# ECONOMICS AND PROFITABILITY OF ORGANIC SESAME (*Sesamum indicum L.*) PRODUCTION IN GWER EAST LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

*Nnama, U. C., Gbadebo, W. A., Wayo, J. S.
Department of Agricultural Economics, Joseph Sarwuan Tarka University (Formerly, Federal University of Agriculture), Makurdi, Benue State, Nigeria.
Corresponding author's email: *ugonnama@gmail.com

**ABSTRACT**
*Organic agriculture offers a sustainable pathway to enhance agricultural productivity and profitability while addressing environmental concerns. This study analyzed the economics and profitability of organic sesame production in Gwer East Local Government Area of Benue State, Nigeria, a region renowned for sesame cultivation. A multi-stage sampling procedure was employed to select 120 organic sesame farmers, and data were collected during the 2023/2024 cropping season using structured questionnaires. Descriptive statistics, gross margin analysis, total factor productivity (TFP) indices, and double-log regression models were utilized for data analysis. The findings revealed that organic sesame farming is predominantly undertaken by experienced male farmers (92%) with a mean age of 40 years, who primarily use inherited land (85%) and traditional implements (93%). While organic practices such as crop rotation with legumes (100%) and animal manure application (100%) were universally adopted, critical gaps existed in the utilization of natural pesticides (24%), mulching (0%), and compost application (0%). The enterprise demonstrated high profitability with a gross margin of ₦62,409 per hectare. However, TFP analysis revealed that most farmers (63%) operated at low efficiency levels (TFP index of 0.6-1.9), with a mean TFP of 1.05 indicating significant productive inefficiency. Regression results identified* Farm size (0.891), *household size (0.278), and farming experience (0.258) as positive and significant drivers of TFP, whereas labor (-0.587) and seed quantity (-0.475) showed diminishing returns. Low market prices, insufficient road networks, and limited access to funding were the main constraints on production. The study concludes that although organic sesame farming is profitable, systemic issues and inefficiencies limit productivity. To support integrated organic agricultural techniques, recommendations include strengthening cooperative organizations, expanding access to credit, improving rural infrastructure, and enhancing extension services.*

**Keywords:** Organic Sesame, Profitability, Gross Margin, Total Factor Productivity, Constraints, Gwer East, Nigeria.

## INTRODUCTION

The global agricultural landscape is undergoing a significant paradigm shift towards sustainable production systems, driven by growing concerns over environmental degradation, climate change, and consumer health (Willer et al., 2023). This transition is particularly critical for developing economies like Nigeria, where agriculture remains the backbone of the economy, contributing approximately 25% to the Gross Domestic Product and employing over 35% of the labour force (National Bureau of Statistics [NBS], 2021). Sustainable agriculture, which balances productivity with environmental stewardship and long-term land quality (Pretty, 2018), finds a practical expression in organic farming—a holistic production management system that promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity (IFOAM, 2022).

Organic agriculture has grown into a major global sector, covering over 76.4 million hectares and generating a market value exceeding €135 billion in 2022 (Willer et al., 2023). The core principles of organic agriculture especially as it touches health, ecology, fairness, and care emphasizes the use of management practices over synthetic inputs, relying instead on techniques such as crop rotations, compost application, and biological pest control (IFOAM, 2022; USDA, 2020). This approach offers multiple benefits, including improved soil health, reduced environmental pollution, and access to premium markets where organic products often command price premiums of 29-32% higher than conventional alternatives (Crowder & Reganold, 2021).

In Nigeria, the adoption of organic agriculture remains nascent but holds considerable promise, particularly for export-oriented cash crops. Benue State, famously known as the "Food Basket of the Nation," is a major agricultural hub where the adoption of sustainable practices is essential for maintaining its competitive edge. Sesame (Sesamum indicum L.), one of the oldest oilseed crops known to humanity, is a critical cash crop in Benue State, with Nigeria ranking among the world's major exporters (Federal Ministry of Agriculture and Rural Development [FMARD], 2021). The economic significance of sesame lies in its high oil content (50%) and protein content (25%), making it valuable for the food, cosmetic, and pharmaceutical industries (Adebowale et al., 2020). Global demand for sesame has been steadily rising, and Nigeria is strategically positioned to benefit from this trend, particularly if it can meet the quality and safety standards of international markets, including organic certification (Olaniran, 2021).

Gwer East Local Government Area (LGA) stands out as a premier hub for sesame cultivation within Benue State. The agro-ecological conditions of Gwer East are highly conducive to sesame farming, with the area contributing significantly to the state's annual output, which averages 40,000 metric tonnes (Benue State Agricultural Development Programme [BNARDA], 2021). The crop enjoys a robust international market, and the Benue State Government has identified sesame as a major revenue earner with substantial potential for economic diversification and export promotion.

However, conventional sesame production in Gwer East, which relies heavily on synthetic agrochemicals, faces severe challenges. Farmers grapple with high input costs, soil degradation, and pesticide residue issues that can hinder access to premium international markets (Ojo & Adebayo, 2022). The soaring cost and erratic supply of chemical fertilizers and pesticides erode profit margins, while the over-reliance on these inputs contributes to environmental pollution and a decline in soil health that is vital to the area's agricultural productivity. Furthermore, yields in Gwer East typically range between 500-700 kg/ha, falling significantly short of the potential yield of 800-1000 kg/ha (BNARDA, 2021), indicating substantial productivity gaps that need to be addressed.

Organic sesame production offers a promising alternative for Gwer East farmers, aligning with traditional practices while reducing costs, improving soil health, and accessing premium organic markets where sesame commands higher prices (Willer et al., 2023). By avoiding synthetic inputs, organic systems reduce vulnerability to price volatility while enhancing long-term productivity and ecosystem health. However, adoption of certified organic practices remains limited, and a critical knowledge gap exists regarding the economic viability of organic sesame production at the farm level in this key locality.

Sesame is a crucial economic crop for smallholder farmers in Gwer East LGA, yet productivity remains suboptimal despite the area's prominence in cultivation. The yield gap, exacerbated by the unsustainability of conventional methods including soaring input costs, erratic chemical supply, soil degradation, and environmental pollution threatens farmer livelihoods and regional economic potential. While organic sesame production offers potential solutions through cost reduction, ecosystem health benefits, and premium market access, adoption is not widespread. Policymakers and farmers lack location-specific empirical evidence on comparative costs, returns, and productivity of organic systems. Without this information, farmers hesitate to transition from conventional methods, and development agencies cannot design effective support programs tailored to Gwer East's context.

This study is justified on multiple grounds: it provides farmers with empirical evidence for informed decision-making; offers policymakers crucial data for designing targeted organic agriculture policies; contributes to academic knowledge on organic farming economics in Nigeria; and assists development partners in designing effective intervention programs. This study therefore fills the knowledge gap by conducting a detailed economic and profitability analysis of organic sesame production in Gwer East LGA of Benue State. Specifically this paper described the socio-economic characteristics of farmers, identified existing organic farming practices, ascertain input-output levels, determined profitability, estimated total factor productivity, identified factors influencing productivity, and production constraints.

## METHODOLOGY

The study was conducted in Benue State, Nigeria, located in the North Central region between latitudes 7° and 9° N and longitudes 7° and 10° E. The state has a land mass of 27,117 square kilometers and experiences a tropical climate characterized by distinct wet (April-October) and dry (November-March) seasons, with average annual rainfall of 1310mm-1450mm and temperatures ranging from 25°C to 36°C (NBS, 2021). The state's population was estimated at 2.5 million people in 2021 (NBS, 2021). The economy is predominantly agrarian, with major crops including sesame, yam, cassava, rice, maize, and soybeans. The state is divided into three Agricultural Zones by the Benue State Agricultural Development Programme (BNARDA), comprising 13 Local Government Areas (LGAs). The soil types, ranging from alluvial to sandy loams, are suitable for sesame cultivation.

The study specifically focused on Gwer East LGA, which stands out as a premier hub for sesame cultivation within Benue State.

The LGA comprises fifteen council wards, and the agro-ecological conditions are highly conducive to sesame farming, making it a critical contributor to the state's annual output.
The population for this study consisted of farming households in Gwer East LGA as provided by BNARDA. A multi-stage sampling procedure was employed to select 120 organic sesame farmers. In the first stage, six council wards were randomly selected from the fifteen wards in Gwer East LGA. In the second stage, a list of registered sesame farmers for each selected ward was obtained from the BNARDA database, and 20 farmers were randomly selected from each ward. This gave a total sample size of 120 organic sesame farmers for the study.

Data for the study were obtained from both primary and secondary sources. Primary data for the 2023/2024 cropping season was collected through a field survey using a structured questionnaire and interview schedule administered with the assistance of volunteer extension staff of BNARDA covering Gwer East LGA. The questionnaire captured data on socio-economic characteristics (age, gender, education, household size, farming experience, land tenure, cooperative membership); production data (farm size, quantity and cost of organic inputs, sesame output, selling price); organic farming practices (crop rotation, manure application, pest management strategies); and constraints faced in organic production and marketing.

Secondary data were obtained from existing publications of the Central Bank of Nigeria, World Bank, Benue State Government, BNARDA, journals, textbooks, and other published and unpublished materials relevant to the study.

Data were analyzed using both descriptive and inferential statistics. Descriptive Statistics had the use of frequencies, percentages, means, and standard deviations to describe the socio-economic characteristics of the farmers, identify common organic farming practices, and analyze input-output levels.

Gross Margin Analysis was used to determine Profitability.

$$GM = GI - TVC$$

Where GM = Gross Margin (₦/ha), GI = Gross Income (₦/ha) = Output (kg) × Price (₦/kg), TVC = Total Variable Cost (₦/ha) = Sum of costs of seeds, organic fertilizers, natural pesticides, and labour.
Total Factor Productivity (TFP) Analysis was estimated using the approach adopted by Key and McBride (2003) and Fakayode et al. (2008):

$$TFP = Y/TVC$$

Where Y = Quantity of output (kg), TVC = Total Variable Cost (₦).
Multiple Regression Analysis using the Ordinary Least Squares (OLS) method was used to identify factors influencing the TFP of organic sesame farms. The implicit form of the model was:

$$TFP = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8)$$

Where $X_1$ = Farm size (ha), $X_2$ = Seed quantity (kg), $X_3$ = Labour (man-hours), $X_4$ = Education (years of schooling), $X_5$ = Organic fertilizer (kg), $X_6$ = Natural pesticide (litres), $X_7$ = Household size (number), $X_8$ = Farming experience (years).
Three functional forms (linear, double-log, semi-log) were estimated, and the lead equation was chosen based on econometric criteria ($R^2$, number of significant variables, and conformity to a priori expectations). The double-log function provided the best fit and was selected as the lead equation.
Constraint Analysis: Descriptive statistics (frequencies and ranking) were used to identify and rank constraint

## RESULTS AND DISCUSSION

### Socioeconomic Characteristics of Organic Sesame Farmers

Table 1 presents the socioeconomic characteristics of the organic sesame farmers surveyed. The data reveal that the majority (92%) of the farmers are male, indicating that sesame production in the region is predominantly a male-dominated enterprise. This finding aligns with studies across sub-Saharan Africa which often report male dominance in the cultivation of cash crops due to factors such as land tenure systems, access to capital, and cultural norms (Ajewole & Iyanda, 2020). The women farmers are largely involved in sesame processing and marketing, reflecting gender-based division of labour in agricultural value chains.

The mean age of farmers is 40 years, with the largest proportion (35%) falling within the 45-56 age bracket. This reflects an active, middle-aged farming population. However, the relatively low percentage of young farmers (35% aged 21-32) raises concerns about agricultural succession and long-term sustainability, a challenge noted in Nigerian agriculture by Nwachukwu et al. (2021). The bimodal age distribution (21-32 and 45-56 years) suggests that young adult farmers are more actively practicing organic farming than elderly farmers, possibly due to greater awareness of environmental issues and market opportunities.

A high percentage (97%) of the farmers are married, which often implies greater access to family labour and potentially more stable household income, factors that can influence agricultural productivity (Ojo et al., 2019). The mean household size is 9 persons, which is relatively large and can be a significant source of family labour. However, the data on labour sources indicate that family labour utilization is low, with young adults often engaged in menial jobs, schooling, or rural-urban migration, a phenomenon consistent with the findings of Udemezue and Oselebe (2021).

Educational status reveals that 28% of farmers are illiterate, while 72% have some level of formal education, with primary (32%) and secondary (25%) being the most common. The higher literacy rate among organic farmers (72%) compared to conventional farmers (45%) suggests that education facilitates understanding and adoption of organic farming techniques.

Education is a critical factor for technology adoption and efficient farm management, and the level of literacy observed is comparable to findings by Ojo et al. (2019), who reported that basic education enhances farmers' capacity to understand and implement improved agricultural practices.

Farmers have a mean farming experience of 12 years, indicating substantial practical knowledge in sesame farming. This is beneficial for organic practices that often require nuanced understanding and observation. The data show that 76% of organic farmers have been cultivating sesame for over 8 years, suggesting that organic production attracts farmers with more farming experience, possibly because experienced farmers are more willing to experiment with new methods and have accumulated knowledge about local agro-ecological conditions.

Land acquisition is predominantly through inheritance (85%), which is common in rural Nigeria but can sometimes lead to land fragmentation and tenure insecurities that limit investment in long-term soil conservation practices (Udemezue & Oselebe, 2021). The overwhelming use of traditional implements (93% use hoes and cutlasses) highlights a significant reliance on manual labour and suggests limited mechanization, a constraint to expanding production scale. This explains why more man-hours (327/ha) were spent on farming operations, contributing to higher labour costs.

Interestingly, 55% of farmers are members of cooperatives. Cooperative membership is crucial for smallholder farmers as it facilitates access to inputs, credit, information, and markets (Abebaw & Haile, 2020). The predominant use of improved seed varieties (63%) over local varieties is a positive indicator of potential yield, while the primary reliance on hired labour (72%) points to the commercial nature of sesame production, even at the smallholder level.

**Distribution of Organic Sesame Farming Practices**

Table 2 outlines the specific organic farming practices adopted by the respondents. The data show universal adoption (100%) of crop rotation with legumes and the use of animal manure. These are foundational practices in organic agriculture; legumes improve soil nitrogen fertility through biological nitrogen fixation, while animal manure enhances soil organic matter and nutrient content (Gomiero, 2018). Green manuring is practiced by 70% of farmers, further emphasizing the focus on soil fertility management.

However, critical gaps are evident in the organic practices employed. The use of natural pesticides is reported by only 24% of farmers, and practices such as compost application and mulching are non-existent (0%). This indicates a significant vulnerability to pest outbreaks and soil moisture loss. The low adoption of natural pest control methods is a common challenge in transitioning to organic systems, often due to a lack of knowledge or access to preparation techniques (Parrott & Olesen, 2021).

Table 1: Socio-Economic Characteristics of Organic Sesame Farmers

| **Variables** | **Frequency** | **Percentage** |
|---|---|---|
| **Sex**: | | |
| Male | 110 | 92 |
| Female | 10 | 08 |
| **Age** | | |
| 21–32 | 42 | 35 |
| 33–44 | 30 | 25 |
| 45–56 | 42 | 35 |
| 57–68 | 06 | 05 |
| **Marital status** | | |
| Married | 116 | 97 |
| Single | 04 | 03 |
| **Educational status:** | | |
| Illiterate | 34 | 28 |
| Primary | 38 | 32 |
| Secondary | 30 | 25 |
| Tertiary | 18 | 15 |
| **F. Experience**: | | |
| 3–8 | 46 | 38 |
| 9–14 | 30 | 25 |
| 15–20 | 36 | 31 |
| 21–26 | 04 | 03 |
| 27–32 | 04 | 03 |
| **L. Acquisition:** | | |
| Inherited land | 102 | 85 |
| Communal land | 14 | 12 |
| Sharecropping | 04 | 03 |
| Total | 120 | 100 |
| **F. Implement**: | | |
| T. Implements | | |
| (hoe &cutlass) | 112 | 93 |
| Implements and tractor | 08 | 07 |
| Cooperative membership: | | |
| Yes | 54 | 55 |
| No | 66 | 45 |
| **Seed variety:** | | |
| Improved seed variety | 76 | 63 |
| Local seed variety | 44 | 37 |
| **Source of labour:** | | |
| Hired labour | 86 | 72 |
| Family labour | 14 | 11 |
| Both family and hired labour | 20 | 17 |

Source: Field Survey, (2024).

**Table2: Distribution of Organic Sesame Farmers According to Farming Practices**

| Organic farming practices | Frequency | Percentage (%) |
|---|---|---|
| Crop rotation with legumes | 60 | 100 |
| Green manuring | 42 | 70 |
| Use of animal manure | 60 | 100 |
| Use of natural pesticides | 60 | 24 |
| Application of compost manure | 0 | 0 |
| Mulching | 0 | 0 |
| Cover cropping | 27 | 37 |
| Tillage and cultivation | 06 | 10 |

Source: Field Survey, (2021).

The absence of mulching and composting suggests a missed opportunity for enhancing soil water retention, nutrient cycling, and weed suppression. Cover cropping is practiced by only 37% of respondents, and conservation tillage by just 10%, indicating that the farming system is still largely conventional, with organic elements focused mainly on fertility management, rather than a fully integrated organic management system. This finding underscores the need for comprehensive training programs that address all aspects of organic production, including pest management, soil moisture conservation, and integrated nutrient management.

**Input and Output Levels of Organic Sesame Production**

Table 3 presents the input-output data, revealing considerable variability across farms. The mean output is 506 kg per farmer, with a wide range from 167 kg to 1000 kg and a Coefficient of Variation (CV) of 38%. A high CV indicates high variability in yield among farmers, which can be attributed to differences in management practices, soil quality, and access to resources (Ogunniyi et al., 2020).

The mean seed quantity used is 7 kg, with a CV of 37%, indicating relatively consistent seed application rates. Labour input shows the highest variability (CV=65%), with a mean of 327 man-hours, underscoring the enterprise's labour-intensive nature. This variability may reflect differences in farm size, use of hired versus family labour, and the timing and intensity of farming operations. The use of organic pesticides (mean: 5.6 litres) and fertilizer (mean: 1381 kg) also shows high variability (CVs of 41% and 77%, respectively). The extremely high CV for fertilizer suggests inconsistent application rates, possibly due to varying availability, cost, or farmers' knowledge. This inconsistency directly impacts yield stability and overall productivity, highlighting the need for standardized recommendations and improved access to organic inputs.

**Table 3: Input and Output Levels of Organic Sesame Farming in Gwer East LGA**

| Variables | Max. | Min | Mean | SD | CV (%) |
|---|---|---|---|---|---|
| Output(kg) | 1000 | 167 | 506 | 190 | 38 |
| Seed(kg) | 18 | 4 | 7 | 2.6 | 37 |
| Labour (manhr) | 1064 | 96 | 327 | 211.7 | 65 |
| Pesticide (litre) | 12 | 1.1 | 5.6 | 2.3 | 41 |
| Fertilizer (kg) | 5000 | 167 | 1381 | 1063 | 77 |

Source: Field Survey (2025).

## Profitability of Organic Sesame Production

Table 4 presents the gross margin analysis, a key indicator of farm profitability. The analysis shows a positive gross margin of ₦62,409 per hectare, demonstrating that organic sesame production is economically viable and profitable for farmers in the study area.

The gross return of ₦93,828 is primarily driven by the average yield (506 kg) sold at ₦185/kg. The major cost component is labour (₦27,815/ha), accounting for about 88.5% of total variable costs, consistent with the labour-intensive nature of organic farming reported by Niggli (2020). Costs for seeds, fertilizer, and pesticides are relatively low, representing only 4.2%, 3.9%, and 2.3% of total variable costs, respectively.

The high profitability, despite low input costs, is a strong argument for promoting organic sesame production as a viable livelihood strategy. This finding corroborates studies by Akinola et al. (2020), who found that organic farming can be more profitable than conventional systems for smallholders due to premium prices and lower cash input costs. The gross margin of ₦62,409 per hectare represents a substantial return on investment, with a benefit-cost ratio of approximately 2.99 (i.e., ₦93,828/₦31,419), indicating that for every naira invested, the farmer earns almost three naira in return.

**Table 4: Gross Margin Analysis of Sesame Farmers**

| Variables | Average Quantity/ha | Average Unit Price | Value (₦/ha) |
|---|---|---|---|
| 1. **Gross Returns** | | | |
| Average yield (kg) | 506 | 185 | 93,828 |
| 2. **Inputs** | | | |
| Seed (kg) | 7 | 235 | 1643 |
| Fertilizer (kg) | 1381 | 1 | 1,228 |
| Pesticides (Lt) | 5.6 | 131 | 733 |
| Labour (manhour) | 327 | 85 | 27,815 |
| 3. Total variable cost/ha | | | 31,419 |
| 4. Gross margin/ha | | | 62,409 |

Source: Field Survey, (2025)

## Total Factor Productivity (TFP) Distribution and Indices

Table 5 and Table 6 present analyses of Total Factor Productivity (TFP), which measures the efficiency of converting all inputs (land, labour, capital) into output. Table 5 shows that the majority of farmers (63%) have a TFP index between 0.6 and 1.9, while only 6% achieve an index above 3.4. This indicates that most farms are operating at a low to moderate level of efficiency.

Table 6 provides summary statistics, revealing a mean TFP of 1.05 with a wide range from 0.60 to 5.80. The high standard deviation (1.9) and coefficient of variation (55%) confirm significant disparities in productive efficiency among the farms. This suggests substantial potential to improve overall productivity by enhancing the efficiency of less productive farmers, perhaps through improved extension services and technology transfer (Ogundari, 2019).

A TFP index of 1.0 indicates that the farm is converting inputs to output at the average efficiency level. The fact that the mean TFP is slightly above 1.0 (1.05) suggests that, on average, farms are operating at near-average efficiency, but the wide dispersion indicates that many farms are operating well below potential. The existence of farms with TFP indices above 3.0 demonstrates that higher efficiency is achievable, and the challenge lies in identifying and disseminating the practices that enable these top performers to achieve such high efficiency.

**Table5: Percentage Distribution of Total Factor Productivity Indices for Organic Sesame Farming**

| TFP Indices | Frequency | Percentage (%) |
|---|---|---|
| 0.6–1.9 | 76 | 63 |
| 2–3.3 | 36 | 31 |
| 3.4–4.7 | 4 | 03 |
| 4.8–6.1 | 4 | 03 |
| >6.1 | 0 | 0 |
| Total | 120 | 100 |

Source: Data Analysis, (2021)

Table 6: Total Factor Productivity Indices for Organic Sesame Farms

**Table6: Total Factor Productivity Indices for Sesame Farms.**

| Variable | Maximum | Minimum | SD | CV | % |
|---|---|---|---|---|---|
| TFP | 5.8 | 0.60 | 1.9 | 1.05 | 55 |

Source: Data Analysis (2021) SD = Standard Deviation. CV = Coefficient of Variation

**Determinants of Total Factor Productivity**

Table 7 presents the results of the double-log regression model analyzing the factors influencing TFP. The model is statistically significant (F-value = 5.963**) and explains 58.4% of the variation in TFP ($R^2 = 0.584$), indicating a good fit.

**Positive and Significant Determinants**: Farm size ($X_1$), household size ($X_7$), and farming experience ($X_8$) have positive and statistically significant coefficients. The positive coefficient for farm size (0.891) implies that a 1% increase in farm size is associated with a 0.891% increase in TFP, suggesting economies of scale in organic sesame production. This may reflect the ability of larger farms to use inputs more efficiently, access better management practices, and spread fixed costs over a larger area. This is consistent with economic theory and empirical studies, such as that of Awotide et al. (2020), which found that farm size positively influences agricultural productivity.

Household size (0.278) has a positive and significant coefficient, indicating that larger households are associated with higher TFP. This is likely due to the availability of family labour, which can be deployed flexibly and reliably during critical farming operations, thereby reducing transaction costs and ensuring timely task completion. Household members may also contribute management inputs and local knowledge that enhance decision-making.

Farming experience (0.258) has a positive and significant coefficient, suggesting that more experienced farmers achieve higher productivity. This finding is consistent with the human capital theory, which posits that experience enhances farmers' skills, knowledge, and ability to make optimal production decisions (Nwachukwu et al., 2021). Experienced farmers are likely better at timing planting, applying inputs, and managing pests and diseases, all of which contribute to higher TFP.

**Negative and Significant Determinants**: Surprisingly, seed quantity ($X_2$) and labour ($X_3$) have negative and significant coefficients. The negative coefficient for seed (-0.475) suggests that beyond a certain point, using more seed reduces TFP, indicating overcrowding and competition among plants for resources. This could be due to excessive seeding rates, which increase plant density and may reduce individual plant performance and overall yield. This finding underscores the importance of optimal seeding rates rather than simply increasing seed quantity.

The negative coefficient for labour (-0.587) indicates diminishing returns to labour, implying that after an optimal level, additional labour reduces productivity. This may reflect over-staffing or inefficient use of labour, where additional workers contribute little to production due to coordination problems or reduced marginal product. In the context of organic farming, which is labour-intensive, this finding suggests that improving labour quality and organization may be more important than increasing labour quantity.

**Insignificant Determinants:** Education ($X_4$), fertilizer quantity ($X_5$), and pesticide quantity ($X_6$) were not statistically significant. The non-significance of education may be due to its effect being captured by experience, or to the level of education being too basic to cause a significant difference in productivity. Alternatively, the measure of education (years of schooling) may not adequately capture the quality or relevance of education for farming activities. The non-significance of organic fertilizer and pesticide inputs may be due to improper application methods, high variability in the quality of these inputs, or the indirect, mediated effects of these inputs on TFP through factors such as soil health and pest pressure. It may also reflect that many farmers use these inputs at suboptimal levels or that the quantity used does not translate into quality improvements.

**Table7: Regression Estimates for Factors of Total Factor Productivity of Organic Sesame Production–Double Log Function.**

| Variables | Coefficients | StandardError | T-value |
|---|---|---|---|
| Constant | 2.937 | 1.023 | 2.872*** |
| Farmsize $X_1$ | 0.891 | 0.232 | 3.831*** |
| Seed $X_2$ | -0.475 | 0.175 | -2.715*** |
| Labour $X_3$ | -0.587 | 0.127 | -4.605*** |
| Education $X_4$ | 0.178 | 0.149 | $1.194^{NS}$ |
| Fertilizer $X_5$ | -0.001 | 0.073 | $-0.009^{NS}$ |
| Pesticide $X_6$ | 0.162 | 0.160 | $1.013^{NS}$ |
| House hold-size $X_7$ | 0.278 | 0.118 | 2.360** |
| Farming experience $X_8$ | 0.258 | 0.105 | 2.467*** |

F-value5.963**. $R^2$-value0.584

Source: Data analysis (2026) *** and ** NS = 1% and 5% level of significance. NS = Not Significant

**Constraints to Organic Sesame Production**

Table 8 ranks the major constraints faced by organic sesame farmers in the study area. The most severe constraint is poor access to credit (ranked 1st), which limits farmers' ability to invest in quality inputs and infrastructure. This is a pervasive issue in African agriculture and is particularly acute for organic farmers, who may need to make substantial investments in soil fertility-building and pest-management infrastructure before realizing benefits (Ojo et al., 2019). Access to credit was cited by 53 respondents as the most important constraint, accounting for 29.4% of all responses.

Poor access road network (ranked 2nd) and low market prices (ranked 3rd) are the next most significant constraints. Poor roads increase transportation costs and reduce market access, particularly during the rainy season when many rural roads become impassable. This constraint was cited by 44 respondents (24.4% of responses).

Poor market access also affects farmers' bargaining power, as they may be forced to accept lower prices from intermediaries due to limited marketing options. Low market prices for sesame grain were cited by 39 respondents (21.7% of responses), highlighting challenges related to price volatility and weak market linkages.

Other constraints include shortage of organic fertilizer (ranked 4th), scarcity of improved sesame seeds (ranked 5th), and poor storage facilities (ranked 6th). These findings highlight critical areas for intervention, including improving rural financial services, developing infrastructure, and establishing robust market linkages and input supply chains tailored to organic production. The relatively low ranking of pests and diseases suggests that farmers are managing these challenges or that they are not perceived as the most pressing constraints. The high cost of organic fertilizer, ranked 8th, may reflect that it is primarily sourced locally (e.g., animal manure) and may not be as expensive as synthetic alternatives, or that farmers are not fully accounting for the costs of labour and transport involved in sourcing organic fertilizer.

**Table8: Constraints to Organic Sesame Production**

| | Constraints | Frequency | Rank |
|---|---|---|---|
| i. | Poor access to credit | 53 | 1st |
| ii. | Poor access road network | 44 | 2nd |
| iii. | Low market prices for sesame grain | 39 | 3rd |
| iv. | Shortage of organic fertilizer | 18 | 4th |
| v. | Scarcity of improved sesame seed | 09 | 5th |
| vi. | Poor storage facility | 08 | 6th |
| vii. | Pests and diseases | 05 | 7th |
| viii. | High cost of organic fertilizer | 04 | 8th |

Source: Field Survey, (2021).

## CONCLUSION AND RECOMMENDATIONS

This study analyzed the economics and profitability of organic sesame production in Gwer East LGA of Benue State. Based on the findings, the following conclusions are drawn:
Organic sesame production is a financially viable enterprise in the study area. The high profitability, driven by decent yields and lower cash input costs, presents a strong case for its promotion as a sustainable livelihood option for smallholder farmers. The gross margin of ₦62,409 per hectare and benefit-cost ratio of 2.99 indicate that the enterprise is economically attractive.

The wide variation in input use and the low TFP indices for a majority of farmers indicate substantial potential for productivity growth through improved technical efficiency. This inefficiency is a significant hidden cost that reduces the profitability and sustainability of organic sesame production.

Organic Seseme productivity is driven more by scale (farm size, family labour) and experience than by the mere quantity of inputs. The negative coefficients for seed and labour suggest that promoting optimal input use is more important than promoting increased input quantity. Farmers should focus on improving the quality and timing of their inputs and management practices rather than simply increasing the number of inputs used.

Constraints identified in Organic Seseme farming are systemic, relating to infrastructure, market access, and finance. Addressing these is prerequisite to unlocking the full potential of organic sesame production in the region. The pervasive nature of these constraints suggests that a coordinated approach involving multiple stakeholders is needed to create an enabling environment for organic agriculture.

**Recommendations**

Based on the findings of this study, the following recommendations are proposed:

For Farmers:

1. Formalize and Strengthen Cooperatives: Farmers should actively strengthen their cooperative groups to enhance bargaining power for better input prices and sesame selling prices, facilitate bulk purchasing and marketing, and provide a unified platform for accessing government and NGO support. Strong cooperatives can also facilitate information sharing, joint investment in infrastructure, and quality control for organic certification.
2. Adopt Integrated Organic Practices: Farmers should be encouraged to adopt a more complete suite of organic practices through training. This should include the preparation and use of natural pesticides from local plants (e.g., neem seeds) and techniques like mulching to conserve soil moisture and suppress weeds. Training programs should be participatory and adapted to local conditions, drawing on indigenous knowledge and experiential learning.
3. Optimize Input Use: Given the evidence of diminishing returns, farmers should be trained on the optimal application rates for seeds and labour to avoid wastage and improve cost-effectiveness, thereby increasing the gross margin further. This may involve simple experiments and demonstrations to identify optimal practices.
4. Promote Market Linkages and Price Stability: The government, in partnership with the private sector, can help establish stable market linkages for organic sesame, potentially by connecting farmers with exporters or companies that value organic produce. Initiatives such as price stabilization funds or guaranteed minimum prices could protect farmers from price fluctuations. Efforts to promote organic certification and quality standards would also enhance market access and price premiums.
5. Facilitate Access to Organic Inputs: Development partners can support the development of local organic input supply chains, including the production and marketing of biopesticides, compost, and improved organic seeds. This would address the constraints related to input availability and quality.

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