Profitability Analysis of "Ugu" (Fluted Pumpkin) Production among Small-Scale Farmers in Owerri Agricultural Zone, Imo State, Nigeria.

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ABSTRACT

This study analyzed the profitability of fluted pumpkin ("Ugu") production among small-scale farmers in the Owerri Agricultural Zone of Imo State, Nigeria. Specifically, the study examined the socio-economic characteristics of fluted pumpkin farmers, estimated the costs and returns associated with production, determined the factors influencing profitability, and identified the major constraints affecting profitable production. Primary data were collected from 60 respondents using structured questionnaires and analyzed using descriptive statistics, gross margin analysis, benefit-cost ratio, and multiple linear regression analysis. The findings revealed that majority of the farmers were female, within the economically active age group, fairly educated, experienced in farming, and operated on small-scale holdings. The cost and return analysis showed that fluted pumpkin production was profitable with a gross margin of ₦370,500 per hectare, net farm income of ₦360,400 per hectare, and a benefit-cost ratio of 2.7, indicating that every ₦1 invested yielded ₦2.70. Regression analysis revealed that educational level, household size, farming experience, quantity of fertilizer used, and farm size positively influenced profitability, while age and cost of planting materials negatively affected profitability. Major constraints identified included high cost of inputs, poor storage facilities, inadequate credit access, high transportation costs, high labour costs, and pest and disease infestation. The study therefore concludes that fluted pumpkin production is a profitable enterprise with significant potential for income generation. It was recommended among others that government should provide subsidized farm inputs such as seeds, fertilizers, agrochemicals, and farm tools to reduce the high cost of production and improve farmers' profitability.

Keywords: Profitability, Fluted Pumpkin, Small-Scale Farmers, Owerri Agricultural Zone, Imo State.

INTRODUCTION

Agriculture remains an important sector in the Nigerian economy, providing food, employment, income, and raw materials for industrial development. In rural areas especially, small-scale farming constitutes the major livelihood activity for millions of households. Among the various agricultural enterprises practiced in Nigeria, vegetable production occupies an important position because of its contribution to household nutrition, income generation, and food security (Mukaila, *et al.,* 2022). One of the most widely cultivated indigenous vegetables in southeastern Nigeria is Telfairia occidentalis, commonly known as fluted pumpkin or "ugu." The crop belongs to the family Cucurbitaceae and is highly popular for its edible leaves and seeds, which are rich in proteins, vitamins, iron, and essential minerals (Ikwuazom *et al.,* 2026)

Fluted pumpkin is mostly cultivated in Southern Nigeria due to favorable climatic conditions and high consumer demand. The crop is a key component of many traditional dishes and has gained increasing acceptance for its nutritional and medicinal properties. In addition to being consumed at the household level fluted pumpkin production has become an important commercial enterprise among smallscale farmers because of its relatively short maturity period, continuous harvesting potential, and high market demand throughout the year (Kareem *et al.,* 2022). Small-scale vegetable farmers according to FAO (2024) are farmers who cultivate vegetables on relatively small areas of land ranging from less than one hectare to about 10 hectares mainly using family labour

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and limited resources for production and household livelihood. They often produce vegetables for both household consumption and local markets. In Imo State, particularly within the Owerri Agricultural Zone, fluted pumpkin production constitutes a major source of income for rural farmers and contributes significantly to local vegetable markets. Despite the economic importance of fluted pumpkin production, small-scale farmers continue to face numerous production and financial challenges that affect profitability. Rising costs of farm inputs such as seeds, fertilizers, agrochemicals, and labor have increased production expenses, while poor access to credit facilities, inadequate extension services, pest and disease incidence, and fluctuating market prices further constrain farmers' returns (Bassey *et al.,* 2026). In addition, the perishability of vegetables and inadequate storage and transportation facilities often lead to post-harvest losses, thereby reducing farm income and productivity (Kunwar *et al.,* 2024).

Profitability analysis in agricultural production is essential because it provides information on the economic viability of farming enterprises and helps determine whether farmers are efficiently utilizing available resources. According to Obiesie *et al.,* (2022), Profitability means how well a business can make earnings or profit over a certain period compared to its sales, assets, or the money invested by owners. Assessing profitability also assists policymakers, investors, extension agents, and development organizations in formulating strategies aimed at improving agricultural productivity and farmers' welfare. Several studies have examined the economics and profitability of fluted pumpkin production in different parts of Nigeria. For instance, studies conducted by Obiekwe (2021) & Uwa *et al* (2026) reported that fluted pumpkin production is profitable among smallholder farmers, with favorable benefit-cost ratios and positive net farm incomes but these studies failed to capture other determinants affecting fluted pumpkin production other than socio economic factors. Other studies have investigated resource-use efficiency and profit functions of dry-season fluted pumpkin production among farmers in Nigeria such as studies conducted by Utobo *et al.,* (2023) and Utobo *et al.,* (2022). However, despite their contributions, important gaps still exist in these studies. These studies concentrated on broad regional analyses across Southeastern Nigeria without providing location-specific evidence for the Owerri Agricultural Zone. Further -more, some of the studies focused specifically on dry-season production systems, thereby limiting understanding of the overall profitability conditions faced by farmers operating under varying production seasons. In addition, some of these studies emphasized resource-use efficiency and production functions while giving limited attention to the detailed cost-return structure. This study therefore addressed these gaps. The broad objective of this study was to determine the profitability analysis of fluted pumpkin production among small-scale farmers in the Owerri Agricultural Zone of Imo State, Nigeria. Specifically, the study aims to examine the socioeconomic characteristics of fluted pumpkin farmers, estimate the costs and returns associated with production, ascertain the determinants of profitability in fluted pumpkin production, and identify the major constraints affecting profitable production in the area. The findings of the study are expected to contribute to existing literature and provide useful information for policymakers, agricultural planners, extension agencies, and farmers toward improving vegetable production and enhancing rural livelihoods in Nigeria.

MATERIALS AND METHODS

This study was carried out in Owerri Agricultural Zone of Imo State which is made up of nine (9) Local Governments Areas (LGAs) out of the twenty seven (27) LGAs of Imo State. The choice of Owerri Agricultural Zone was due to the high number of vegetable farmers in the area. A multi stage sampling technique was adopted in the selection of respondents. In the first stage, five (5) Local Government Areas were randomly selected from the zone. Secondly, two communities were selected from each of the Local Government Areas. The list of registered vegetable farmers in each of the sampled communities was collected from ADP Extension officers. This formed the sampling frame for the selection of respondents in the study Area. From the list, six vegetable farmers from each of the ten communities were randomly selected to give a sample size of sixty (60) respondents for the study.

Analytical Tools and Model Specifications.

Cost and return analysis was applied to evaluate the profitability of vegetable production using the formular:

$GM = TR - TVC$ … (1)

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$TC = TVC + TFC$ … (2)

$NFI = TR - TC$ … (3)

$BCR = TR/TC$ … (4)

Where: TR = Total revenue, TVC = Total variable cost, TC = Total cost (₦), TFC = Total fixed cost (depreciation on fixed assets), and BCR = Benefit Cost Ratio (Used to determine the profitability of fluted pumpkin production. If the BCR > 1, it is profitable

If the BCR < 1, it is not profitable)

The Multiple Linear Regression Model

Multiple linear regression analysis is a model useful for estimating the relationship between dependent and independent variables. A multiple linear regression model was used to ascertain the determinants of profitability in fluted pumpkin production in the study area. The estimation model generally formed is stated below as:

$Q = \beta_0 + \beta_n X_n$ ..... (5)

Based on the general estimation model above, the equation for this research is stated as follow:

$Q = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X3 + \ldots + \beta_8 X_8 + \mu$ ……. (6)

Where:

Q = Output of Vegetable (₦)

β_0 = Constant

X_1 = Educational Level of Farmers (Years)

X_2 = Household size (number)

X_3 = Farming Experience (Years)

X_4 = Age of farmers (Years)

X_5 = Harvesting frequency (Number of times)

X_6 = Cost of Planting Material (₦)

X_7 = Quantity of fertilizer (kg)

X_8 = Farm Size (ha)

$\beta_1 - \beta_8$ = Regression Coefficients

μ = Random error term

The linear regression equation above is transformed using a Natural logarithm (ln). Natural logarithm is used to analyze the linear relation between the independent and dependent variables to avoid biasness of linear regression estimates (Tenriawaru, 2021)

Equation (6) above is transformed to the model below:

$\ln Q = \ln b_0 + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + b_7 \ln x_7 + b_8 \ln x_8 + \mu$ …….. (7)

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RESULTS AND DISCUSSION

Fig 1 shows the educational level of the respondents. Majority (46.7%) of the farmers had secondary education, with mean educational level of 9 years, indicating that most farmers had at least basic education. This suggests that the respondents were fairly educated and capable of understanding improved farming practices, innovations, and market information necessary for profitable ugu production. According to Okeke & Mbah, (2022), education enhances managerial ability, adoption of modern technologies, and efficient resource utilization. The household size distribution in fig 2 shows that majority (51.7%) of the respondents had between 6–10 persons in their households with mean household size of 7 persons, implying relatively large households. This findings is in line with the findings of Okonkwo-Emegha *et al.,* (2024). Large household sizes may provide family labour for farm operations, thereby reducing labour costs and increasing profitability (Nwosu *et al.,* 2021). The farming experience of the respondents in fig 3 indicates that most of the respondents 48.3% had 6–10 years of farming experience with mean farming experience of 10 years. This implies that majority of the farmers were experienced in ugu production. This finding is in tandem with Eze *et al.,* (2023) who noted that farming experience improves managerial skills, decision-making ability, and knowledge of pest control, marketing, and resource management, which increases profitability. Fig 4 shows the sex distribution of the respondents which revealed that female farmers dominated ugu production in the study area, accounting for 63.3% of the respondents. This is in line with (Food and Agriculture Organization [FAO], 2022). This suggests that fluted pumpkin production is largely practiced by women in the Owerri Agricultural Zone. Women are often actively involved in vegetable production because it provides quick income and contributes to household food security. The age distribution in fig 5 shows that majority (55%) of the respondents were between 34–49 years with mean age of 39 years, indicating that most of the vegetable farmers were in their economically active and productive years. This finding confirms the findings of Faasema *et al.,* (2026) & Onyenweaku & Nwaru, (2021). Farmers within this age bracket are more energetic and capable of engaging in the labor-intensive activities associated with fluted pumpkin production. The farm size analysis in fig 6 indicates that most (38.3%) of the respondents cultivated between 0.6–1.0 hectares with mean farm size of 0.9 hectares, showing that the respondents were predominantly small-scale farmers. Small farm sizes are characteristic of vegetable production in Nigeria and may limit large-scale production and profit expansion due to limited land availability and capital (National Bureau of Statistics [NBS], 2023).

Table 1 presents the cost and return analysis of fluted pumpkin ("ugu") production per hectare among small-scale farmers in the Owerri Agricultural Zone. The total variable cost (TVC) incurred in fluted pumpkin production was ₦203,100 per hectare. This indicates that a large proportion of production expenses came from variable inputs such as labour, fertilizer, and planting materials. High variable costs are common in vegetable production due to the intensive labour and input requirements associated with crop management (Adebayo & Oladele, 2022). The fixed cost, represented by depreciation on farm tools, was ₦10,100 with a standard deviation of 7,141.78. This suggests that farmers used relatively simple farm tools and incurred minimal fixed costs. Consequently, the total cost of production was estimated at ₦213,200 per hectare. The low fixed cost implies that fluted pumpkin production among the respondents was largely dependent on traditional farming implements and small-scale production systems (Nwankwo *et al.,* 2021). On the revenue side, income was generated from the sale of vegetables and pods. Revenue from vegetable sales amounted to ₦453,600 with a standard deviation of 319,895.11, indicating wide variation in farmers' output and sales revenue. The high variability may have resulted from differences in farm management practices, market prices, and production scale. Revenue from pods was ₦120,000 with a standard deviation of 80,610.17. The total revenue realized from fluted pumpkin production was ₦573,600 per hectare. This finding agrees with the report of Eze and Okorji (2023), who observed that vegetable farming generates substantial income for smallholder farmers due to high market demand for leafy vegetables. The gross margin, obtained by subtracting total variable cost from total revenue, was ₦370,500. This indicates that the enterprise generated substantial returns above the variable production costs. The net farm income, which represents profit after deducting both variable and fixed costs, was ₦360,400 per hectare. This positive net income confirms that fluted pumpkin production is a profitable agricultural enterprise in the study area. The Benefit-Cost Ratio (BCR) was estimated at 2.7. This implies that for every ₦1 invested in fluted pumpkin production, the farmers realized ₦2.70 in return. Since the BCR is greater than one, it indicates that fluted pumpkin production is economically viable and profitable among small-scale farmers in the Owerri Agricultural Zone. According to Iheanacho and Nwaru (2022), a benefit-cost ratio greater than one is an indication of a profitable and sustainable farm enterprise.

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Table 2 presents the results of the multiple linear regression analysis used to determine the factors influencing the profitability of fluted pumpkin ("Ugu") production among small-scale farmers in the Owerri Agricultural Zone. The regression model shows an R^2 value of 0.84, which implies that 84% of the variation in profitability of fluted pumpkin production is explained by the independent variables included in the model. This indicates that the model has a high explanatory power and is suitable for analyzing the determinants of profitability. The F-value of 122 further shows that the overall regression model is statistically significant, meaning that the explanatory variables jointly influence profitability (Gujarati & Porter, 2021). The constant term has a coefficient of 7.502 and is statistically significant at 1% level ($p < 0.001$). This suggests that when all explanatory variables are held constant, profitability will still increase by 7.502 units due to other factors not included in the model. Educational level (X_1) has a positive coefficient of 0.315 and is statistically significant at 5% level ($p = 0.030$). This implies that an increase in the educational level of farmers leads to an increase in profitability. Educated farmers are more likely to adopt improved farming techniques, better management practices, and efficient resource allocation, thereby increasing profit from fluted pumpkin production (Okeke & Mbah, 2022).. Household size (X_2) has a positive coefficient of 0.226 and is highly significant ($p = 0.0002$). This indicates that larger household size contributes positively to profitability. This may be because according to Nwosu *et al.,* (2021), larger households provide family labour, reducing the cost of hired labour and improving farm productivity. Farming experience (X_3) also has a positive coefficient of 0.102 and is statistically significant ($p = 0.0036$). This means that experienced farmers tend to achieve higher profitability due to better knowledge of production practices, pest management, and efficient use of farm inputs (Eze *et al.,* 2023). Age of farmers (X_4) has a negative coefficient of -8114.363 and is statistically significant ($p < 0.001$). This implies that an increase in farmers' age decreases profitability. Older farmers according to Onyenweaku & Nwaru, (2021), may be less energetic and less willing to adopt modern farming technologies, which could negatively affect productivity and profit. Harvesting frequency (X_5) has a positive coefficient of 5567.765 but is not statistically significant ($p = 0.398$). This suggests that although more frequent harvesting may increase profitability, its effect is not strong enough to significantly influence profit among the sampled farmers. Cost of planting material (X_6) has a negative coefficient of -6876.545 and is highly significant ($p < 0.001$). This indicates that higher expenditure on planting materials reduces profitability. Increased production costs without a corresponding increase in output may lower the net returns from fluted pumpkin production (Adebayo & Oladele, 2022). Quantity of fertilizer (X_7) has a positive coefficient of 3.25117 and is statistically significant ($p < 0.001$). This means that increased application of fertilizer positively influences profitability by improving soil fertility and crop yield, which subsequently increases farmers' income (Nwankwo *et al.,* 2021). Farm size (X_8) has a positive coefficient of 73116.74 and is statistically significant at 5% level ($p = 0.014$). This implies that larger farm sizes increase profitability because farmers cultivating larger areas are able to produce more output and benefit from economies of scale (Iheanacho & Nwaru, 2022).

Fig 7 shows the major constraints faced by small-scale farmers in the production of fluted pumpkin ("Ugu") in the Owerri Agricultural Zone. The result indicates that the most serious problem encountered by the farmers was the high cost of inputs, as reported by 54 respondents representing 90.0% of the farmers. This suggests that the prices of essential production inputs such as seeds, fertilizers, agrochemicals, and farm tools are very high, thereby increasing the overall cost of production and reducing farmers' profitability. This finding agrees with the report of Food and Agriculture Organization (2023), which noted that rising input costs remain one of the major challenges affecting smallholder agricultural production in developing countries. The table further reveals that poor storage facilities constituted another major constraint, with 50 respondents (83.3%) identifying it as a problem. Since fluted pumpkin is a highly perishable vegetable, inadequate storage facilities can lead to post-harvest losses, spoilage, and reduction in market value, thereby negatively affecting farmers' income. This finding supports the study by International Food Policy Research Institute (2022), which emphasized that inadequate storage and post-harvest handling facilities contribute significantly to food losses among vegetable farmers in Sub-Saharan Africa. Inadequate credit facilities were also identified as a serious challenge by 47 respondents (78.3%). This implies that many farmers lack access to loans and financial support needed to purchase inputs, expand production, and adopt improved farming technologies. Limited access to credit may therefore restrict the scale of production and reduce productivity. According to World Bank (2023), poor access to agricultural finance continues to limit the productivity and profitability of small-scale farmers in many developing economies. Additionally, high cost of transportation was reported by 43 respondents representing 71.7%. This indicates that the cost of moving farm inputs and harvested produce from farms to markets is

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expensive, possibly due to poor road conditions and rising fuel prices. High transportation costs reduce farmers' profit margins and market efficiency. This observation is in line with the findings of International Fund for Agricultural Development (2022), which stated that poor rural infrastructure and high transportation costs negatively affect agricultural marketing and farmers' incomes. The chart also shows that high cost of labour was reported by 34 respondents (56.7%). Labour is essential in land preparation, planting, weeding, and harvesting of fluted pumpkin. The high cost of hiring labour increases production expenses, especially for small-scale farmers who depend largely on hired labour. This agrees with the findings of Food and Agriculture Organization (2022), which observed that labour shortages and rising wage rates have increased production costs for vegetable farmers in Africa. Lastly, pest and diseases were identified by 31 respondents (51.7%) as a constraint to fluted pumpkin production. Pest infestation and diseases can reduce the quality and quantity of output, thereby lowering farmers' revenue and profitability. This finding corroborates the report of International Institute of Tropical Agriculture (2023), which highlighted that pests and diseases remain major threats to vegetable production and food security in Nigeria.

CONCLUSION

This study examined the profitability of fluted pumpkin ("Ugu") production among small-scale farmers in the Owerri Agricultural Zone of Imo State, Nigeria. The findings revealed that fluted pumpkin production is a profitable and economically viable enterprise capable of improving the income and livelihood of rural farmers. The socio-economic characteristics showed that majority of the farmers were female, within the economically active age group, fairly educated, and experienced in farming. These characteristics positively influenced their ability to adopt improved farming practices and efficiently manage production activities. The study further showed that most of the respondents operated on small-scale farm holdings with an average farm size of less than one hectare. Despite the small farm sizes, the enterprise generated substantial returns. The cost and return analysis indicated that total revenue exceeded total production costs, resulting in a positive gross margin and net farm income. The benefit-cost ratio greater than one confirmed that fluted pumpkin production is profitable and economically sustainable in the study area. This implies that the enterprise has great potential for poverty reduction, employment generation, and food security improvement among rural households. The regression analysis identified educational level, household size, farming experience, fertilizer application, and farm size as positive and significant determinants of profitability. However, age and high cost of planting materials negatively affected profitability. The study also identified major constraints faced by farmers, including high cost of inputs, poor storage facilities, inadequate credit access, high transportation costs, high labour costs, and pest and disease infestation. These challenges reduce productivity and profitability by increasing production costs and causing post-harvest losses. Finally, fluted pumpkin production remains a promising agricultural enterprise among small-scale farmers in the Owerri Agricultural Zone. Improving access to affordable inputs, credit facilities, storage infrastructure, extension services, and modern production technologies will greatly enhance productivity, profitability, and sustainability of fluted pumpkin production in the area.

RECOMMENDATIONS

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

- Government should provide subsidized farm inputs such as seeds, fertilizers, agrochemicals, and farm tools to reduce the high cost of production and improve farmers' profitability.
- Farmers should be encouraged to form cooperative societies to enhance their access to credit facilities, farm inputs, extension services, and collective marketing opportunities.
- Financial institutions and government agencies should provide accessible and low-interest agricultural loans to small-scale fluted pumpkin farmers to enable them expand production and adopt improved technologies.
- Extension agents should intensify farmer education and training programs on improved agronomic practices, pest and disease management, efficient fertilizer application, and post-harvest handling techniques.
- Government and private investors should establish modern storage and preservation facilities to reduce post-harvest losses associated with the perishability of fluted pumpkin.

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- Improvement of rural road networks and transportation infrastructure should be prioritized in order to reduce transportation costs and improve farmers' access to markets.

Socio Economic Characteristics of Respondents

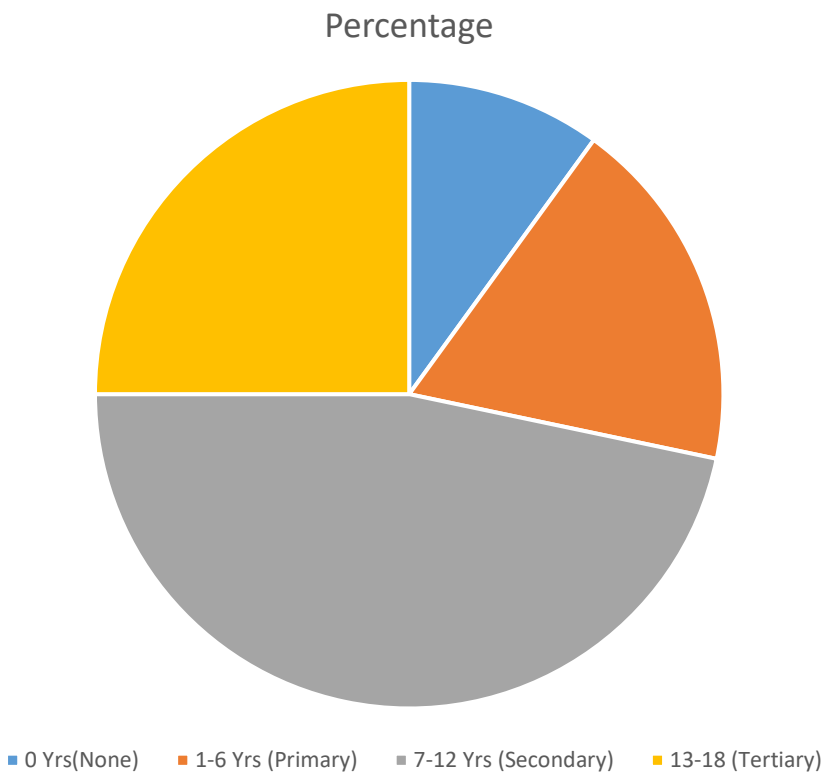

Fig 1: Educational Level of Respondents

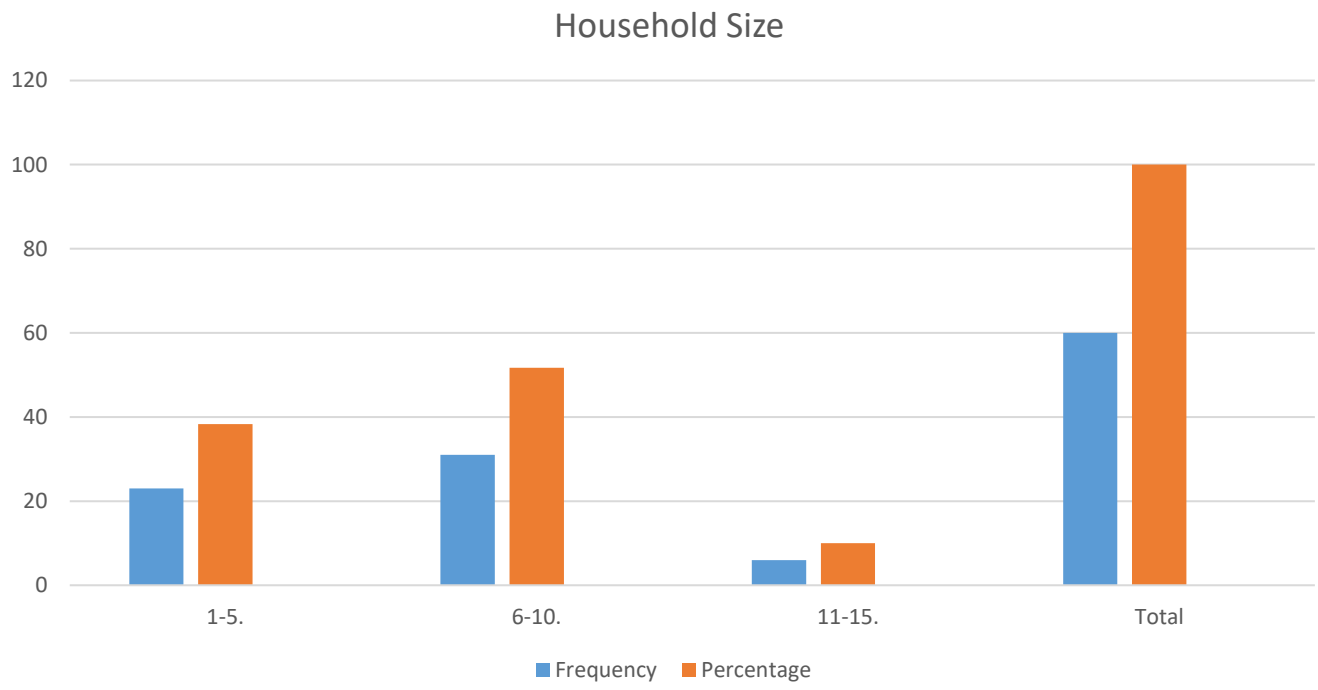

Fig 2: Household Size of Respondents

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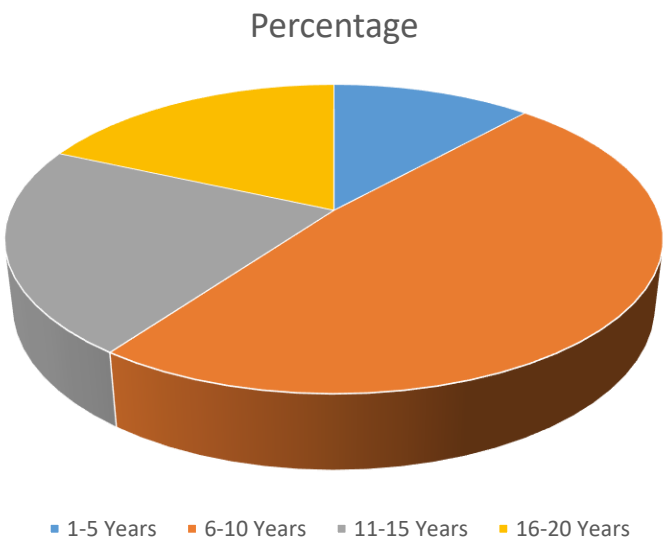

Fig 3: Farming Experience of Respondents

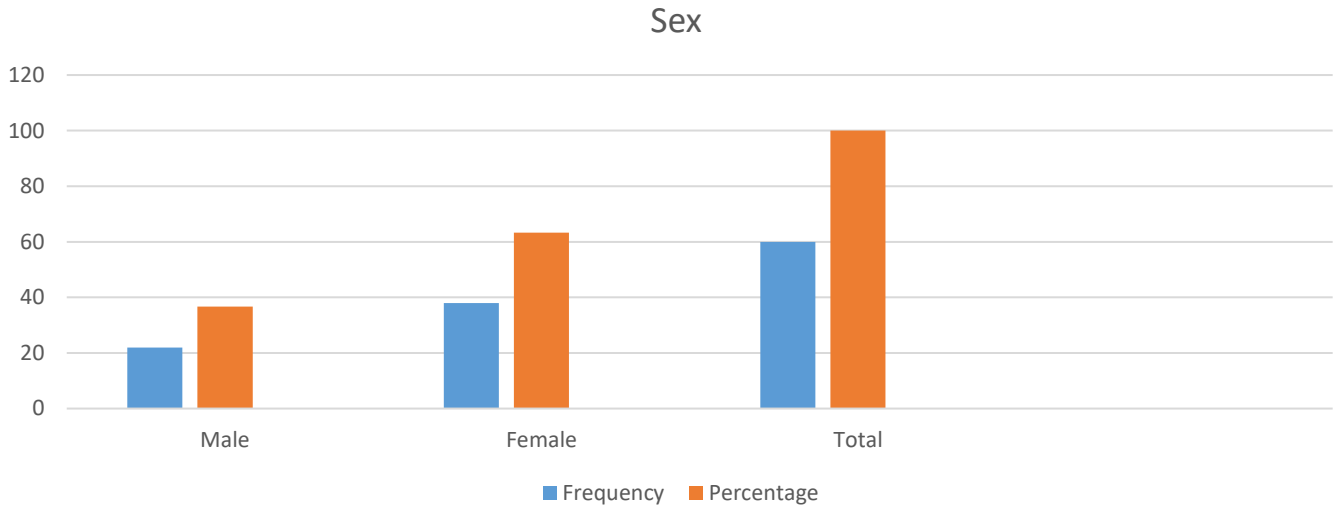

Fig 4: Sex of Respondents

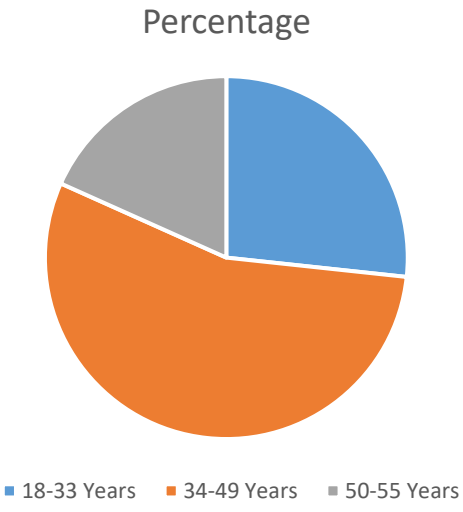

Fig 5: Age of Respondents

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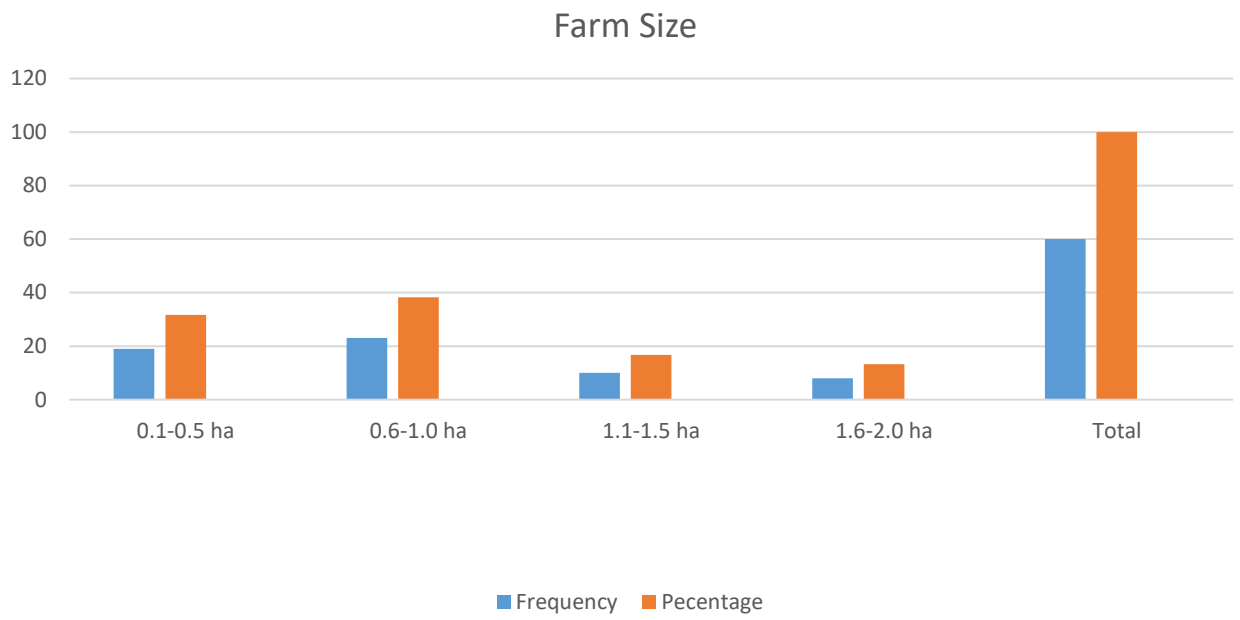

Fig 6: Farm Size of Respondents

Table 1: Cost and Return Analysis of Fluted Pumpkin Production/ha

Items	Unit of Measurement	Unit Cost (₦)	Total Quantity	Total Value (₦)	Standard Deviation
Variable Cost					
Site Clearing		6000	3	18,000	8,485.28
Ridging		8000	3	24,000	11,313.71
Cost of planting Material	3kg paint	12,000	2	24,000	8,485.28
Planting		5000	2	10,000	3,535.53
Weeding		7500	3	22,500	10,600.60
Staking		4000	2	8,000	2,828.43
Cost of Fertilizer	50kg	30,700	2	61,400	21,708.18
Cost of Organic Manure	50kg	600	7	4,200	2,545.58
Fertilizer/Organic Manure Application		4500	2	9,000	3,181.98
Cost of pesticide	Liter	4000	2	8,000	2,828.43
Harvesting		4000	2	8,000	2.828.43
Packing		3000	2	6,000	2,121.32
Total Variable Cost (TVC)				**203,100**	
Fixed Cost					
Depreciation on Farm Tools (10% of Fixed cost)				10,100	7,141.78
Total Fixed Cost (TFC)				**10,100**	
Total Cost				**213,200**	
Revenue					
Vegetables	Bundle	1200	378	453,600	319,895.11
Pods		6000	20	120,000	80,610.17
Total Revenue				**573,600**	
Gross Margin				**370,500**	
Net Farm Income				**360,400**	
BCR				**2.7**	

Field Survey Data, 2026

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Table 2: Parameters of Multiple linear Regression Analysis of determinants of profitability in fluted pumpkin production.

Variables	Coefficients	Standard error	t-values	P-value
Constant term	7.502	0.484	15.50	<0.001*
Educational Level (X_1)	0.315	0.145	2.17	0.030**
Household Size (X_2)	0.226	0.061	3.70	0.0002*
Farming Experience (X_3)	0.102	0.035	2.91	0.0036*
Age of Farmers (X_4)	-8114.363	575.729	-14.09	<0.001*
Harvesting Frequency (X_5)	5567.765	6589.136	0.85	0.398
Cost of Planting Material (X_6)	-6876.545	485.707	-14.16	<0.001*
Quantity of Fertilizer (X_7)	3.25117	0.46754	6.95	<0.001*
Farm Size (X_8)	73116.74	29713.62	2.46	0.014**
R^2	0.84			
F-value	122			

Field Survey Data, 2026. * Significant at 1%, ** Significant at 5%

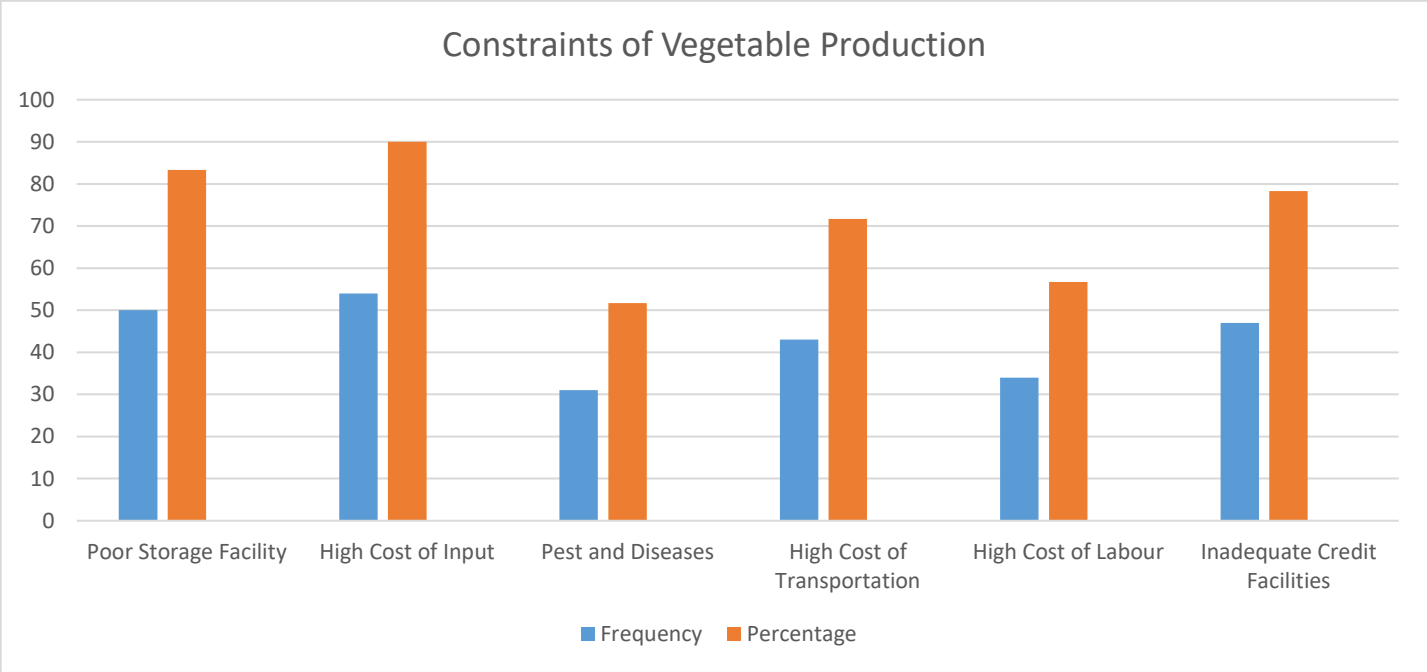

Fig 7: Constraints of Vegetable Production in the Study Area

Multiple Responses Recorded

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