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RESEARCHARTICLE

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Profitability Analysis of Sustainable Organic Cassava Production in Anambra State

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Abstract

Organic farming represents a sustainable agricultural system that emphasizes ecological balance, soil health, and biodiversity conservation. Organically produce cassava is presumed to gives higher incomes compare to the conventional production method, still fewer farmers engage in its production. The reason for this act is not clear to research consequently this study examined the analyse the profitability of sustainable organic cassava production in Anambra State. Nigeria, using a three-stage sampling technique. Awka South, Anaocha, Ogbaru, Anambra west, Idemili North and Ihiala Local Government Areas (LGAs) were purposively selected due to high number of maize farmers. Structured questionnaire was used to collect data: socioeconomic profile, organic farming practices, cost and return on organic cassava farming and constraints to organic cassava production. From each LGA, two villages were randomly selected. Ten farmers were randomly selected from each village. Twenty farmers were sampled per LGA, totaling 120 farmers. The result showed majority (55.8%) were female with (43.3%) married and majority (41.7%) had secondary education. The mean age of the farmers was (41years). Majority **(**77.5%) had household size of ≤3 and mean experience **(**9.6). Majority of the farmers used organic manures (60%), integrated pest control (65.8), natural pesticides (72.5%) compost manure (60) manual or mechanical weed (85), disease resistant varieties (65%). The Variable Cost was 761,700 and the Revenue was 4,450,000 gave a total of 3,279,500 profit per hectare. Constraints faced by farmers were low capital, poor pricing, inadequate and high cost of farm inputs. The study recommends improved farmer access to input and better pricing of products through strengthening institutional support.

KEYWORDS
Profitability analysis, Smallholder farmers, Sustainable cassava, Production

1 |INTRODUCTION

Agriculture remains the backbone of Nigeria's economy, providing employment for the majority of the population despite its declining contribution to foreign exchange earnings (Nnanna et al., 2014). Nigeria's diverse climatic conditions support the production of a wide range of food and cash crops (Ajayi & Olutumise, 2018). Staple food crops produce in Anambra include cassava, yams, maize, cocoyam, rice, millet, sorghum, cowpeas, and a variety of fruits and vegetables, while commercial farming is limited to a few farmers; majority still practice subsistence farming (Mary & Edwin, 2016; Olutumise et al., 2021). Among these crops, cassava, cocoyam, yam, rice, sorghum, groundnuts, oil palm, and cocoa are particularly important for food security and income generation, but the crops were majorly produced using conventional method and neglecting the sustainable practices that were eco-friendly.

Cassava (Manihot esculenta Crantz) stands out as one of Nigeria's most important crops. Nigeria is currently the largest producer and exporter of cassava in the world, accounting for about 77% of global exports (Olutosin & Barbara, 2019). The crop is cultivated in all ecological zones of Nigeria, with planting possible year-round depending on moisture availability. The peak

planting season is April to May, and mixed cropping is the most common production system. Its roots and leaves serve as essential calorie sources for rural households, while also providing income opportunities. Globally, cassava is consumed by more than 600 million people, especially in Africa where it plays a central role in household diets (Nwachukwu, 2020). Its resilience tolerance to low soil fertility, drought, pests, and diseases makes it a crop of choice for poor farmers in marginal conditions (Joana, 2016). Cassava is rich in carbohydrates, vitamins, and minerals, though its nutrient composition varies depending on variety, soil conditions, and cultivation environment. Beyond food, cassava is highly versatile; its starch derivatives are used in confectionery, sweeteners, textiles, paper, biodegradable products, pharmaceuticals, adhesives, and animal feed (Sivalee et al., 2019).

In Nigeria, crops contribute about 85% to agricultural GDP, with cassava among the leading staples alongside yam, rice, sorghum, and millet (NEEDS, 2004). More than 90% of production is by smallholder farmers cultivating less than two hectares (Akerele et al., 2018). Cassava has been identified as having high poverty-reduction potential due to its relatively low production costs and its role in enhancing food security (Apata, 2019). Historically, cassava is believed to have originated in Brazil and was introduced into West Africa by Portuguese traders. Today, numerous cultivars exist, varying in root size, color, branching habit, maturity period, and hydrocyanic acid content. Cassava foodstuffs are an integral part of Nigerian household diets, consumed daily by both poor and non-poor households. The growing demand for cassava products in urban and international markets has shifted cassava from a subsistence crop to a significant income-generating commodity**.** According to FAO (2018), cassava plays a vital role in rural development, poverty alleviation, economic growth, and food security. Nigeria's dominance in global cassava production has been driven largely by expansion of cultivated land rather than yield improvements (Ezedinma et al., 2006; Angba & Iton, 2020).

Organic farming represents a sustainable agricultural system that emphasizes ecological balance, soil health, and biodiversity conservation. Instead of synthetic chemicals, it employs natural inputs and ecological processes to maintain soil fertility and control pests, but fewer farmer engages in it production. It is presumed that organic production is profitable, but the participation of fewer farmer in its production challenges its profitability. According to Rahmann et al. (2018), organic agriculture is a production system designed to safeguard the health of soils, ecosystems, and people by relying on biodiversity, ecological cycles, and locally adapted practices rather than harmful external inputs. In the case of cassava (Manihot esculenta), organic farming entails cultivation without synthetic fertilizers, pesticides, or genetically modified organisms (GMOs). Instead, practices such as crop rotation, compost application, and biological pest management are adopted to enrich soil fertility, reduce pest and disease pressure, and promote both environmental sustainability and healthier food production. The objectives of the study were to describe the socioeconomic characteristics of organic cassava farmers in the study area; identify the types of organic farming practices; estimate the profitability of the organic cassava farmers and ascertain the constraints associated with the organic and sustainable cassava production in the study area.

2 MATERIAL AND METHOD

2.1. Study Area

The research area for this study was Anambra State; Nigeria Anambra State has 21 local government areas. The population of the study comprised of all the registered cassava farmers in Anambra State.

2.2. Data Source and Method of Collection

For this study, a three-stage sampling technique. was employed. In the first stage six Local Government Areas (LGAs): Awka South, Anaocha, Ogbaru, Anambra west, Idemili North and Ihiala, were purposively selected due to high number of maize farmers. From each LGA, two villages/ communities were randomly selected. Ten farmers were then randomly selected from each village. Twenty farmers were sampled per LGA, totaling 120 farmers. Structured questionnaire was used to collect data on socioeconomic profile, organic farming practices, cost and return on organic cassava farming and constraints to organic cassava production.

2.3. Analytical Technique

To achieve the study's objectives, the data was analyzed using various statistical techniques: Objective (i, ii & iv) was achieved using descriptive statistics, such as frequency, percentage and mean. Objective (iii) Costs and returns associated with cassava production was analyzed using Net farm income estimate (Budgeting) as follows (Akerele et al., 2018):
NFI = TR – (TVC + TFC) Where;
NFI = Net Farm Income
TR = Total Revenue
TFC = Total Fixed Cost
TVC = Total Variable Cost

3 RESULTS AND DISCUSSION

3.1. Socioeconomic Characteristics of Organic Cassava Farmers

The socioeconomic profile of organic cassava farmers in the study area reveals several important insights.

3.2. Field Study 2025

3.2.1. Sex Distribution

The study shows that 55.8% of farmers are female, while 44.2% are male, suggesting that cassava farming is predominantly female-driven. This is consistent with earlier studies (FAO, 2018; Akinola & Adeyemo, 2013), which emphasize the central role women play in root and tuber crop production across Sub-Saharan Africa. Women's dominance in cassava farming highlights their contribution to household food security and income generation. However, it also reflects the gendered nature of agriculture, where women are often engaged in labor-intensive but small-scale farming with limited access to resources such as land, credit, and extension services.

3.2. Age Distribution (Years)

Most farmers fall within the 31–40 years age group (42.5%), followed by 51–60 years (19.2%), with a mean of 41 years. This indicates that cassava farmers are in their economically active and productive age bracket, which is advantageous for labor-intensive organic farming. Younger and middle-aged farmers are also more likely to adopt innovative agricultural practices compared to older farmers (Oladejo, 2020). The implication is that the sector benefits from a relatively youthful workforce capable of sustaining cassava production and integrating improved organic technologies.

3.3. Marital Status

The majority of respondents are married (43.3%), followed by singles (35.8%) and widows/widowers (20.8%). Being married can positively influence farming, as family members may provide labor and emotional support. The high proportion of widows and widowers further underscores cassava's role as a safety net for vulnerable groups, especially women-headed house-holds.

3.4. Household Size

Most households are small, with 77.5% having 0–3 members and a mean of 2 persons per household. This suggests that family labor availability is limited, which may affect labor-intensive tasks such as weeding, land preparation, and harvesting. Consequently, farmers may depend more on hired labor, which could raise production costs. This finding contrasts with studies in rural Nigeria where larger household sizes are often an advantage in smallholder farming (Okoye et al., 2021).

3.5. Educational Status

A significant proportion of farmers attained secondary education (41.7%), followed by primary (30.8%) and tertiary (27.5%). This relatively high literacy level is advantageous, as education enhances awareness, access to information, and willingness to adopt improved organic practices. It also indicates that farmers can better engage with extension services, market information, and record-keeping (Nnadi & Akwiwu, 2008).

3.6. Farming Experience (Years)

Farmers have an average of nearly 10 years of experience in cassava farming, with many having between 6–15 years of experience (68.3%). This suggests a deep reservoir of indigenous knowledge and practical expertise in cassava cultivation. Experienced farmers are often more risk-averse but are also capable of integrating new technologies when convinced of their benefits. Such experience strengthens resilience against production risks.

3.7. Farm Size (ha)

Farm sizes are generally small, averaging 0.99 hectares, with most farmers cultivating between 0.1–1.5 ha. This highlights the smallholder nature of cassava farming, with limited opportunities for large-scale commercial production. Small farm sizes may constrain productivity and profitability, but they are consistent with the subsistence orientation of farming in rural Nigeria. The small scale also implies that interventions aimed at scaling production would require collective approaches, such as cooperatives or farmer groups, to overcome economies of scale challenges. The findings from this study indicate that organic cassava farming is female dominated, small-scale, and practiced mainly by middle-aged, moderately educated farmers with substantial farming experience. While this profile shows potential for growth, especially given the relatively high education levels and farming experience, several challenges persist (Onoja et al., 2021). Small household sizes and limited farm sizes suggest constraints in labor availability and land access. These limitations may hinder expansion and adoption of more labor- or land-intensive innovations. Nevertheless, the predominance of women presents an opportunity for gender-sensitive agricultural policies that empower female farmers with access to credit, training, and inputs. The moderate education level among farmers is a positive factor, as it can enhance the adoption of modern and sustainable agricultural practices. Policymakers and extension agents can leverage this to promote the uptake of organic inputs, better soil management techniques, and improved cassava varieties (Ani et al., 2019). Finally, the relatively young average age (41 years) and significant farming experience provide a strong foundation for productivity growth, provided that enabling conditions such as access to land, credit, extension services, and markets are strengthened.

3.8. Organic Farming Practices among cassava farmers

The data in Table 2 shows the extent of adoption of various organic farming practices among cassava farmers:

3.9. Field Study 2025

3.9.1. Use of Organic Manures

The table above shows that 60% of farmers apply organic manures, while 40% do not. This indicates a moderate level of organic manure adoption, suggesting that while many farmers recognize its benefits, access and availability might limit wider use.

3.10. Integrated Pest Control

The result shows that 65.8% of farmers use integrated pest control, compared to 34.2% who do not. This reflects a fairly high adoption, showing awareness of environmentally friendly alternatives to synthetic pesticides.

3.11. Natural Herbicides

The result shows that 72.5% of respondents rely on natural herbicides, while 27.5% do not. This is a strong indicator that most farmers avoid synthetic chemicals, consistent with organic principles.

3.12. Mixed Cropping

The Table 1 above shows that 66.7% practice mixed cropping, while 33.3% do not. This aligns with traditional cassava farming systems in Nigeria, where intercropping is used to diversify income and manage risks.

3.13. Use of Compost

The Table 1 shows that 60% make use of compost, while 40% do not. This mirrors the findings on organic manure, reinforcing that organic nutrient management is common but not universal.

3.14. Crop Rotation and Intercropping

The Table 1 shows that 75% of farmers practice crop rotation or intercropping, while 25% do not. This high adoption rate reflects sustainability efforts, as crop diversification helps maintain soil fertility and reduce pest/disease pressure.

3.15. Manual or Mechanical Weeding

The result indicates that 85% of farmers rely on manual/mechanical weeding, compared to 15% who do not. This is the most widely adopted practice, suggesting that weed control is still predominantly labor-intensive in organic cassava farming.

3.16. Disease-Resistant Cassava Varieties

The Table 1 shows that 65% of farmers use disease-resistant cassava varieties, while 35% do not. This shows that improved varieties are fairly widespread, but some farmers may lack access or awareness. The results demonstrate that cassava farmers in the study area have embraced a wide range of sustainable farming practices that lead to the production of organic cassava, though the level of adoption varies. The high adoption of manual/ mechanical weeding (85%), crop rotation/intercropping (75%), and natural herbicides (72.5%) reflects reliance on low-cost, environmentally friendly, and traditional methods that align with organic principles. Manual weeding, though labor-intensive, remains the dominant practice due to limited mechanization and farmers' avoidance of synthetic herbicides. Similarly, mixed cropping (66.7%) and integrated pest control (65.8%) demonstrate farmers' preference for practices that enhance biodiversity, minimize pest outbreaks, and improve resilience. These practices are consistent with organic farming objectives and with prior studies highlighting intercropping as a risk management strategy in cassava-based systems (Ojo & Adebayo, 2012).

Table 1: Socioeconomic characteristics of organic cassava farmers

Variables	Frequency (120)	Percentage (%)	Mean
Sex			
Male	53	44.2	
Female	67	55.8	
Age (Years)			
21-30	21	17.5	
31-40	51	42.5	41
41-50	15	12.5	
51-60	23	19.2	
61-70	10	8.3	
Marital Status			
Single	43	35.8	
Married	52	43.3	
Widow/widower	25	20.8	
Household size			
0-3	93	77.5	2
4-7	27	22.5	
Educational Status			
Primary	37	30.8	
Secondary	50	41.7	
Tertiary	33	27.5	
Farming experience			
1-5	26	21.7	
6-10	42	35.0	9.6
11-15	40	33.3	
16-20	12	10.0	
Farm size (ha)			
0.1-0.5	39	32.5	0.99
0.6-1.0	20	16.7	
1.1-1.5	38	31.7	
1.6-2.0	23	19.1	

The moderate adoption of organic manures (60%) and compost (60%) suggests challenges in access, production, or labor required for their preparation and application. Organic fertilizers are crucial for improving soil fertility and sustaining productivity; however, their use may be limited by inadequate knowledge, lack of organic input markets, or higher labor requirements compared to chemical fertilizers. The use of disease-resistant cassava varieties (65%) indicates that many farmers recognize the importance of genetic solutions to pest and disease pressures. However, the fact that more than one-third of farmers still do not use such varieties suggests gaps in extension delivery, availability of planting materials, or farmers' conservatism toward adopting new varieties.

Table 2: Organic Farming Practices among cassava farmers

Variables	Frequency (120)	Percentage (100%)
Use of organic Manures		
Yes	72	60
No	48	40
Integrated pest control		
Yes	79	65.8
No	41	34.2
Natural pesticides		
Yes	87	72.5
No	33	27.5
Mixed cropping		
Yes	80	66.7
No	40	33.3
Use of compost		
Yes	72	60
No	48	40
Crop rotation and intercropping		
Yes	90	75
No	30	25
Manual or mechanical weed		
Yes	102	85
No	18	15
Disease resistant cassava varieties		
Yes	78	65
No	42	35

4. Field study 2025

4.1. Total Variable Cost (TVC)

The major variable cost items were labor (₦146,000), insecticides (₦140,900), herbicides (₦161,800), and cassava cuttings (₦176,000). These account for a significant proportion of recurrent expenditure.

4.2. Total Fixed Cost (TFC)

This includes expenses on tools and equipment such as cutlass, hoe, basin, knife, wheelbarrow, file, head pan, and land rent. Land rent (₦280,000) constitutes the largest fixed cost component.

4.3. Total Cost (TC)

This is the sum of variable and fixed costs.

4.4. Total Revenue (TR)

This revenue was generated from the sale of cassava tubers (₦3,150,000) and cassava stems (₦1,300,000), showing that both the primary product and by-products are economically valuable.

4.5. Net Farm Income (NFI = TR – TC)

This indicates that cassava farming under organic practices is highly profitable, as the revenue far exceeds the cost of production. The findings reveal that organic cassava farming is a profitable enterprise in the study area, yielding a net farm income of ₦3.28 million per production cycle. This profitability is driven largely by the strong market value of cassava tubers and stems, which together contribute significantly to farm revenue.

The relatively high variable costs (₦761,700) highlight the resource-intensive nature of cassava production, particularly in terms of labor and planting materials. Labor is a dominant cost factor due to the manual nature of farm operations such as weeding, land preparation, and harvesting, consistent with earlier studies (Nwajiuba & Akinsanmi, 2020). Similarly, cassava cuttings account for a large share of recurrent costs, reflecting the challenge of sourcing quality planting materials.

On the fixed cost side, land rent (₦280,000) is the most significant expense, underscoring the constraints faced by farmers who do not own land. Other equipment such as hoes, cutlasses, and wheelbarrows involve relatively smaller but essential investments for continuous farming.

The impressive revenue performance (₦4.45 million) demonstrates the strong market demand for cassava and its by-products. Cassava stems in particular, often considered a secondary product, generated ₦1.3 million, suggesting that farmers benefit from diversified revenue streams. This aligns with the findings of Otekunrin et al. (2019), who emphasized that cassava by-products can significantly boost farm profitability.

The high net returns also suggest that despite the relatively small average farm size (0.99 ha, from Table 1), organic cassava farming can generate substantial income if well managed. This profitability reinforces cassava's role as a key food security and income-generating crop for rural households.

4.6. Constraints Encountered by the Organic Cassava Farmers

The results from Table 4 reveal that organic cassava farmers face multiple interrelated production and market constraints that undermine their profitability and sustainability.

4.7. Low Capital

A majority of respondents strongly agreed (45.0%) or agreed (31.7%) that low capital is a major constraint.

This indicates that inadequate financial resources limit farmers' ability to invest in farm inputs, mechanization, and expansion. Limited access to credit further compounds the challenge, leaving farmers dependent on personal savings or informal lending.

Table 3: Profitability of the organic cassava farmers

Item	Quantity	Unit Price (₦)	Total (₦)
Variable Cost			
Labor	Man day		146,000
Insecticides	Kg		140,900
Herbicides	Kg		161,800
Cassava cuttings	220 bundles		176,000
Miscellaneous			137,000
Total Variable Cost (TVC)			761,700
Fixed cost			
Land rent	Ha		280,000
Cutlass			20,000
Hoe			23,600
Basin			18,200
Knife			12,000
Wheelbarrow			30,000
File			10,000
Head pan			15,000
Total Fixed Cost (TFC)			408,800
Total Cost (TC) (TFC+TVC)			1,170,500
Revenue			
Sales from tuber	2100 bags	15000	3,150,000
Sales from Stems	650 bundles	2000	1,300,000
Total Revenue (TR)			4,450,000
NFI = (TR-TC)			3,279,500

4.8. Distance from the Farm

The responses are more evenly distributed, with 30.8% strongly agreeing, 29.2% agreeing, and 28.3% disagreeing. This suggests that while some farmers struggle with long distances to their farms leading to high transportation costs and reduced efficiency others are relatively unaffected, possibly due to better farm location or infrastructure.

4.9. Poor Pricing

About 75% (Strongly Agree + Agree) reported poor pricing as a serious issue. This reflects the weak bargaining power of smallholder farmers, coupled with exploitation by middlemen and unstable market conditions. Poor pricing discourages large-scale production and reduces profitability.

4.10. Attack of Pests and Diseases

More than three-quarters of respondents (76.7%) strongly agreed or agreed that pest and disease infestation is a major challenge. This problem threatens yield, quality, and farm income, especially as organic farmers have limited access to synthetic agrochemicals and must rely on organic alternatives, which are often less effective or costly.

4.11. Inadequate Farmland

With 66.7% strongly agreeing or agreeing, farmland scarcity is a notable problem. Increasing population pressure, land fragmentation, and competition for land use reduce cassava farmers' access to sufficient arable land.

4.12. Inadequate Storage Facilities

Nearly 73% identified poor storage facilities as a key constraint. Cassava is highly perishable, and without effective storage, post-harvest losses are high. This reduces income and discourages investment in larger production volumes.

4.13. Inadequate Extension Services

About 81.7% of respondents strongly agreed or agreed that extension services are inadequate. The lack of regular training and advisory support means farmers are less exposed to improved organic practices, technologies, and market information. This gap limits productivity and competitiveness.

4.14. Lack of Improved Cassava Varieties

With 71.7% in agreement, the absence of improved cassava varieties tailored for organic systems is another constraint. Traditional varieties may have lower yields, poor resistance to pests/diseases, or longer maturity periods, all of which affect productivity.

Table 4: Constraints Encountered by Organic Cassava Farmers (Likert Scale)

Variables	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
Low capital	45.0	31.7	16.7	6.6
Distance from the farm	30.8	29.2	28.3	11.7
Poor pricing	40.0	35.0	16.7	8.3
Attack of pest and disease	50.0	26.7	18.3	5.0
Inadequate farm land	35.0	31.7	21.7	11.6
Inadequate storage facilities	47.5	25.0	21.7	5.8
Inadequate extension services	49.2	32.5	8.3	10.0
Lack of improved cassava varieties	40.0	31.7	16.7	11.6
High cost of inputs	50.0	26.7	15.0	8.3

4.15. High Cost of Inputs

The most severe constraint highlighted was high input cost, with 76.7% strongly agreeing or agreeing. Organic inputs such as compost, bio-pesticides, and organic fertilizers are expensive and not always readily available. This raises the cost of production and reduces profitability.

In total the results suggest that while all listed constraints significantly affect organic cassava farming, financial limitations (low capital and high input costs), pest and disease problems, and inadequate extension services are the most critical. These findings are consistent with previous studies (Ezeh et al., 2012; Otekunrin et al., 2019), which emphasized that resource limitations and weak institutional support are major barriers to smallholder cassava farming in Nigeria.

5. Recommendations

1. Access to Credit: Government and financial institutions should improve farmers' access to affordable loans and grants to overcome capital limitations and reduce dependence on informal financing.

2. Input Support: Subsidized or community-based organic input supply systems should be developed to reduce the high cost and scarcity of organic fertilizers, compost, and improved cassava cuttings.

3. Extension Services: Strengthening agricultural extension delivery is crucial to enhance farmers' knowledge of modern organic practices, pest and disease management, and value addition.

4. Research and Innovation: Research institutes should prioritize the development and dissemination of disease-resistant and high-yielding organic cassava varieties suitable for diverse agroecological zones.

5. Infrastructure Development: Investment in rural roads, storage facilities, and processing centers will reduce post-harvest losses, improve market access, and enhance farmers' bargaining power.

6. Women Empowerment: Since cassava farming is largely female-driven, targeted policies such as training programs, women-focused cooperatives, and gender-sensitive credit schemes should be promoted.

7. Market Linkages: Strengthening cassava value chains and linking farmers directly to processors and industrial users will help stabilize prices and increase profitability.

Conclusion

This study examined the analyses the profitability of sustainable organic cassava production in Anambra State. Nigeria. Findings revealed that organic cassava farming is predominantly practiced by middle-aged, moderately educated, and experienced smallholder farmers, with women constituting the majority. The study further established that farmers adopt a wide range of organic practices such as composting, crop rotation, biological pest control, and mixed cropping, which contribute to environmental sustainability. Despite relatively small farm sizes, organic cassava production proved highly profitable, generating a net farm income of ₦3.28 million per hectare. However, challenges such as limited capital, high cost of inputs, pest and disease infestations, inadequate extension services, poor storage facilities, and unfavorable market conditions continue to constrain productivity and profitability. Overall, the study demonstrates that organic cassava farming holds significant potential for improving household incomes, enhancing food security, and promoting sustainable agriculture in Nigeria if the identified constraints are addressed.

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