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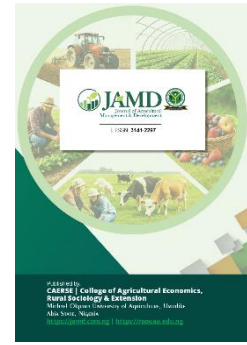
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## Productivity and Profitability of Garden Eggs Farming among Farmers in Isiala Ngwa South Local Government Area of Abia State, Nigeria

Simonyan, J.B. and Osondu, K.R.

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**Author(s) Affiliation(s):**

Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Nigeria

**Correspondence:**

Email: [simonyan.judith@mouau.edu.ng](mailto:simonyan.judith@mouau.edu.ng)  
[osondu.rosemary@mouau.edu.ng](mailto:osondu.rosemary@mouau.edu.ng)  
Phone: 2348063741940, 234806255776

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### ABSTRACT

Garden eggs are significant source of income for many smallholder farmers and contribute substantially to food security. Improving the productivity level will increase the profitability as well as its sustainability as a high value crop. This study investigates the productivity and profitability of garden eggs (*Solanum melongena*) farming in Isiala Ngwa South Local Government Area, Abia State, Nigeria. A multistage sampling procedure were used to select 120 garden eggs farmers used for the study. Data were collected through the aid of well-structured questionnaire. Methods of data analysis employed include descriptive statistics, total factor productivity (TFP) index, net return analysis, and ordinary least squares (OLS) regression. The findings showed that most (66.7%) of the garden egg farmers were male, with an average age of 42.8 years. The majority (94.2) were married and had 6-12 years of farming experience, with a mean household size of 4.7 and average monthly income of ₦180,833. Additionally, most farmers were members of cooperatives and had regular access to extension services. Further findings showed an average TFP of 1.919, indicating that farmers generate ₦1.92 in output for every ₦1 invested in inputs. The net profit per hectare is ₦144,739, demonstrating the economic viability of garden egg farming in the area. OLS regression results identified cost of seed, cost of herbicides, education, farming experience at 1% respectively, monthly income (10%), and access to extension contact (5%) as significant determinants of profitability of garden eggs production. The study recommends improving farmers' access to cheap herbicides and strengthening extension services to improve productivity and profitability of the farming communities.

### Introduction

Garden egg (*Solanum melongena*), a commonly grown vegetable in Nigeria, is crucial for household nutrition, generating income, and ensuring food security (Adeoye *et al.*, 2021). It serves as a vital part of traditional diets and is an essential cash crop for smallholder farmers. Nigeria ranks among the top producers of garden egg in Africa, with an estimated annual output exceeding 1.2 million metric tons, making a significant contribution to the vegetable sector (Food and Agriculture Organization (FAO), 2023). In Abia

State, especially in the Isiala Ngwa region, garden egg farming has become increasingly popular due to its suitability for the local climate, strong market demand, and relatively short production cycle (Okpara *et al.*, 2022).

The cultivation of garden eggs (*Solanum melongena*) holds the promise of becoming a lucrative venture; however, smallholder farmers in the Isiala Ngwa South Local Government Area (LGA) of Abia State encounter considerable obstacles that hinder its productivity. Many farmers view garden eggs cultivation as a risky endeavor because of production difficulties, which deters them from committing their limited resources to the growth. The main challenges faced include insufficient storage facilities, restricted access to funding, high expenses for chemical fertilizers, significant post-harvest losses, inadequate soil fertility, and frequent pest and disease outbreaks (Onu *et al.*, 2016). The attendants' effect of the production challenges includes low productivity rates, production inefficiencies, and decreased profitability, subsequently restricting the role of garden eggs farming in enhancing household income and contributing to local food security.

Although previous researches (Onu *et al.*, 2016; Abayomi *et al.*, 2017; Mangan *et al.*, 2017; Oreoritse, 2022; Ibe *et al.*, 2022) have investigated different dimensions of garden eggs cultivation across various regions, there is a lack of empirical data concerning productivity and profitability of garden eggs farmers in Isiala Ngwa South LGA. With the rising demand for garden eggs and their significance in local diets and markets, it is essential to evaluate the productivity, cost and returns, and factors impacting its profitability in this region. This study addressed this knowledge gap.

**Methodology**

The research was carried out in Isiala Ngwa South Local Government Area (LGA), located in Abia State, Nigeria, which has an estimated population of 199,000 and a density of 395 individuals per square kilometer (NPC, 2022). A multistage sampling approach was employed, with Isiala Ngwa South intentionally selected due to its significant involvement in garden egg farming. Three communities were randomly selected, subsequently leading to the choice of five villages within each community, and a total of eight farmers from each village, resulting in 120 respondents overall. Data collection was accomplished using structured questionnaire, and analyzed using descriptive statistics, total factor productivity, net return analysis, and ordinary least squares (OLS) regression.

The Total Factor Productivity (TFP) is specified as:

$$TFP = \frac{Y}{\sum P_i X_i} \tag{1}$$

Where,

TFP = total factor productivity,

Y = Output of garden egg

P<sub>i</sub> = unit price of i<sup>th</sup> variable input and

x<sub>i</sub> = quantity of i<sup>th</sup> variable input.

From cost theory,

$$AVC = \frac{TVC}{Y} \tag{2}$$

Where AVC = Average variable cost in naira (N). Therefore,

$$TFP = \frac{Y}{TVC} = \frac{1}{AVC}$$

As such, TFP is the inverse of the AVC

The interpretation of TFP index are as follows as used by Folorunso and Bayo (2020);

<b>Index</b>	<b>Interpretation</b>
(< 0.1)	Sub-optimal
(1.0 –1.09)	Optimal
(≥ 1.10)	Super-optimal

The net return model is defined as the difference between the total revenue (TR) and total cost (TC). It is specified thus:

$$NR = TR - TC \tag{3}$$

Total cost is the addition of the entire variable cost (VC) and fixed cost (FC) items:

$$TC = TVC + TFC \tag{4}$$

Total revenue is the total amount of money that a farmer received from the sale of garden eggs crop;

$$TR = \sum P_x Q_x \tag{5}$$

Where;

$P_x$  = price garden eggs crop sold (₦)

$Q_x$  = Quantity of garden eggs crop sold (kg)

$$GP = TR - TVC \tag{6}$$

$$R/N = \frac{GP}{TC} \tag{7}$$

$$\text{Gross Ratio (GR)} = TC/TR \tag{8}$$

GP = Gross profit (₦)

R/N = Return per naira invested

The generalized OLS model is given as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + e_i \tag{9}$$

Where,

Y = Profit (₦)

$X_1$  = Cost of Seeds (₦)

$X_2$  = Cost of Herbicide (₦)

$X_3$  = Cost of Labour (₦)

$X_4$  = Farm size (Ha)

$X_5$  = Household size (numbers)

$X_6$  = Age (years)

$X_7$  = Education (years),

$X_8$  = Monthly Income (₦),

$X_9$  = Farming experience (years),

$X_{10}$  = Extension contacts (Number)

$e_i$  = Error term

$\beta_0$  = coefficients

$\beta_1, \beta_{11}$  = parameters estimated

## Results and Discussion

### *Socioeconomic Characteristics of Garden Eggs Farmers in Isiala Ngwa South Abia State, Nigeria*

Table 1 showed the socio-economic characteristics of garden eggs farmers in Isiala Ngwa. The study reveals that 66.7% of the farmers are male, reflecting the demanding nature of garden eggs farming, this is consistent with the report obtained by Ibe et al. (2022). With an average age of 42.8 years, most farmers are in their productive middle age, enhancing their resource management (Barau et al., 2020; Chah et al. 2019). Marital status analysis shows that 94.2% are married, signifying the importance of taking up responsibilities and availability of family labour in reducing costs, as also noted by Chah et al. (2019). In terms of education, 66.7% of farmers have 6–12 years of schooling, with an average of 9.2 years, which can improve their ability to adopt innovative farming practices, as supported by Adeosun et al. (2022). The average household size of 4.7 persons indicates sufficient labour availability, supporting findings by Ibe et al. (2022). Additionally, farmers' average monthly income of ₦180,833.3, above the national minimum wage, supports the adoption of new technologies (Adeosun et al., 2022). With an average of 6.7 years of farming experience, the farmers possess significant expertise, aligning with Abiodun et al. (2019). However, 73.3% of the garden eggs farmers in the study area lack access to credit, a barrier due to collateral and risk concerns, truncated Barau et al.

(2020). While 52.5% have access to extension services, the limited coverage remains a challenge (Ibe *et al.*, 2022). Addressing these constraints is crucial to improving productivity in the area and Nigeria at large.

As indicated in Table 1, majority (57.5%) of the garden eggs farmers in the study area cultivated family land, 25.8% rented land, 11.7% inherited it, and 5.0% owned the land cultivated for the production of garden eggs in the study area. This aligns with the prevalence of communal land tenure structures, which may limit long-term investments in land developments (FMARD, 2024). Analysis of the farm size of the farmers shows that, most (65.0%) farmers cultivated less than 0.5 hectares, while 22.5% farmed between 0.5ha and 0.9ha, and 12.5% had farm sizes between 1ha and 5ha. The average farm size was 0.7 hectares, indicating predominance of small-scale production, consistent with Barau *et al.* (2020)

### **Productivity**

The result on the productivity of garden egg farmers in Isiala Ngwa LGA of Abia State is presented in Table 2. The result in Table 2 shows the mean, minimum and maximum values of the TFP of garden egg cultivation in Isiala Ngwa South, Abia State, highlighting notable discrepancies in productivity levels among farmers. The mean TFP of 1.919 indicates that, on average, farmers obtain ₦1.92 in output value for each ₦1 spent on inputs, suggesting a relatively efficient production system (Fare *et al.*, 2018). However, the lowest recorded TFP of 0.6742 points to certain farmers facing inefficiencies, likely a result of challenges such as restricted access to quality inputs, inadequate farm management techniques, or unfavorable environmental conditions (Ibe *et al.*, 2022). In contrast, the highest TFP of 3.9035 shows that some farmers attain high levels of efficiency, potentially due to superior agronomic practices, enhanced input usage, or economies of scale (Ogunniyi *et al.*, 2020).

### **Cost and Returns**

The cost and return, hence profitability of garden eggs production in the study area is presented in Table 3. The result on the cost and return analysis for garden egg farming revealed a total variable cost of ₦159,280 per hectare yearly, with fixed costs amounting to ₦5,422, amounting to a total cost of ₦164,702 per hectare. The primary cost components were labour (40.2%) and fertilizers (34.6%), reflecting trends identified by Onu *et al.* (2016), who noted that labour made up the largest portion of costs (57.6%). With total revenue of ₦309,442 per hectare, farmers earned a gross margin of ₦150,162 and a net profit of ₦144,739, which indicates that garden eggs farming is a profitable enterprise in the study area. These results support previous studies, such as those by Onu *et al.* (2016), which indicated profitability in garden egg farming (₦113,658 per hectare). Access to inputs, including fertilizers and labor-saving technologies, could enhance returns, encouraging rural economic growth (Adebayo & Daramola, 2018; Ogunniyi *et al.*, 2020).

### **Determinants of Profitability of Garden Egg Production**

The Ordinary Least Squares (OLS) regression model result is presented in Table 4. Double log functional form was chosen as the lead equation with the coefficient of determination of 0.6607. The result in Table 4 shows that 66.07 % of the variation in the net profit of garden eggs farmers can be explained by the explanatory variables included in the model. The F-statistic was statistically significant at the 1% probability level, suggesting a well-fitted model.

All the explanatory variables included in the model significantly determined the level of net profit obtained by the garden eggs farmers studied. The cost of herbicide had a significant effect on the net profit of garden egg production, with 12.83 increase in net profit for every unit of herbicide cost increase. This finding challenges the common belief that higher herbicide costs would reduce net profits. Given the crop's high socio-cultural and nutritional value, farmers may raise the price of garden eggs more than proportionally to herbicide cost increases (Ibe *et al.*, 2022). This is in contrast with earlier research by Ibe *et al.* (2022), which found that agrochemical use reduced garden egg profitability. The coefficient of labour is significantly signed at 1% level and negatively correlated with the net profit of garden egg. This suggests that as the cost of labour increases the farmers' level of net income declines.

Monthly income also positively influenced net profit at 10% level of significant, with a unit increase in income causing a 2.20 rise in net profit of garden egg farming by ₦47,152.96. This suggests that higher income enables farmers to make more investments in garden egg farming, thereby increasing yield and profitability. This aligns with the study of Adebayo and Daramola (2018), who posited the positive link between income and farm investment. Also, access to extension service showed a considerable positive effect

on profitability of garden eggs production in the study area, where an increase of one unit in extension service access raised net yield by 0.217 unit. This implies that increase in the farmers extension contact help them to adopt innovations and technologies that lead to garden egg productivity and profit maximization as well. This result is consistent with Adeyemo and Olayemi (2020), who established that regular extension contact offers farmers with critical production and marketing information, improving farm productivity and financial effects.

### Conclusion and Recommendations

The study concludes that garden egg production in Isiala Ngwa South LGA is profitable, with an average TFP of 1.919 and a net profit of ₦144,739 per hectare. Nevertheless, the observed variability in TFP among farmers points to differences in production.

- Strengthening extension services can provide farmers with up-to-date agronomic practices, leading to improved farm management and increased productivity.
- Implementing financial programs to support farmers can alleviate constraints related to input purchases, thereby enhancing production capacity
- Training farmers on the judicious use of herbicides can optimize weed control, potentially increasing yields and profitability.

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**Appendix**

**Table 1: Socioeconomic Characteristics of Garden Eggs Farmers in Isiala Ngwa South Abia State**

<b>Variables</b>	<b>Frequency (N =120)</b>	<b>Percentage (100%)</b>
<b>Gender</b>		
Male	80	66.7
Female	40	33.3
<b>Age</b>		
Below 40	47	39.2
40-60	70	58.3
Above 60	3	2.5
<b>Mean age 42.8</b>		
<b>Marital Status</b>		
Single	2	1.7
Married	113	94.2
Divorced	3	2.5
Widower	2	1.6
<b>Years of Education</b>		
<b>Mean= 9.2</b>		
6-12	115	66.7
Above 12	3	18.3
Below 6	2	15
<b>Household Size</b>		
Below 4	33	27.5
4 – 6	71	59.2
Above	16	13.3
<b>Mean household size 4.7</b>		
<b>Monthly income</b>		
Below ₦100,000	8	6.7
₦100,000 - ₦300,000	94	78.3
Above ₦300,000	18	15.0
<b>Mean = ₦ 180,833.3</b>		
<b>Cooperative Membership</b>		
Yes	8	6.7
No	112	93.3
<b>Access to Extension</b>		
Yes	63	52.5
No	57	47.5
<b>Farming Experience</b>		
Below 5	30	25.00
5 - 10	79	65.83
Above 10	11	9.20
<b>Mean = 6.7 years</b>		
<b>Access to Credit</b>		
Yes	32	26.7
No	88	73.3
<b>Access to Extension Service</b>		
Yes	63	52.5
No	57	47.5
<b>Land Acquisition</b>		
Owned	06	5.0
Rent/leased	31	25.8
Inherited	14	11.7
Family	69	57.5
<b>Farm size</b>		
Below 0 .5 Size (ha)	78	65.0
0.5 – 0.9 size (ha)	27	22.5
1 – 5 sizes (ha)	15	12.5
<b>Mean (0.7 ha)</b>		

Source: Field Survey, 2024

**Table 2: Total Factor Productivity (TFP) of Garden Egg Production.**

	Total Value Product (₦)	Input Cost (₦)	TFP
Mean	309,441.67	159280.42	1.919062
Minimum	90000	68500	0.6742
Maximum	1025000	380050	3.9035

Source: Field Survey data, 2024.

**Table 3: Cost and Return and Profitability of garden egg production in the study area**

Variable Cost	Amount (₦)/ha	Percentage
Seed	7,537	4.7
Labour	63,958	40.2
Rents	19,019	11.9
Herbicides	11,293	7.1
Fertilizers	55,104	34.6
Transportation	2,369	1.5
Total Variable Cost (TVC)	159,280	
Depreciation	5,422	
Total Fixed Cost	5,422	
Total Cost	164,702	
Returns		
Sales	309,442	
Total Returns	309,442	
Gross margin	150,162	
Net Profit	144,739	

Source: Field Survey data, 2024

**Table 4: OLS Regression Result of Determinants of Profitability of Garden Eggs in the Study Area**

Variable	Coefficient	Standard error	T -Value
Constant	2.56	0.19176	13.350 <sup>xxx</sup>
Seed	0.004	0.00043	9.304 <sup>xxx</sup>
Farm size	0.454	0.21943	2.069 <sup>x</sup>
Labour	-0.30	-0.05703	-5.260 <sup>xxx</sup>
Herbicides	12.83 <sup>3</sup>	1.80274	7.12 <sup>xxx</sup>
Age	0.31	0.02607	11.89 <sup>xxx</sup>
Farming Experience	0.08	0.02694	2.97 <sup>xxx</sup>
Education	0.01	0.00123	8.12 <sup>xxx</sup>
Income	47'52.96	21601.68	2.20 <sup>x</sup>
Household size	0.390	0.07457	5.26 <sup>xxx</sup>
No of Extension contact	0.21704	0.8466	2.56 <sup>xx</sup>
R <sup>2</sup>	0.6607		
Adjusted R <sup>2</sup>	0.6395		
F - Statistic	31.15		
No of Respondents	120		

Source: Field survey 2024, <sup>xxx</sup> significant at 1%, <sup>xx</sup> 5% = significant at and <sup>x</sup> =significant at 10%