ECONOMIC ANALYSIS OF YAM PRODUCTION TECHNIQUES IN NIGER STATE, NIGERIA (A CASE STUDY OF GURARA AND PAIKORO LOCAL GOVERNMENT AREAS)

Patience Maru Ezuma, Kenneth C. Baba, and Bwala Madu Ali
Department of Agricultural Economics and Extension Services, Faculty of Agriculture, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria
Corresponding email**: ojangpatience@gmail.com**

ABSTRACT

This study is on the economic analysis of yam production techniques in Gurara and Paikoro LGA of Niger State, Nigeria. The objective is to assess these techniques' profitability, technical efficiency, and constraints. Primary data were collected using structured questionnaires. A multi-stage sampling was used to select 20 farming communities across the two LGAs, and 129 yam farmers were surveyed. Results of socioeconomic characteristics revealed that those aged 40 years and below, were more likely to use the Yam sett technique (53%) compared to those using seed yam (42%), suggesting that younger farmers were male, with Yam sett technique (100%) while seed yam is (99%). Yam sett technique gross margin amounted to ₦1,059,500 while Yam sett recorded ₦635,000. The Return on Investment (ROI) for the Yam sett Technique are estimated at 230.93% and compared to 174.79% which shows that yam production is profitable in the study area. The study found that farmers using Yam sett achieve better input utilization, particularly in seed and labour, leading to higher output with fewer resources. However, inefficiencies persist in both techniques, influenced by education, credit access, and farm size. Additionally, constraints such as high input costs, inadequate knowledge, poor soil fertility, pests, and limited access to finance were common across both techniques, with Yam sett users facing greater challenges in acquiring quality Yam sett and Seed Yam users struggling with access to quality seed yams. The study recommended prioritizing investment in education, optimizing input use, and promoting the adoption of the Yam sett technique as a more profitable alternative.

Keywords: Yam production, Seed Yam technique, Yam sett technique, technical efficiency

INTRODUCTION

Agriculture is a crucial sector in Nigeria's economy, contributing approximately 21% to the nation's GDP and employing around 25 million individuals, accounting for about 30.1% of the total workforce (National Bureau of Statistics, 2024; Statista, 2023). These figures reflect a decrease from previous estimates that reported agriculture contributing approximately 41% to Nigeria's GDP and employing around 70% of the labour force (National Bureau of Statistics, 2019) In Nigeria, agricultural development is key to poverty reduction and overall economic growth (Tahir *et al.,* 2019). Small-scale farmers make up the backbone of Nigeria's agricultural sector, producing a variety of crops in subsistence farming systems across different ecological zones (Tahir *et al.,* 2019). Among these crops, yam (Dioscorea species) holds significant importance, ranking as the fifth most harvested crop in Nigeria, after cassava and maize (National Bureau of Statistics, 2020). Yam plays a vital role in food security and income generation, and it is an essential source of carbohydrates for nearly 400 million people in West Africa (Bhattacharjee *et al.,* 2011; Nweke, 2016; Aighewi *et al.,* 2021).

Yam is also crucial culturally and socially in Nigeria, being associated with festivals like the New Yam Festival, and it is considered a prestigious crop (Ilemobayo and Ijigbade, 2019). In West Africa, yam is the main crop grown, with Nigeria, Ghana, and the Ivory Coast accounting for 86% of global yam production (FAOSTAT, 2019). Despite its importance, yam production faces several challenges, especially in the traditional seed yam system. This system, which involves recycling seed yam from the previous harvest, is slow, disease-prone, and often results in poor seed quality (Aighewi, *et al.,* 2020). Additionally, the demand for seed yam competes with food consumption, making it expensive and leading to high production costs, accounting for up to 40.2% of the total variable costs (Aigbokhaevbolo and Odiase, 2024). The scarcity and high cost of seed yams underscore the importance of exploring innovative propagation methods to improve yam production and ensure the sustainability of the agricultural sector in Nigeria (Olowosegun and Adebola, 2021).

Yam production plays a crucial role in Nigeria's agricultural sector, serving as a key contributor to food security, employment, and economic sustainability, particularly in Niger State. As one of the leading yam-producing regions in the country, Niger State benefits from favorable agro-ecological conditions that support large-scale cultivation (Nweke and Ugwu, 2022). However, despite its potential, yam production faces significant challenges that hinder productivity and profitability. These include inadequate access to modern agricultural inputs, poor infrastructure, limited access to credit, inefficient farming practices, and external factors such as climate change, pest infestations, and fluctuating market prices. Additionally, the lack of effective extension services has further restricted the adoption of improved farming technologies, leading to persistently low yields and reduced income for farmers (Adetunji and Adegbite, 2023; Musa and Bello, 2024).

To address these challenges, researchers have developed the Yam sett technique, which involves cutting larger yam tubers into smaller pieces for seed production. This method is seen as a more efficient way to propagate yam, potentially reducing costs, improving seed availability, and enhancing production. While the technique shows promise, its economic benefits are still unclear, and further studies are needed to assess its impact on production efficiency (Maroya *et al.,* 2014; Balogun *et al.,* 2017). However, existing studies have primarily focused on the technical aspects of yam production, with limited emphasis on the socio-economic barriers that prevent farmers from adopting modern innovations. The economic viability of proposed interventions, such as the yam sett technique, remains underexplored, leaving a crucial gap in understanding how these methods impact production efficiency and profitability. Addressing this gap is essential for designing policies and support systems that can improve yam farming outcomes and contribute to broader agricultural development in Niger State.

In Gurara and Paikoro Local Government Area (LGA), the reliance on traditional farming methods has led to a decline in yam productivity. A study by Abdullahi (2015) examined yam production among small-holder farmers in Munya, Paikoro, and Suleja LGAs, revealing that inputs were under-utilized, with technical efficiency scores ranging from 68% to 98%, and an average of 90%. This indicates potential for increased efficiency in farming activities. In recent years, for instance, in Shiroro LGA, a farmer reported planting over 3,000 heaps of yams but harvesting only half, attributing the poor yield due to yam seed to delayed rains and theft of planted seeds (The Nation Newspaper, 2023; Olowosegun and Adebola, 2021). This study aims to conduct a comparative economic analysis of yam production systems in Gurara and Paikoro LGAs, evaluating the costs, revenues, and profitability of both traditional and Yam sett methods to enhance yam production and the economic outcomes for smallholder farmers.

The specific objectives are to;

i. determine the costs and returns to yam production under the two production techniques;
ii. determine the technical efficiencies of yam production under the two production techniques;
iii. identify the constraints associated with yam production in the study area.

METHODOLOGY

The study was conducted in Paikoro and Gurara Local Government Areas (LGAs) of Niger State, Nigeria, focusing on yam production. The study area consists of several districts, including Paiko, Adunu, and Kaffin Koro, with a population dependent on agriculture, particularly yam farming. The region experiences a seasonal climate with annual rainfall varying between 1300mm and 1600mm. Multi-stage sampling technique was used to collect data from yam farmers. The first stage is the purposive selection of Gurara and Paikoro Local Government Areas based on the intensity of yam production. In the second stage, ten (10) farming communities were randomly selected from each of the selected Local Government Areas to give rise to twenty (20) farming communities. Finally, seven (7) yam farmers were randomly selected from each of the twenty (20) selected farming communities, but one community had only 9 farmers and this gave rise to a total sample size of one hundred and twenty-nine (129) respondents for the study. The study covered a total of twenty (20) farming communities and a total of 129 yam farmers. Primary data were collected using structured questionnaires.

The study also utilized budgetary techniques to determine costs and returns, calculating net farm income (NFI) and gross margin (GM) to evaluate farm profitability. Additionally, the study used a t-test to compare the profitability between yam farmers using traditional seed yam and Yam sett techniques. Stochastic Frontier Analysis (SFA) was applied to assess technical efficiency, estimating the production frontier and comparing the efficiency of the two yam propagation methods. Lastly, constraints to yam production were identified using descriptive statistics, providing insights into the challenges faced by farmers.

Model specification as:

1. **Budgetary Technique**

NFI = GM – TFC ……………………………………….(1)
GM = TR – TVC ………………………………………. (2)
TR = Py. Y ……………………………………………..(3)

Where;

NFI = Net farm income; GM = Gross margin; TFC = Total fixed cost (average annual depreciation cost for fixed inputs); TR = Total Revenue; TVC = Total variable cost; Py = Price per unit of output (₦); Y = Total quantity of output (kg) per unit per hectare; TC = Total Cost

Depreciation:

The fixed cost items such as the cost of hoe, knapsack, cutlass etc. were depreciated using the straight line depreciation method. Thus, expressed as:

Depreciation = $\frac{\text{Initial cost } - \text{Salvage value}}{\text{Useful life (yrs)}}$ ……………….. (4)

Profitability analysis

i. **Return on investment:**

The return on investment (ROI) will be obtained as follows:

ROI = $\frac{Net\ farm\ income}{Total\ cost\ of\ production}$ …………………………… (5)

ii. **Gross Margin = TR – TVC** …………………… .(6)

TR = Total Revenue
TVC = Total variable cost

iii. **Rate of Return** = $\frac{\text{Net Revenue}}{\text{Total Cost}}$ …………………… (7)

iv. **Gross Ratio** = $\frac{\text{Total Cost}}{\text{Total Revenue}}$ ………………………(8)

The student T-test was used to test if there is a statistical difference between seed yam and Yam sett yam farmers in Paikoro and Gurara local government areas.

Formula for the t-test is;

t= $\frac{X_{t-X_t}}{\sqrt{\frac{Var\,T}{nT}+\frac{Var\,C}{nC}}}$ ……………………………………………….. (9)

t = t-test
X_t = mean of yam profit/hectare of yam produced from Yam sett (₦)
X_c = mean of yam profit/hectare from yam produced from seed yam (₦)
VarT = variance of profit /hectare produced from Yam sett
VarC = variance of profit /hectare produced from seeds yam
N_T = No. of farmers sampled (Yam sett)
N_C = No. of farmers sampled (Yam sett)

2. **Stochastic Frontier Analysis (SFA)**

$$\log Y = B_0 + B_1 logX_1 + B_2 logX_2 + \beta_3 logX_3 + \beta_4 logX_4 + \beta_5 logX_5 + \beta_6 logX_6 + \beta_7 logX_7 + \beta_8 logX_8 \dots\dots \ (10)$$

Y = output of yam (from traditional seed yam and Yam sett) ; X_1 = Land (Hectares); X_2 = Labour (Number); X_3 = Seed (kg); X_4 = Fertilizer (kg); X_5= Herbicide (Liters); X_6 = Age of farmer; X_7 = Household size; X_8 = Education; e =error term

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Yam Production in the Study Area

The socioeconomic analysis of yam farmers in the study area revealed several key insights. Age distribution showed that younger farmers, particularly those aged 40 years and below, were more likely to use the Yam sett technique (53%) compared to those using seed yam (42%), suggesting that younger farmers are more inclined to adopt new agricultural technologies (Doss, 2006; Mburu and Liser, 2018). Regarding household size, farmers using Yam sett had a more varied household size, potentially offering greater flexibility in labour allocation, while seed yam users tended to have larger, more concentrated households, which may rely more on family labour (Nkurunziza, 2006; Osei-Asare, 2010). Educationally, a significant portion of both groups had no formal education, indicating that educational interventions could enhance the adoption of the Yam sett technique (Afolabi *et al.,* 2020). The study also found that marital status did not significantly impact the choice of yam propagation method, as most farmers in both groups were married. However, a stark gender disparity was observed, with 99% of seed yam users and 100% of Yam sett users being male, reflecting socio-cultural barriers that limit women's participation in modern farming (FAO, 2020).

Table 1: Socioeconomic Characteristics of Yam Production in the Study Area

Characteristics	Frequency	Percentage (%)	Frequency	Percentage (%)
	Seed yam = 54		**Yam sett** = 75	
Age (years)				
40 years and below	23	42	40	53
41-45 years	7	13	14	19
46-50 years	10	19	16	22
50 years and above	14	26	5	7
Mean	44		41	
Household size				
5 and below	4	7	7	9
6-10	18	33	20	27
11-15	23	43	21	28
16-20	7	13	17	23
21 and above	2	4	10	13
Mean	13		15	
Household head education				
No formal education	27	50	48	64
Primary	13	24	14	19
Secondary	8	15	8	11
Tertiary education	6	11	5	7
Marital status				
Married	52	96	72	96
Not Married	2	4	3	4
Gender				
Male	54	99	75	100
Female	1	1	0	0

Source: Field survey, 2023.

Costs and Returns to Yam Production per Hectare

Tables 3 provide information on " Comparative Analysis of Costs and Returns to Yam Production under the Yam Production Techniques" with a detailed analysis of the economic aspects associated with yam farming using seed yam and Yam sett techniques for a 1-hectare farm size.

Table 3: Comparative Analysis of Cost and Returns for Seed Yam and Yam Sett Techniques per Hectare

Items	Seed Yam Technique				Yam Sett Technique			
	Quantity	**Unit Price (₦)**	**Valuation (₦)**	**% of Total Cost**	**Quantity**	**Unit Price (₦)**	**Valuation (₦)**	% of Total Cost
Total Revenue/Ha	1000 kg	1000	1,000,000	-	1000 kg	1500	1,500,000	**-**
Variable Cost								
Hired Labor	30 MD	5,000	150,000	44.37%	35 MD	5,000	175,000	42.26
Family Labor	10 MD	3,000	30,000	8.87%	15 MD	3,000	45,000	10.87
Seed	270 kg	200	54,000	16.18%	300 kg	300	90,000	21.73
Fertilizer	50 kg	35,000	35,000	10.36%	50 kg	35,000	35,000	8.45
Manure	150 kg	15,000	15,000	4.44%	150 kg	15,000	15,000	3.62
Agrochemical	3.00 L	3,500	10,500	3.11%	3.00 L	3,500	10,500	2.53
Transportation	-	3,000	3,000	0.89%	-	3,000	3,000	0.72
Total Variable Cost (TVC)	-	-	**297,500**	**88.02**	-	-	**373,500**	90.12
Fixed Cost								
Hoe	6	2,000	6,000	1.77%	6	2,000	6,000	1.45
Cutlass	4	4,500	6,000	1.77%	4	4,500	6,000	1.45
Sprayer	3	25,000	15,000	4.44%	3	25,000	15,000	3.62
Land Rental Value	1	40,500	40,500	12.00%	1	40,500	40,500	9.88
Total Fixed Costs (TFC)	-	-	67,500	20.00	-	-	67,500	16.30
Total Cost (TC)	-	-	365,000	100	-	-	441,000	100
Gross Margin (GM)	-	-	635,000	-	-	-	1,059,000	-
Net Farm Profit (NFI)	-	-	597,500	-	-	-	1,019,000	-
Return on Investment (ROI)	-	-	174.79	-	-	-	230.93	-
Rate of Return (ROR)	-	-	174.79	-	-	-	230.93	-
Gross Ratio (GR)	-	-	63.79	-	-	-	71.06	-
T-test Result	**t-cal**	**t-tab**	**DF**					
	4.14	1.98	116					

Source**:** Field Survey, 2023.

The Seed Yam Technique and Yam Sett Technique represent two different methods of yam production, each with distinct cost structures and financial outcomes. Both techniques share similarities in their variable costs, with hired labour being the largest expense, accounting for over 42% in both cases. The Seed Yam Technique has hired labour costs of 150,000 Naira (44.37%), while the Yam Sett Technique's hired labour costs total 175,000 Naira (42.26%). Family labour contributes significantly in both methods (8.87% for Seed Yam, 10.87% for Yam sett). Other key costs include seed, fertilizer, and manure, with the Yam Sett technique requiring more seed (21.73% of costs) compared to the Seed Yam Technique (16.18%). Despite these differences, the fixed costs are similar for both techniques, totalling around 40,500 Naira, indicating that scaling up production would primarily affect variable costs rather than fixed costs.

In terms of revenue and profitability, the Yam Sett technique significantly outperforms the Seed Yam Technique. Total revenue from the Yam sett Technique is 1,500,000 Naira, compared to 1,000,000 Naira for the Seed Yam Technique, leading to a gross margin of 1,059,500 Naira for Yam sett and 635,000 Naira for Seed Yam. The net farm income (NFI) for the Yam sett Technique is 1,019,000 Naira, compared to 597,500 Naira for Seed Yam, indicating the former's higher profitability. The Return on Investment (ROI) and Rate of Return (ROR) for the Yam sett Technique are exceptionally high at 230.93% and 230.93% respectively, compared to 174.79% for ROI and 174.79% for ROR in the Seed Yam Technique. The higher gross ratio for the Yam sett Technique (75.1%) further demonstrates its efficiency in generating profit. These results align with the findings of Agbaje *et al.* (2020) and Oghenruemu (2020), highlighting the superior profitability of the Yam sett Technique, with higher seed costs offset by better returns, making it a more financially rewarding choice for yam producers.

The t-test results comparing the profitability of farmers using Seed Yam and Yam sett as planting material reveal a statistically significant difference between the two groups. Specifically, the calculated t-statistic is 4.14, which is greater than the critical t-value of 1.98 at a 5% significance level. This leads to the rejection of the null hypothesis (H_0), which states that there is no significant difference in the mean profitability of the two techniques and the acceptance of the alternate hypothesis. This result implies that Yam sett techniques lead to higher profitability compared to Seed Yam techniques. The findings of the study align with Akinyosoye and Ogunlade (2020) who found that using improved planting materials such as Yam sett significantly increased yam yields compared to seed yam techniques, leading to higher overall profitability. This is consistent with the results of the t-test in this study, which revealed that farmers using Yam sett techniques earned higher profits.

Technical Efficiencies of Yam Production

Table 4 presents the result of the technical efficiency of yam production under the two different production techniques using the stochastic production frontier model and the t-test.

Table 4: Estimates of Stochastic Production Frontier and Technical Efficiency

Output/ha	Coefficient	Std. Error	p-value	Coefficient	Std. Error	p-value
Frontier	**Seed yam techniques**			**Yam sett techniques**		
Constant	5.299	1.508	0.000***	12.109	0.398	0.000***
Fertilizer/ha	-0.526	0.576	0.000**	0.194	0.346	0.009**
Chemical/ha	-0.341	0.198	0.087*	-0.125	0.150	0.008**
Seed/ha	0.163	0.122	0.009**	0.693	0.043	0.000***
Labour/ha	-0.025	0.108	0.007**	0.026	0.053	0.000***
Land (ha)	-0.153	0.259	0.000***	-0.950	0.163	0.000***
Inefficiency						
Marital status	0.770	1.399	0.573	1.078	0.918	0.247
Education (years)	0.048	0.044	0.278	0.087	0.028	0.000***
Household size	-0.050	0.058	0.008**	-0.033	0 .030	0.000***
Farming Exp. (years)	-0.064	0.029	0.027**	-0.012	0 .023	0.000***
Credit (yes = 1)	0.250	0.112	0.024**	0.128	0.053	0.019
Extension	-2.051	1.295	0.126	0 .928	1.496	0.537
Constant	2.789	0.451	0.000***	5.543	0.389	0.000***
Sigma_u	0.532			0.675		
Sigma_v	0.493			0.490		
lambda	1.078			1.375		
Number of obs.	54			75		
Wald chi2(5)	71.95			67.78		
Prob > chi2	0.0000			0.0000		
Log likelihood	-85.5337			-94.2062		

Source: Field survey, 2023. ***Significant at 1%; *Significant at 10%

The stochastic frontier production function for Seed Yam and Yam Sett techniques is presented in Table 4. Both techniques show significant constant terms, with p-values of 0.000. Fertilizer use has a negative impact on output for Seed Yam techniques (-0.526) but a positive effect for Yam sett techniques (0.194), indicating that the Seed Yam method may experience diminishing returns or over-fertilization, while the Yam sett method benefits more from fertilizer use. The negative effect of chemicals on output is significant only for the Yam sett technique, suggesting that excessive chemical use may harm yields. Seed input has a stronger positive effect on Yam sett techniques (0.693) than on Seed Yam (0.163), reflecting the higher return on seed input with Yam sett methods. Labour shows a positive relationship with output in the Yam sett technique (0.026), which is consistent with previous studies like Zinash *et al.* (2020), suggesting that labour is more effective in the higher-input Yam sett system.

The study also examines the impact of land, education, household size, farming experience, and access to credit on inefficiency in both techniques. Land has a significant negative effect on output for both techniques, with the negative impact being stronger for Yam sett techniques, possibly due to land degradation or improper management, as supported by Ogunlade (2018). Education has a positive but non-significant effect on inefficiency for Seed Yam techniques, while it is significant for Yam sett techniques, indicating that higher education may lead to inefficiencies in Yam sett farming, a finding that contrasts with Ogunniyi *et al.* (2021). Household size reduces inefficiency for both techniques, which aligns with Gachukia *et al.* (2019), while more farming experience reduces inefficiency, especially with Yam sett techniques, as confirmed by Omotayo *et al.* (2020).

The study also highlights the role of credit in inefficiency, with access to credit having a positive effect on inefficiency for Seed Yam techniques, which is statistically significant (p-value = 0.024). This suggests that credit may not always be optimally used, as noted by Kebede and Ayenew (2020). The parameters Sigma_u and Sigma_v show that inefficiency is a significant source of variation in both techniques, with lambda values (1.078 for Seed Yam and 1.375 for Yam sett) indicating that inefficiency plays an important role in explaining output variation. The Wald chi2 statistic (71.95 for Seed Yam and 67.78 for Yam sett) and the Log-likelihood values suggest that the models are statistically significant and robust in explaining the data, with inefficiency being a key factor in both farming techniques.

Table 5: Distribution of Efficiency Index for Sampled Yam Farmers.

Techniques	**Seed yam techniques**		**Yam sett techniques**	
Level of efficiency	**Frequency**	**Percentage**	**Frequency**	**Percentage**
≤ 0.30	10	18.52	-	
0.31 – 0.50	15	27.78	5	6.67
0.51 – 0.70	20	37.04	20	26.67
0.71 – 0.90	7	12.96	30	40.00
0.91 – 1.0	2	3.70	15	20.00
Total	54		75	
Minimum	0.25		0.31	
Maximum	0.95		0.99	
Mean	0.56		0.78	

Source: Field survey, 2023.

The study found that yam farmers in the area exhibited a technical efficiency (TE) range of 0.25 to 0.95, with a mean TE of 0.56 to 0.78, meaning that farmers could increase their output by 56% to 78% by improving their resource use without incurring additional costs. This result aligns with Bwala *et al.* (2015), who observed similar efficiency ranges for cereal farmers in North Central Nigeria, and Chavez (2013), who found a technical efficiency of 0.537 for agricultural development. Specifically, 37.04% of seed yam farmers fell within the 0.51 to 0.70 efficiency range, while 27.78% operated at lower efficiency levels between 0.31 and 0.50.

Conversely, farmers using the Yam sett technique displayed higher efficiency, with 40% achieving efficiencies between 0.71 and 0.90, and 20% reaching 0.91 to 1.0. These findings support the conclusion that the Yam sett technique is more effective in promoting higher efficiency compared to the seed yam method, consistent with research by Olayemi and Adeleke (2019) and Akinola and Adeola (2019) highlighting the benefits of modern farming techniques.

Constraints Associated with Yam Production in the Study Area

Table 6 provides information on the constraints associated with yam farming using seed yam and Yam sett techniques.

Table 6: Comparative Analysis of Major Constraints in Seed Yam and Yam Sett Techniques

Constraint	Seed Yam Technique			Yam Sett Technique		
	Frequency	Percentage (%)	Rank	Frequency	Percentage (%)	Rank
Limited Access to Quality Seed Yams/Yam Sett	45	83.33%	1st	68	90.67%	1st
High Cost of Inputs (e.g., fertilizers, labor)	41	75.93%	2nd	63	84.00%	2nd
Inadequate Knowledge and Technical Skills	38	70.37%	3rd	58	77.33%	3rd
Poor Soil Fertility	32	59.26%	4th	51	68.00%	5th
Pests and Diseases	30	55.56%	5th	55	73.33%	4th
Lack of Access to Finance	28	51.85%	6th	48	64.00%	6th
Inadequate Storage Facilities	26	48.15%	7th	45	60.00%	7th
Climate Change and Unpredictable Weather	24	44.44%	8th	40	53.33%	9th
Land Tenure Issues	22	40.74%	9th	28	37.33%	14th
Poor Road Infrastructure and Transportation	20	37.04%	10th	43	57.33%	8th
Limited Market Access	18	33.33%	11th	36	48.00%	11th
High Labor Costs	17	31.48%	12th	33	44.00%	12th
Post-Harvest Losses	16	29.63%	13th	39	52.00%	10th
Limited Extension Services and Support	15	27.78%	14th	26	34.67%	15th
Lack of Irrigation Facilities	14	25.93%	15th	30	40.00%	13th
Lack of Processing Facilities	13	24.07%	16th	23	30.67%	16th

Source: Field Survey, 2023.

Findings of the study on constraints associated with yam production show that farmers using both the Seed Yam and Yam sett techniques face several shared constraints, such as the high cost of inputs (seed yam=75.93%, Yam sett =84.00%), inadequate knowledge and technical skills (seed yam=70.37%, Yam sett =77.33%), pests and diseases (seed yam=55.56%, Yam sett =73.33%), poor soil fertility (seed yam=59.26%, Yam sett =68.00%), and lack of access to finance (seed yam=51.85%, Yam sett =64.00%). However, notable differences exist: Yam sett farmers struggle more with limited access to high-quality Yam sett (90.67%), while Seed Yam farmers face challenges with access to quality seed yams (83.33%). Yam sett farmers are also more affected by poor road infrastructure (57.33%) and lack of processing facilities (30.67%), likely due to the specific needs of handling Yam sett. Furthermore, Yam sett farmers report greater impacts from climate change (53.33%) and higher post-harvest losses (52.00%) due to the delicate nature of the planting material. Seed yam farmers are more affected by land tenure issues (40.74%), reflecting their reliance on larger plots. These findings align with previous studies, such as Agbaje *et al.* (2019), which highlighted theft and high input costs as significant constraints, and Adebayo and Onu (2020), who noted financial limitations and high transportation costs as barriers to yam farming profitability.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the study shows several findings into yam production in Gurara and Paikoro Local Government Areas of Niger State, revealing significant differences between the Seed Yam and Yam sett techniques. Farmers using the Yam sett technique outperform those using Seed Yam in terms of revenue, profitability, and technical efficiency, with a higher return on investment and gross margin, despite higher seed costs. The stochastic frontier analysis shows that Yam sett users are more efficient in input usage, particularly seed and labour, leading to higher output with fewer resources. While both techniques face inefficiencies, education and access to credit play crucial roles in influencing productivity. The study also identifies common constraints for both techniques, including high input costs, inadequate knowledge, pests, poor soil fertility, and limited access to finance. However, Yam sett users are more affected by limited access to high-quality Yam sett, while Seed Yam users are concerned with access to quality seed yams. Overall, the study emphasizes the benefits of adopting the Yam sett technique and addressing these constraints to improve Yam farming's profitability and sustainability.

Based on the findings, the following recommendations can be made:

1. Given the higher profitability of the Yam sett technique, it is recommended that yam farmers transition from traditional Seed Yam methods to the Yam sett technique, despite the initial higher seed costs. Additionally, efforts to improve seed availability and reduce initial costs could further incentivize farmers to adopt this more profitable technique.

2. To enhance productivity, farmers using the Seed Yam as planting material should be encouraged to optimize input use, particularly by reducing excessive fertilizer and chemical applications, as these were found to have diminishing returns. On the other hand, farmers using the Yam sett as planting material should be supported in maintaining efficient fertilizer and seed use to further improve their output.
3. Given the substantial variation in technical efficiency among farmers, especially those using Seed Yam techniques, it is recommended that targeted interventions, such as farmer training, access to better resources, and improved farming practices, be implemented to raise the technical efficiency of lower-performing farmers.
4. To address these constraints, it is recommended that farmers be provided with improved access to quality planting materials, financial support, technical training, and better pest and soil management practices, alongside infrastructure improvements to reduce production costs and enhance productivity.

REFERENCES

Abdullahi, M. (2015). *Profitability and efficiency of yam production among small-holder farmers in selected Local Government Areas of Niger State, Nigeria*. Retrieved from https://kubanni.abu.edu.ng/items/73ad4422-acba-433c-85ed-81c7639a2e71/full

Adebayo, A. O., & Onu, J. I. (2020). “Economic analysis of yam production in Nigeria: A case study of rural areas”. *International Journal of Agricultural Extension and Rural Development, 9*(4), 120-136.

Adetunji, M. A., & Adegbite, A. O. (2023). Constraints to yam production and the adoption of modern agricultural technologies in Niger State, Nigeria. *African Journal of Agricultural Economics*, 18(2), 89-104.

Afolabi, A. F., Ojo, T. S., & Adeyemi, O. A. (2020). The role of education in agricultural technology adoption: Evidence from yam farming in Nigeria. *Journal of Agricultural Education and Extension,* 26(1), 27-34.

Agbaje, G. O., Adekunle, A. A., & Oluokun, J. A. (2020). “Adoption of improved yam seed technology in Nigeria: An economic assessment”. *Journal of Agricultural Research and Development, 19*(3), 45-57.

Aigbokhaevbolo, M. O., & Odiase, A. I. (2024). Socio-Economic Analysis of Cost and Returns of Yam Production Among Small Holder Farmers in Delta State, Nigeria. *Global Journal of Research in Agricultural and Life Sciences*, 4(5), 1-6.

Aighewi, B. A., Asiedu, R., Maroya, N., & Balogun, M. (2021). Improved propagation methods to raise the productivity of yam (Dioscorea rotundata Poir.). *Food Security, 7*(4), 823–834. https://doi.org/10.1007/s12571-015-0481-6.

Aighewi, B.; Maroya, N.; Kumar, P.L.; Balogun, M.; Aihebhoria, D.; Mignouna, D.; Asiedu, R. (2021). “Seed Yam Production Using High-Quality Minitubers Derived from Plants Established with Vine Cuttings”. *Agronomy 11978. https:// doi.org/10.3390/agronomy11050978* [Accessed 05/09/2022].

Akinola, R., & Adeola, J. (2019). Adoption of modern agricultural techniques by Smallholder farmers in Nigeria. *International Journal of Farming Systems, 34(4), 200-215.*

Balogun, T. S., Olowosegun, O. F., & Maroya, N. G. (2017). Economic viability of the yam minisett technique in Nigeria: A case study in Oyo State. *Journal of Agricultural Economics and Development*, 6(2), 35-44.

Bhattacharjee, R., Nweke, F. I., & Ofori, J. M. (2011). *The impact of yam production on food security in West Africa*. Food Security Research Network, 24(1), 101-112.

Bwala, M.,A., Kokoye, H.,S.,E., Yegbemey, R.,N. (2015). "Technical Efficiency of Cereal Production in North Central Nigeria: a Case for maize, Rice and Sorghum Farmers". *Journal of Agricultural science and environment.*15 (1):25-34.

Doss, C.R. (2006). *Analyzing Technology Adoption: Theoretical and Empirical Considerations*. Agricultural Economics, 34(1), 41-53. This study discusses factors influencing technology adoption in agriculture, including demographic characteristics.

Ezeh, C. I., Onyenweaku, C. E., & Ukoha, O. O. (2021). "Comparative analysis of economic efficiency of yam production in Nigeria: A case study of farmers using traditional and modern techniques". *Nigerian Journal of Agricultural Economics, 15*(2), 102-117.

FAO (2019). Food and Agriculture Organization Statistics. Yam Production in 2019 Crops/Regions/World/Production Quantity; http://www.fao.org/faostat/en/#data/QC [Accessed 12/06/2022]..

FAO. (2020). The role of women in agricultural development. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org

FAOSTAT. (2019). (Food and Agricultural Organization of the United Nations). Rome, Italy. www.fao.org/statistics/en [Accessed 12/06/2022].

Gachukia, S., Kiptarus, J. M., & Onyango, E. M. (2019). *The effect of household size on inefficiency in smallholder farming systems in Kenya*. Agricultural Economics Research Journal, 21(3), 44-51.

Idowu, T.A., Adeniyi K.O. (2021). Adoption of modern Farming Techniques and Economic Outcome for Farmers. *Journal of Agricultural Economic and Practice 12(2):45-67*

Ilemobayo, O. O., Ijigbade J. O, (2019). "Analysis of Yam Production in Ondo State, Nigeria". *International Journal of Research and Scientific Innovation* (IJRSI) 5(8): 2321–2705.

Kebede, E., & Ayenew, B. (2020). *Credit access and its effect on farm inefficiency in Ethiopia: Implications for agricultural policy*. Journal of Rural Development, 36(2), 122-134.

Maroya, N. G., Balogun, T. S., & Olowosegun, O. F. (2014). Evaluation of yam propagation techniques: The impact of the minisett method on yam production. *African Journal of Agricultural Research*, 8(4), 24-34.

Mburu, J., & Liser, P. (2018). Youth involvement in agriculture and its impact on food security in Kenya. *Journal of Agricultural Economics*, 10(3), 56-72.

Musa, B. M., & Bello, A. (2024). *Impact of inadequate agricultural infrastructure on yam production in Niger State, Nigeria*. Agricultural Systems Journal, 26(2), 78-92. National Bureau of Statistics. (2019). *Annual agricultural report*. National Bureau of Statistics.

National Bureau of Statistics. (2020). *Nigeria agricultural production report: Yam statistics*. National Bureau of Statistics.

Nkurunziza, D. (2006). Impact of household size on agricultural productivity in Sub-Saharan Africa: Evidence from Rwanda. African Journal of Economic Policy, 3(2), 25-33.

Nweke, F. I. (2016). *Yam production and the socioeconomic impact on rural households in West Africa*. West African Food Security Journal, 19(1), 60-72.

Nweke, F. I., & Ugwu, I. (2022). *Barriers to yam farming and strategies for sustainable development in Nigeria*. Journal of Agricultural Development, 14(1), 89-101.

Obiekwe, H. A. (2024). Profitability of rice production in the Southeastern region of Nigeria. *Journal of Agribusiness and Rural Development*, 32(1), 45-60.

Ogbonna, B. O., Adebayo, A. O., & Onu, N. D. (2011). *Economic implications of yam seed scarcity in Nigeria*. Agricultural Economics Review, 22(3), 11-19.

Ogunlade, T. O. (2018). *The impact of land management practices on farming inefficiency in Nigeria: A case study of smallholder farms*. Journal of Agricultural Economics and Development, 16(4), 42-50.

Ogunniyi, S. O., Olayemi, D., & Adepoju, A. F. (2021). *Education and inefficiency in agricultural production: A study of yam farming in Southwest Nigeria*. International Journal of Agricultural Economics, 8(1), 15-22.

Olowosegun, A.A., & Adebola, F.A. (2021). Barriers to adoption of the minisett technique among yam farmers in Ekiti State, Nigeria. *Journal of Agricultural Extension,* 25(1), 45-58.

Omojola, O. M. (2019). Profitability analysis of yam production in Osun State, Nigeria. *International Journal of Agricultural Economics and Rural Development*, 14(4), 37-42.

Omotayo, O. O., Alabi, R. O., & Olayinka, F. I. (2020). *The role of farming experience in reducing inefficiency among smallholder farmers in Nigeria*. Journal of Agricultural Systems, 18(2), 98-106.

Osei-Asare, Y. (2010). The role of household size in farm labor allocation in rural Ghana. African *Journal of Agricultural Research*, 5(9), 157-164.

Statista. (2023). Distribution of Gross Domestic Production (GDP) across activity sectors in Nigeria as of 2023. Retrieved from https://www.statista.com/statistics/1207951/gdp-distribution-across-sectors-in-nigeria/

Tahir, M. A., Muhammad, B., & Sanusi, O. A. (2019). *Agricultural development and poverty reduction in Nigeria*. Agricultural Economics Journal, 15(4), 109-115.

The Nation Newspaper. (2023). *Yam farmers battle challenges of climate change, insecurity*. Retrieved from https://thenationonlineng.net/yam-farmers-battle-challenges-of-climate-change-insecurity/

Zinash, S., Guesh, M., Tesfaye, A. (2020). Returns to labor in African smallholder farming: A focus on intensive farming systems in Ethiopia. *Agricultural Economics*, 51(3), 315-326.