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EFFICIENCY USE OF RESOURCES AND PROFITABILITY OF "*UGU" (*FLUTED PUMPKIN*) (Telfairia occidentalis Hook F.) PRODUCTION* AMONG SMALL-SCALE FARMERS IN SOUTHEAST, NIGERIA

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ABSTRACT

This study examined efficiency use of resources and profitability of fluted pumpkin production among small-scale farmers in Southeast, Nigeria using 400 farmers selected through multistage and purposive sampling techniques. Data collection was done with structured questionnaire and analyzed using descriptive and inferential statistics. Results showed that 80% of fluted pumpkin farmers were females while 20% of them were males and aged 38years that operated on the average of 0.7ha which earned them average annual income of ₦ 98,000.00 from fluted pumpkin sales. Results also revealed that the farmers had formal education with 12years average farming experiences and average household size of 7 persons. R^2 was 0.794 meaning that 79% of the variations in output of fluted pumpkin in the study area were accounted for, by the independent variables included in the model. The F-value of 19.774 was significant at 1%. Results further showed that farm size (0.517), cost of manure (0.331), farming experience (0.327), and capital input (0.221) were significant and positively related to output of "ugu". However, age (-0.022) and household size (-0.039) were inversely related to output of "ugu" in the area. The most technical efficient factor inputs were farm size (88.539) and labour (3.166), while fluted pumpkin seed (0.273) and capital input (0.377) were technically inefficient considering their values. The inputs of farm size (3.924) and capital input (24.900) were underutilized, while labour (0.169), cost of fluted pumpkin seed (0.004), cost of manure (0.002) and agro-chemicals (-0.001) were over-utilized. The result of profitability analysis showed that the cost-return-ratio was 1:1.44, meaning that every ₦1 invested would generate a profit of ₦0.44k. It would be concluded that small-scale "ugu" producers in Southeast, were not utilizing productive resources efficiently, though cultivation of "ugu" in the area is s viable venture. There is the need for regular training of the farmers in resource utilization and management for optimum productivity.

Keywords: Farmers, Small-scale, Resource, Output, Ugu

INTRODUCTION

"Ugu" (*Telfairia*) ranked the mostly grown crop in southern Nigeria for its leaves. It is, now cultivated in almost all parts of the country especially Southeat Nigeria (Igbozulike, 2015). It brings reasonable revenue to the producers (Utobo, Ngbede, Nwanguma and Nwankwo, 2017). Consumption of "ugu" has skyrocketed over the years, because it is consumed as food by man and as fodder by animals (Olabanji., Ibrahim and Olayiwola. 2018). It serves as an important supplement in the diet of man, mostly lactating mothers as well as livestock due to its high nutritive value (Utobo, Ezeano, Umebali, Okeke and Nwibo, 2022).

Sustainability of "ugu" cultivation could be possible if resource inputs are available, affordable and optimally utilized (Utobo, *et al.* 2017). Higher productivity in fluted pumpkin cultivation could be attained through efficient resource allocation and utilization among the farmers (Adaigho and Okpeke, 2018). Economic efficiency is the combination of resources such as land, labour, capital, seeds, fertilizer, e.t,c., in a manner to generate maximum output of fluted pumpkin (technical) while realizing maximum revenue from the sales of fluted pumpkin output (allocative) with least cost (Ogisi, *et al.* 2014). If a fluted pumpkin farm is economically viable, the farm must be cost effective.

For increased fluted pumpkin production to a commercial level to be achieved, the farmers must be economically knowledgeable to boost their incomes through fluted pumpkin output maximization (Utobo, *et al.*2017). "Ugu" production generally has increased but marketing efficiency is not yet actualized. Boosting production without boosting marketing system can lead to glut of the vegetable in the market. This can depress prices and discourage farmers from investing in its cultivation. Production and marketing is totally dependent on all the factors that encourages farm environmental friendliness, agricultural input and socio-cultural and economic composition of the farmers' communities (Okpeze, Umekwe, Obijekwu, Obasi, Achugbu and Aja, 2019). Productivity is also dependent on agricultural growth and expansion of market opportunities to improving the competitiveness of agricultural products

Several literatures, (Utobo and Nwankwo 2019; Okpeke and Adaigho, 2018; Elhendy and Alkahtani 2013; Utobo, Ezeano, Nwibo and Nwankwo 2022) studied resource use efficiency and profitability of various vegetable crops especially fluted pumpkin production and reported profitability and viability of fluted pumpkin production with inefficient utilization of productive resources. Certainly, conducting a comprehensive literature review is crucial for contextualizing the research within the existing body of knowledge. The review will encompass an extensive examination of relevant studies focusing on efficiency use of resources and profitability in *telfaira* farming, with a particular emphasis on small scale agricultural practices. By synthesizing and analyzing previous research, this study aims to identify key trends, gaps, and emerging themes in the field of agricultural efficiency assessment. Furthermore, the literature review will scrutinize the diverse factors that influence technical and allocative efficiency in agriculture, encompassing a wide range of determinants, including farm-level inputs, environmental variables, technological advancements, market dynamics, and socio-economic factors. By critically evaluating the key drivers of agricultural efficiency, this study seeks to establish a comprehensive framework for understanding the complex interplay between resource utilization, productivity, and profitability in smallholder farming contexts. Through this holistic review, the research aims to bridge the existing knowledge gaps and contribute to the ongoing discourse on sustainable agricultural development and resource management practices in South East Nigeria.

Olowa and Olowa (2016) examined the profitability of growing fluted pumpkin on commercial scale in Ikorodu Local Government Area (ILGA) using gross margin, net profit, benefit-cost and Shepherd-Future analyses, and exponential regression model of combined profit function for irrigation and rain-fed systems. Results showed net profit of ₦380,150 and ₦207,150; economic efficiencies of 36.64 per cent and 28.57 per cent; benefit-cost ratios of 2.7 and 3 for rain-fed and dry season/irrigated practice respectively. Utobo, Ezeano, Nwibo and Nwankwo (2022) studied the constraints on fluted pumpkin production among smallholder farmers in Mbato Okigwe, Imo State, Nigeria using purposive and random sampling techniques. Data were analyzed using descriptive and inferential statistics. Result categorized the constraints on profitable fluted pumpkin production into production, economic and managerial. Udoh and Akpan, (2016) estimated the efficiency of resource use among urban vegetable (*Talinium triangulare*) farmers in Akwa Ibom State using 200 farmers selected through simple random sampling technique. Data for the study were collected with structured questionnaire. Data collected were analysed using simple efficiency indices and Cobb Douglas production function. Results showed that waterleaf farmers were inefficient in the use of these resources with land and manure being underutilized, while labour was over utilized. Ala (2013) examined profitability and resource-use efficiency of yam production by women in Bosso Local Government Area of Niger State, Nigeria using farm budgeting, multiple regression and ratio of marginal value product and marginal value cost (MVP/MFC). The result showed that farmers obtained a net profit of ₦12,678/ha and that resources were inefficiently allocated. Utobo, Ezeano, Umebali, Okeke and Nwibo (2022) analyzed the profitability of dry season fluted pumpkin production among smallholder farmers in Okigwe using simple random sampling technique. Data were analyzed using descriptive and inferential statistics. Result showed that, the total cost and total revenue of production were N163,005 and N338,340 respectively. Net return was N175,335, Benefit to cost ratio was 2.08 and return on investment was 1.08, with shepherd future of 48%.

These studies had been conducted on efficiency use of productive resources and profitability of "Ugu" cultivation through different approaches and techniques but none of them seems to have addressed the problems of the farmers in the region, hence the need to analyze efficiency use of production inputs and profitability of "Ugu" cultivation among small scale farmers in Southeast, Nigeria with the following research questions: Are fluted pumpkin farmers efficient or inefficient in resource use? What are the input and output relationship in small scale "Ugu" cultivation? Are small scale fluted pumpkin producers utilizing production input efficiently? Is fluted pumpkin production profitable?

METHODOLOGY

Study Area

This study was carried out in Southeast Nigeria. Southeast is located on longitude 8^{o} 30^{1}N and latitude 5^{o} 45^{1} N and borders Cross River State to the east, River state to the south, Benue State to the north. It consists of Abia, Anambra, Ebonyi, Enugu, and Imo states with population of 16.4 million people and projected population of 22 million people (NPC, 2006 and NBS, 2017). Southeast Nigeria has a total land mass of approximately 41,440Km^2 square kilometers with Agriculture as the backbone of the economy (EBADEP, 2016).

The population for the study comprised of all the smallholder fluted pumpkin farmers in Southeast, Nigeria. The sample of smallholder fluted pumpkin farmers used for the study were selected from the five States that make up Southeast zone of Nigeria. The sample size for the study was drawn Ebonyi, Enugu and Imo.

Sample and Sampling Techniques

Purposive and multistage sampling techniques were adopted in the selection of the farmers.

Stage I: Ebonyi, Imo and Enugu States were selected purposively, because of their dominance in fluted pumpkin farming and according to Agricultural Development Program (ADP) of the three States.

Stage II: two (2) Senatorial zones were randomly selected in each of the three (3) states selected to give six (6) Senatorial Zones.

Stage III: two (2) Local Government Areas were randomly selected in each senatorial zones to give twelve (12) Local Government Areas.

Stage IV: three (3) communities were randomly in each LGAs selected to give thirty-six (36) communities used for this study.

Ebonyi has six thousand six hundred and fifty five (6,655) smallholder fluted pumpkin farmers, Enugu has four thousand five hundred and seventy-two (4,572) smallholder fluted pumpkin farmers, Imo has six thousand seven hundred and thirteen (6,713) smallholder fluted pumpkin farmers. The summation of these figures gave seventeen thousand nine hundred and forty (17,940) smallholder fluted pumpkin farmers which formed the sampling frame. Taro Yamane sample size determination formula was used to determine the sample size of the study from the sampling frame as stated, thus:

$$n = \frac{N}{1+N(e)^2}$$

(1)

Where:

N = Population of the Study;

n = Sample Size;

(e) = Level of significance;

1 = Unit (a constant)

Note: (e) = 0.05

$$n = \frac{17940}{1 + 17940(0.05)^2}$$

$$n = \frac{17940}{45.85} = 391$$

This was approximated to 400.00 for coverage of the study area . Similarly, the Kumaison formula was used to distribute sample size per state relative to their numerical strength of the smallholder farmers, thus:

$$\text{ith} = \frac{\text{ni}}{\text{N}} * \text{n}$$

(2)

Where:

n = total sample size for the study,

ni = population of small scale fluted pumpkin farmers per state,

N = Sample frame,

ith = sample size per state

$$\text{Ebonyi, ith} = \frac{6655}{17940} * 400 = 148$$

$$\text{Enugu, ith} = \frac{4572}{17940} * 400 = 102$$

$$\text{Imo, ith} = \frac{6713}{17940} * 400 = 150$$

Method of Data Collection and Analysis

The researcher used structured questionnaire administered in the form of interview schedule to the smallholder fluted pumpkin farmers in order to gather data for the study. Analyses of data were done using Cobb-Douglas functional form of stochastic frontier, Efficiency indices and gross margin analysis. Specifically, Objectives I was achieved using Cobb-Douglas functional form of stochastic frontier, Objectives II and III were realized using efficiency and gross margin analysis respectively.

Specification of Model

The following models were used for the study; Cobb-Douglas stochastic frontier model, Efficiency model, Costs and gross margin.

Efficiency Indices

The coefficients of the explanatory variables in Cobb-Douglas equation were used as measure of efficiencies and were used also, to establish the relationship of the ratio of MVP and MFC as follows:

$$Technical\ Efficiency\ (TE) = \frac{Input}{Output} = \frac{\overline{y_i}}{\overline{x_i}} \quad (3)$$

$$Marginal\ Physical\ Product\ (MPP) = a_i * \frac{\bar{y}_i}{\bar{x}_i} \quad (4)$$

$$Marginal\ Value\ Product\ (MVP) = MPP * P_y \quad (5)$$

$$Marginal\ Factor\ Cost\ (MFC) = \bar{x}_i$$

(6)

$$Efficiency\ Ratio\ (r) = \frac{MVP}{MFC}$$

(7)

The rule of thumb here is that when:
r =1, there is efficient use of a resource; r>1 indicated underutilization of a resource
r<1 showed overutilization of a resource
Where:
r =efficiency ratio, MVP=Marginal value product, MPP=Marginal physical product,
MFC=Marginal factor cost, Px_i=unit price of input xi, P_y=unit price of output
The implicit form of the Cobb-Douglas functional form of stochastic frontier is stated implicitly and explicitly as follows.
$Y=f(x_1, x_2, x_3, x_4, x_5, e)$ (8)
Where,
Y= Value of output (Kg); X_1= Farm size (ha); X_2= Labour (mandays); X_3= Capital (Naira);
X_3=Cost of fluted pumpkin seeds (Naira); X_4=Cost of fertilizer (Naira),
X_5=Cost of agro-chemicals (Naira)
The functional form was explicitly stated as:
$\text{Log } Y = \text{Log } a_o + a_1\text{Log}x_1+a_2\text{Log}x_2+a_3\text{Log}x_3+a_4\text{Log}x_4+a_5\text{Log}x_5+et$ (9)
Where,
Log = Natural Logarithm; Y = Output; X_1 --- X_5 = Inputs;
$a_i = Coefficient\ of\ explanatory\ variables$; et = error term; a_o = Regression constant
Gross margin is the gross income from an enterprise minus the variable costs incurred in achieving production. In this study, GM was used to determine the cost and return of fluted pumpkin production in the study area. The formula for gross margin is stated thus;
GM = TR – TVC (10)
Where; GM = Gross Margin, TR = Total Revenue, TVC = Total Variable Cost.
While the farmers' profit was calculated by gross margin less the total fixed cost.
II =GM – TFC (11)
Where; II = Profit, GM = gross margin, TFC = total fixed cost
However, return to investment is calculated as: $\frac{TR}{TC}$ (12)

RESULTS AND DISCUSSION

Table 1 showed that majority (80%) of fluted pumpkin smallholder farmers were females while 20% of them were males. This finding agreed with the findings of Addebiyi and Adejumo (2017) and Jobirov, Yuejie, Kibona (2022) who reported that women were more involved in vegetable production than their male counterpart. The results also showed that the smallholder fluted pumpkin farmers had average age of 38years. This is consistent with the findings of Esiobu *et al.*, (2019) who reported that farmers in their active working age are adopters, innovative and good risk managers. Results further revealed that majority (43%) of the farmers were married. This finding is in consonance with the findings of Eze *et al.*, (2015) who reported that married people were mostly engaged in farming activities with their household as a way of diversifying their agricultural engagement and improvement in the household income. The result further showed that majority (32%) of the farmers had JSSC or SSSC. The majority of the farmers that had formal education might be better mangers due to training and could use resources effectively. This agreed with the findings of Gideon *et al.*, (2018) who reported that educated farmers know the intricacies in farm business and input mix for effective farm production especially crop production. Results of farming experience showed 12.20years average farming experiences. This was also in conformity with Esiobu *et al.*, (2019) who reported that past knowledge of agricultural production management gives the farmers the leverage of setting attainable objectives bearing in mind the cost implications of their decisions and its attendant risks as well as effectiveness in resource utilization. The results of the farm size of 0.7ha of land, implied that fluted pumpkin farmers in the study area were micro-holder farmers according to Small and Medium Enterprises Development Agency of Nigeria (SMEDAN), (2017) who reported that micro enterprise farmers are those that operated on less than 5hectares of land and employed less than 5 persons. Result also showed that the average annual income from sales of fluted pumpkin was ₦98,000.00. The income level of an individual also plays a great role in shaping the type of agricultural enterprise to venture into. This is consistent with the findings of Nwibo and Okorie (2013) who reported that farmers with higher farm income would easily be involved in entrepreneurial activities than those of their counterpart who have poor farm income. Results further showed that the average household size of smallholder farmers was 7 persons. This showed that farmers in the study area have fairly large household size. This agreed with the findings of Ovharhe *et al.* (2020) who stated that farmers engaged at the different agricultural subsectors had a household size range of 6–10 persons.

Table 1: The Socioeconomic Characteristics of Smallholder Fluted Pumpkin Farmers in the Area

Variable	Freq (N=400)	Percentage (%)	Mean $\bar{X}$
Sex			
Males	80	20.00	
Females	320	80.00	
Age (years)			
< 30	140	35.00	
30-40	178	44.50	
41-50	62	15.50	38.10
>51	20	5.00	
Marital status			
Married	170	42.50	
Single	70	17.50	
Divorced	40	10.00	
Widow	120	30.00	
Level of education			
No formal education	50	12.50	
FSLC	96	24.00	
JSSC/SSSC	128	32.00	
OND/HND	116	29.00	
B.Sc/M.Sc/ Ph.D	10	2.50	
Farming experience (years)			
<5	47	11.75	
5-10	139	34.75	
11-15	164	41.00	12.20
>15	50	12.50	
Farm size(ha)			
<1	330	82.50	
1-3	54	13.50	0.70
>3	16	4.00	
Annual Farm Income (₦)			
< 100,000	286	71.50	
100,000- 200,000	94	23.50	₦ 98,000
> 200,000	20	5.00	
Household size			
<5	120	30.00	
5-10	212	53.00	7.00
>10	68	17.00	
Extension Contact			
Yes	116	29.00	
No	284	71.00	
Co-operative membership			
Yes	340	85.00	
No	60	15.00	

Source: Field Survey 2023

Results of extension contact indicated that majority (71%) of the farmers had no contact with extension agents, whereas only 29% had extension contact. This implied that farmers in the study area do not have access to extension services. This agreed with the findings of Benjamin *et al.*, (2020) who reported that inadequate extension contacts are detrimental to the productivity of farmers due to poor advisory services and on farm teaching.

Results of farmers association revealed that majority (85%) of the farmers belonged to cooperative society while 15% do not belong to farmers association. The farmers in the study area were mostly members of cooperative society where there is synergy in their

agricultural undertakings and effective resources utilization. As cooperating members, farm inputs were always bought in bulk which always translates to low input cost due to bulk discount and products were always sold at higher product market and not at farm gate due to adequate access to market information and product value addition along the product value chain. This agreed with the findings of Gwary *et al*. (2016) who reported that value addition within the agricultural product value chain is better achieved through farmers' cooperative societies.

Results of table 2 indicated that the coefficient of multiple determination (R^2) was 0.794 which implied that 79% of the changes in the output of "Ugu" in the study area were explained by the explanatory variables in the model. Similarly, the F-ratio value of 19.774 which was statistically significant at 1% probability level showed that the coefficients of the explanatory variables included in the model was statistically different from zero.

Furthermore, it was observed that the age of farmer (-0.022) was negatively significant at 1%. This implied that age of the farmer was inversely related to output of fluted pumpkin. This agreed with the findings of Ibeawuchi *et al.,* (2018) who reported that increase in the age of a farmer would probably translate to decrease in farm production output due to decrease in innovation adoption capacity of the farmer. The farm size (0.517) was significant and positively related to output at 1% significant level. This implied that increase in the area under cultivation would lead to increase in output of fluted pumpkin. This corroborated with the findings of Busari *et al.,* (2017) who reported that increase in farm size leads to increased output of fluted pumpkin. Household size (-0.039) was significant and negatively related to output of fluted pumpkin. This implied that increase in the household size of farmers would lead to decrease in the output of fluted pumpkin in the study area. This agreed with the findings of Oyetunde *et al.,* (2021) who reported that although household size is high in rural Nigeria, agricultural productivity is low, all the food produced is consumed because household size is large but few are producing. Cost of manure was 0.331 and significant at 1% level. This implied that increase in cost of manure would lead to increase in output. Organic manure improves soil fertility by accumulating a large amount of plant nutrients in the soil and preventing their losses through lixiviation (Büchi *et al.,* 2018). The use of organic manure is ideal for pumpkin production because they can supply adequate nutrients and suppress weed growth thereby reducing cost of production. Farming experience (0.327) that was significant at 5% level was positively related to the output of "Ugu". This agreed with Onyebinama (2014) that reported that previous years of experience in farm production as an edge to the farmers because it would enable them to set realistic time and cost targets, allocate and utilise resources efficiently, and identify production risks.

Table 2: Cobb Douglass Result of Input and Output Relationship of fluted Pumpkin

Variables	Double-log function		
	Coefficients	**Std error**	**t-values**
Age of Farmer	-0.022	0.007	-3.143***
Farming Experience	0.327	0.151	2.164**
Farm Size	0.517	0.114	4.535***
Household Size	-0.039	0.012	-3.250***
Cost of manure	0.331	0.064	5.172***
Cost of seed	0.050	0.081	0.609
Cost of agro-chemicals	-0.106	0.040	-2.650*
Capital input (₦)	0.221	0.058	3. 810**
Mandays of Labour	0.114	0.085	1.343
Education Level	0.005	0.079	0.063
Membership of Cooperative Society	0.197	0.041	4.805
Extension Contact	-0.077	0.123	-.0626
Constant	5.557	0.845	6.576***
R^2	0.794		
R^2 adjusted	0.778		
F-ratio	19.774***		

Source: Field Survey, 2023. *, ** and *= significant at 1%, 5% and 10%, respectively**

From table 3, the coefficients of Cobb-Douglas production function were used as the measure of elasticities. The sum of the elasticities of the individual production inputs were used as the measure of return to

scale in the production of fluted pumpkin. Return to scale (1.127) implied increasing return to scale for fluted pumpkin farmers in the study area. This result further implied that an increase of 10% in any of the factor inputs would lead to 11.3% increase in fluted pumpkin output in the study area. The result of increasing return to scale was in agreement with the findings of Ajibefun (2020) who reported that increasing return to scale is a function of a unit increase in the factor inputs used in the production processes.

The most technical efficient factor inputs were farm size (88.539) and labour (3.166), thus for every 10% increase in farm size and labour would lead to 885% and 32% increase in fluted pumpkin output. The cost of fluted pumpkin seed (0.273) and capital input (0.377) were technically inefficient considering their values. Thus a 10% change in the cost of seed and capital would technically contribute 2.7 and 3.8% increase in fluted pumpkin output. Other technically inefficient factor inputs were cost of agro-chemicals (0.084) and cost of manure (0.071). This is consistent with the findings of Ogundele and Okoruwa, (2016) who reported that technical efficiency is attained when the ratio of output to input used is highest. However, farm size (3.924) and capital input (24.900) were underutilized. Labour (0.169), cost of fluted pumpkin seed (0.004), cost of manure (0.002) were over-utilized. Further analysis revealed that cost of agro-chemicals (-0.001) was extremely over-utilized as their marginal physical products was negative and these implied inefficient resource allocation In view of these, fluted pumpkin farmers needed to reduce the use of over-utilized resources and increase the use of of underutilized resources.to attain optimal resource allocation and this would raise productivity of resources, increase output, revenues and net returns. This result was consistent with the findings of Alimba and Ezinwa (2011) and Nwachukwu and Onyenweaku, (2017) who reported that resource allocation under the existing traditional system of farming in Southeast Nigeria was inefficient.

Table 3: Estimation of Efficiency of Resource Use in Fluted Pumpkin Production

Variables	EP **(bi)**	**TE** $(\frac{output}{input})$	**MPP** **(bi *** $\frac{\bar{y}}{\bar{x}}$**)**	**MVP (mpp.py)**	**MFC**	**AEI** $(\frac{mvp}{mfc})$	**Efficiency Status**
Labour (man-days)	0.114	3.166	0.361	108.300	640	0.169	Over utilized
Farm Size (ha)	0.517	88.539	45.775	13732.500	3500	3.924	under utilized
Cost of Fluted Pumpkin Seed	0.050	0.273	0.014	4.200	1000	0.004	Over utilized
Cost of manure	0.331	0.071	0.024	7.200	3500	0.002	Over utilized
Capital input	0.221	0.377	0.083	24.900	-	24.900	under utilized
Cost of agro-chemicals	-0.106	0.084	-0.009	-2.700	3200	-0.001	Over utilized
Total (return to scale)	**1.127**						

Source: Field Survey, 2023; NB: Py = price of output (N300/kg). MPP=marginal physical product, MVP=Marginal Value Product; MFC = marginal factor cost; EP=Elasticity of Production.AEI=Allocative Efficiency Indices; TE= technical efficiency

Table 4 showed that the total return on the production of fluted pumpkin in the study area was ₦115, 000 and the gross margin of ₦48, 000. This implied that the profitability of fluted pumpkin production increased as the gross margin increases, therefore the gross margin of ₦48**,**000 was the contribution of fluted pumpkin production to offsetting the fixed costs of the fluted pumpkin business. It was observed that fluted pumpkin production was a profitable farm business and this was further justified by the cost-return-ratio of 1:1.44, which implied that every ₦1 invested would generate a profit of ₦0.44k. This agreed with economic theory which states that an enterprise would be considered viable when the cost-return-ratio of such enterprise is equal to or greater than one. The low gross margin showed that the total variable cost was high at ₦66, 800. High variable cost might indicate the need to change the production technique, hence the need for efficient resource allocation and least cost combination of inputs. This also implied that output per unit of input was low as a result of inefficient resource utilization. This followed Osuji *et al.,* (2022) who reported the viability of fluted pumpkin production in Southeast, Nigeria

Table 4: Gross Margin Analysis of fluted pumpkin production per Hectare

S/N	Items	Total QTY	Unit Cost (₦)	TR & TC(₦)
A	**Returns**			
	Fluted Pumpkin (leaf output)	30bundles (30kg)	3000	90, 000
	Fluted Pumpkin (pod output)	25 pods	1000	25, 000
	Total Revenue (TR)			**115, 000**
B	**Variable Cost (VC)**			
I	**Labour cost**			
	Site Clearing	10 man-days	600	6,000
	Making of heaps or beds	25 man-days	1000	25,000
	Sowing of seed	2 man-days	500	1000
	Weeding (herbicides)	3 man-days	600	1,800
	Fertilizer application	2 man-days	500	1,000
	Total labour cost			**34,800**
II	**Operating Input Costs**			
	Cost of seeds	20 (kg)	800	16,000
	Fertilizer	10kg	400	4,000
	Herbicides	3 (bottles)	3000	9,000
	Transportation	Lump sum		3,000
	Total Operating Input Cost			**32,000**
	Total Variable Cost (TVC)			**66,800**
C	**Fixed Costs (FC)**			
	Depreciation excluding land (Tools and equipment)			12,800
	Total fixed cost (TFC)			**12,800**
	Total Costs (TC) =TFC+TVC			**79,600**
	Gross Margin = TR-TVC			**48,000**
	Profitability (TR-TC)			**35,400**
	Cost-return-Ratio (TR/TC)			**1:1.44**

Source: 2023 survey

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it would be concluded that fluted pumpkin production in Southeast Nigeria is profitable, but the farmers are not efficient in utilization of productive resources. However, the study recommended that;

There is the need to strengthen multi stakeholder process to achieve better understanding of the appropriate dosage of inputs in fluted pumpkin production to ensure efficient usage.

Extension agents in the study area should be encouraged by providing favourable conditions of service to promote quality extension service delivery in the study area

Government should also assist the fluted pumpkin growers in providing the needed inputs especially improved varieties to enhance fluted pumpkin production in the zone

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