Cost of Agrochemicals	-0.0816
Cost of Planting Materials	0.109
Cost of Implements	0.508
RTS	1.6804

Marginal Productivity of Inputs in Yam production

Table 8 details the incremental impact of various production resources on yam production, both in physical quantities and economic value. Adding a unit of land input leads to an increase of 2.071 kilograms in yam output and a corresponding revenue boost of ₦414,293. However, increasing the costs associated with labour and agrochemicals is associated with diminished returns from yam cultivation.

Table 8. Marginal Productivity of Inputs in Yam Production

Inputs	MPP(kg)	MVP(N)
Farm Size	2.071	414.293
Cost of Labour	-0.328	-65.495
Cost of Agrochemicals	-0.124	-24.858
Cost of Planting Materials	0.166	33.204
Cost of Implements	0.774	154.751

Problems Militating against Yam Production in the study area

The research identified numerous obstacles faced by farmers in the region in growing yams for both consumption and commercial purposes. These challenges are detailed and presented in Table 9, which covers a spectrum of problems from insufficient funding, pest and disease infestation, transport difficulties, labor and land shortages, increased costs of planting material and agrochemicals to lack of storage facilities. A significant proportion of farmers (19.3%) cited insufficient financing as the primary obstacle to increasing farm size and production efficiency. Lack of suitable storage facilities, identified by 18.1% of respondents, was the second major problem, resulting in significant wastage of yam intended for future consumption or replanting. Another significant challenge was the high cost of quality planting materials, noted by 14.9% of participants, which made it difficult to afford quality seeds. Labour shortages, exacerbated by educational activities, urban migration, and employment in the telecommunications sector, were another critical issue affecting yam production.

Additionally, 10.6% of respondents reported that infestation by rodents, pests, and diseases significantly reduced yam yields. Other problems noted included a lack of available land (9.6%), high cost of agrochemicals (8.5%), and transportation difficulties (6.3%), all of which significantly affect agricultural operations in the area.

Table 9. Distribution of Respondents By Problems Faced by the Farmers

Problems	Frequency	Percentage	Rank
Inadequate fund	95	19.3	1 st
Rodents, Pests & Diseases infestations	52	10.6	5 th
Transportation problems	31	6.3	8 th
Shortage of labour	63	12.8	4 th
Shortage of land	47	9.6	6 th
High cost of planting materials	73	14.9	3 rd
Lack of storage facilities	89	18.1	2 nd
High cost of agrochemicals	41	8.4	7 th
Total	491	100.0	

Note: *Multiple Responses

CONCLUSIONS AND RECOMMENDATIONS

The study conducted in Irele Local Government Area of Ondo State, Nigeria, provides valuable insights into the efficiency of resource use among yam farmers, shedding light on both the challenges and opportunities present in the agricultural sector, particularly in yam production. Through a detailed analysis, including budgetary analysis and production function models, several key findings were brought to the forefront. Firstly, the study underscored the significant role that smallholder farmers play in the agricultural landscape of Nigeria, with their efforts being crucial to both local food security and the broader economy. Despite the financial viability of yam cultivation demonstrated through gross margin and net income analyses, farmers encounter numerous obstacles. These range from insufficient funding and inadequate storage facilities to the high costs of planting materials, which collectively hinder their capacity to maximize production efficiency and profitability. Moreover, the research highlighted the importance of efficient resource allocation in boosting yam output. The determinant factors affecting yam production levels pointed out the critical need for targeted interventions that address both the positive and negative influences on yam yields. This includes the positive impact of factors

like farm size and education levels on production, against the backdrop of challenges such as labour and agrochemical costs. Given these findings, the recommendations are made to support yam farmers and improve the overall productivity and sustainability of yam cultivation in the region. There is a pressing need for more accessible and affordable financial services tailored to the needs of smallholder farmers. This could include low-interest loans, grants, and subsidies specifically aimed at reducing the cost burdens associated with planting materials, labour, and other critical inputs. Also, strengthening extension services to provide training and resources on best practices in yam cultivation can help improve yield and efficiency. Special emphasis should be placed on modern farming techniques, pest and disease management, and resource optimization. Investing in rural infrastructure, particularly in storage facilities and transportation, can significantly reduce post-harvest losses and ensure that yams reach markets in optimal condition. Improved road networks will also ease the transport of inputs and produce, reducing costs and increasing market access. Encouraging policies that facilitate access to additional arable land could help address land shortages. This might include land reform initiatives or programs that incentivize the use of underutilized lands for agriculture. Continued research into high-yield, pest-resistant yam varieties and sustainable farming practices can provide farmers with the tools needed to increase output and adapt to changing environmental conditions.

FURTHER STUDY

his research still has limitations, so it is necessary to carry out further research related to the topic of Optimizing Resource-Use Efficiency of Yam Producers in Ondo State, Nigeria: a Path to Enhanced Food Production in order to improve this research and add insight to readers.

REFERENCES

- Adegoroye, A., Olubunmi-Ajayi, T. S., Akinbola, A. E., & Oguntuase, D. T. (2023). Socioeconomic and performance of agripreneurs: A case study of dried melon value chain in Owo local government of Ondo State, Nigeria. *International Journal of Management & Entrepreneurship Research*, 5(12), 851-862.
- Adegoroye, A., Olutumise, A.I., and Aturamu, O.A. (2021). Determinants of Food Security Status and Coping Strategies to Food Insecurity among Rural Crop Farming Households in Ondo State, Nigeria. *European Journal of Nutrition & Food Safety*, 13(7), 39-50.
- Adeyemo, R., Oke, J. T. O., & Akinola, A. A. (2010). Economic efficiency of small-scale farmers in Ogun State, Nigeria. *Tropicultura*, 28(2), 84-88.
- Amos, T. T. (2007). An analysis of productivity and technical efficiency of smallholder cocoa farmers in Nigeria. *Soc. Sci.*, 15(2), 127-133.

- Badamosi, A. P., Olutumise, A. I., Olukoya, O. P., Adegoroye, A., & Aturamu, O. A. (2023). Socioeconomic impacts of flooding and its coping strategies in Nigeria: Evidence from Dagiri community, Gwagwalada area council of Abuja. *Natural Hazards Research*. <https://doi.org/10.1016/j.nhres.2023.09.010>
- Bobola, O.M., Afolayan, J.A. and Olutumise, A.I. (2019). Market Inequality and Performance of Gari Marketing in Ondo State, Nigeria. *Applied Tropical Agriculture*, 24(1): 23 - 32.
- Coursey, D. G. (1969). Ascorbic acid in Ghana yams. *Journal of Food Science and Agriculture*, 17, 446-449.
- Dillion, J. L., & Hardaker, J. B. (1993). *Farm Management Research For Small Scale Farmer Development*. FAO.
- Ene, L. S. O., & Okoli, O. O. (1985). Yam improvement genetic consideration and problems. In G. Osuji (Ed.), *Advances in Yam Research*. Frontline Publishers.
- Fatuase, A.I., Aborisade, A.S. and Omisope, E.T. (2015). Determinants of Adaptation Measures to Climate Change by Arable Crop Farmers in Owo Local Government Area of Ondo State, Nigeria. *World Rural Observations*, 7(1): 49 - 57.
- Food and Agricultural Organization. (2002). *Bulletin of Statistics*.
- Hahn, S. K., Osiru, D. S. O., Akoroda, M. O., & Ato, J. A. (1993). *Production of Yams, Present Role and Future Prospects (IITA Research Guide 46)*. IITA Ibadan.
- Ijigbade, J.O., Olutumise, A.I., Toluwase, S.O.W., Awoseyila, F. & Aturamu, O.A. (2023). Assessing the efficiency and profitability potentials of honey input supply: The case of South West Nigeria. *Tropical Agriculture*, 100(4), 351-364. <https://doi.org/10.37234/>
- International Institute of Tropical Agriculture. (2003). *Annual report*.
- Murray, U., Gebremedhin, Z., Brychkova, G., & Spillane, C. (2016). Smallholder farmers and climate smart agriculture: Technology and labor-productivity constraints amongst women smallholders in Malawi. *Gender, Technology and Development*, 20(2), 117-148.
- Nanbol, K. K., & Namo, O. (2019). The contribution of root and tuber crops to food security: A review. *J. Agric. Sci. Technol. B*, 9(10.17265), 2161-6264.
- National Population Commission. (2006).

- Ogunyemi, A. I., Olutumise, A. I., & Adegoroye, A. (2022). The extent of Vulnerability to Food Insecurity and Household Coping Strategies: Case of Yam Farmers in Ekiti State, Nigeria. *Turkish Journal of Agriculture-Food Science and Technology*, 10(10), 1921-1928.
- Oladoyin, O. P., Adegoroye, A., Akinbola, A. E., & Borokini, E. A. (2023). Unlocking the economic potentials of leafy vegetable: A case study of farmers in Akoko South West Local Government Area of Ondo State, Nigeria. *Asian Journal of Research in Agriculture and Forestry*, 9(4), 327-336.
- Olagunju, O., & Akinbile, L. A. (2020). Farmers perceptions of the effect of rural transportation systems on farming income in Ondo State, Nigeria.
- Olayemi, J. K., & Olayide, S. O. (1981). *Elements of Applied Economics*. Ibadan CARD.
- Olayide, S. O., & Heady, E. O. (1992). *Introduction to Agricultural Production Economics*. University of Ibadan Press.
- Olubunmi-Ajayi, T. S., Amos, T. T., Borokini, E. A., & Aturamu, O. A. (2023). Profitability and Technical Efficiency of Maize-Based Cropping System Farmers in Ondo State, Nigeria. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EESs)*, 13(1), 11-22.
- Olutumise, A. I. (2022). Determinants of market participation and preference for production of pepper (*Capsicum spp.*) among farmers in southwest, Nigeria. *Heliyon*, 8(9), e10585.
- Olutumise, A. I. (2023). Impact of credit on the climate adaptation utilization among food crop farmers in Southwest, Nigeria: application of endogenous treatment Poisson regression model. *Agricultural and Food Economics*, 11(1), 7.
- Olutumise, A. I., Ijigbade, J. O., & Aturamu, O. A. (2022). Marketers' Conduct and Profitability as a Response to Sustainable Livelihood: The Example of Bush Mango Kernels (*Irvingia spp.*) in Ondo State, Nigeria. *Small-scale Forestry*, 1-18.
- Olutumise, A.I. (2020). Transportation System and Output Market Participation Nexus among Yam Producers in Southwest Region of Nigeria. *Scientific Paper Series Management, Economic Engineering in Agriculture and Rural Development*, 20(4): 365 - 379.

Oseni, J.O., Olutumise, A.I. and Olutumise, B.O. (2018). Performance Evaluation of Cocoa Marketing in Osun State, Nigeria. *Journal of Perspectives on Financing and Regional Development*, 6(1): 97 - 112.

Parid. A. A. (2016). Sustaining and Enhancing Small Farm Productivity in an Era of Emerging Challenges. *Family Farming*.