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FACTORS PRODUCTIVITY IN SMALL SCALE UPLAND VEGETABLE PRODUCTION IN THE SOUTH – SOUTH REGION OF NIGERIA

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Abstract

The study examined the social and economic characteristics of fluted pumpkin farmers and determined the extent of farm resource productivity. The study was carried out in the southern region of Nigeria. 100 leafy fluted pumpkin farmers were used in the study. Results showed that majority of the farmers (72.00%) were females, 74.00% were married, the mean age and farming experience stood at 42.97 and 14.96 years respectively. Social capital formation was very poor, while the mean household size and farm income were 6.00 members and ₦188, 560.00 respectively. The empirical result showed that; family labour, hired labour, quantity of seed, manure, fertilizer and farm size were significant farm inputs that influenced the production of fluted pumpkin. Apart from fertilizer utilization which occurs in irrational stage in a classical production surface, all other farm inputs' levels of utilization were in the rational stage. The study also found increasing rate of return (1.7847) among fluted pumpkin farms in the region. In addition, more family labour was substituting hired labour while more manure was substituting fertilizer usage in fluted pumpkin production in the region. The study recommends fertilizer subsidy and timely delivery to vegetable farmers in the rural areas of the State.

Key words**:** *farmers, productivity, fluted pumpkin, vegetable, Nigeria*

INTRODUCTION

According to Udoh and Akpan [35], vegetable crops are among the staple food components in the world and their productions have continued to increase over the years. For instance, in Nigeria, annual production stood at 6,001,932 tons in 2010, 6,502,565 tons in 2013, 6,870,068 tons in 2015 and 7,053,219 tons in 2016 [19]. Several studies have shown that vegetables are rich in minerals and vitamins [21, 13]. In the South-South region of Nigeria, prominent vegetable crops include water leaf, fluted pumpkin (*Telfairia occidentalis)*, pepper, cucumber, bitter leaf (*Vernonia amygdalina*), Amaranthus spp. and okra among others.

As noted by Mlozi, [28] and Francisca [20]; increased in vegetable production has improved food security and offered employment opportunities to many rural dwellers in Nigeria. However, the consumption of vegetables and fruits generally in Nigeria is far less than the World Health Organization recommended standard [4]. According to Kebede and Gan [27], the main source of farm income for small and resource poor farmers are basically arable crop production consisting of vegetable and non-vegetable crops. In the southern part of Nigeria, vegetable production and consumption has gained popularity due to several reasons including; lower set up cost, short gestation period, all year round cultivation, as well as it affordability [5].

In south – south region of Nigeria, fluted pumpkin (*Telfairia occidentalis*) had become one of the popular cultivated vegetable crops [3, 6]. The crop is cultivated on upland during rainy season and on wetland area during dry season. It is the most preferred homestead crop among the Ibibio, Annang and Efik tribes in the South-South region of Nigeria. The green succulent leaves are used to prepare the most popular traditional delicacy in the region known as "Edikan Ikong". The medicinal functions of *Telfairia occidentalis* have been reported by many researchers. In Nigeria, the herbal preparation of the plant has been employed in the treatment of several diseases such as anaemia, chronic fatigue and diabetes etc., [1, 31, 12, 16, 25, 26].

Fluted Pumpkin *(Telfairia occidentalis*) is among the most important leafy vegetables grown by the small-holder farmers in the region [8]. The crop has short gestation and payback periods in addition to all year-round production cycle [35]. Despite these advantages; the production of leafy *Telfairia occidentalis* in the region has been constrained by several factors, resulting in all season fluctuation in outputs and prices [9, 6, 17].

As observed by Hussian and Perera [22], agricultural production or output changes are explained by such factor as climatic, agronomic, and socio-economic and farm management factors. The need to increase food crop production and make food sufficient to all populace is one of the major challenges of the Nigerian government. Following the numerous setbacks, it is noted that farmers are not getting maximum returns or benefits from resources committed to their farm enterprises. Farm productivity is fundamental for real income growth and important for improving economic well-being and quality of life of farmers [5, 10].

Due to the population pressure, increasing urbanization and land fragmentation in the south – south region of the country; vegetable production as noted by Akpan *et al.,* [8] is sometimes done in marginal or less fertile lands. Sustained vegetable production in the region can be achieved under increasing agricultural resources intensification and dynamic economic environment only if farm resources are efficiently utilized. Given the important of the vegetable sub sector to the economy of the region; the constraints inherent in its production and various agricultural programmes or policies implemented in the region to boost vegetable production; it has become imperative to empirically analyze the productivity status (farm factor productivity) of vegetables farms in the region. According to Ogunfowara and Olayide [32], farm resources are not efficiently used or allocated under the small scale farming which is mainly traditional in style. Could this assertion be true for the small scale vegetable farmers in the Western region of Akwa Ibom State located in the southern region of Nigeria? Besides, the majority of rural farmers are resource and technology constrained due to increasing poverty. The need to assess their socio-economic features is obvious [11, 7]. In order to develop a good farm-based policy in Akwa Ibom State, it is important to understand the status of farm factors productivity especially among poor resource farmers like the vegetable farmers. Hence, the study was designed to analyze the socio-economic characteristics of fluted pumpkin farmers and determine the level of farm-input productivity in the study area.

Literature Review

Literature from different regions in Nigeria has revealed some social and economic characteristics of vegetable farmers in Nigeria. For instance, Nwalieji and Ajayi [30] in Anambra State in the eastern region of Nigeria, has showed that, majority (70.0%) of vegetable farmers in the region are males; had relatively large household size and long farming experience as well as operate an average farm size of 0.63 to 0.87 hectares. In a related study, Busari *et al.,* [15] revealed that, majority (76.15%) of women involved in vegetable production in the south western Nigeria fell in the age range of 41-60 years and had a mean age of 50.85 years. Also, majority of the women were literate and acquired farm land through gift. Besides, Fakayode *et al.,* [18] in Osun State, western region of Nigeria discovered an average age of 40.1 years for vegetable farmers in the region. In the same region, Balogun *et al.,* [14] reported the mean age and farming experience of 40.1 ± 1.1 years and 6.5±2.3 years respectively for vegetable farmers. Also, Sijuwade and Oladele [34] submitted an average household size of 6-10 members and farm size of 0.5-3.4 acres for the same category of farmers. The findings further revealed that majority of them acquired secondary school education and social capital as well as having considerably contacts with agricultural extension agents. It was further revealed that majority of the vegetable farmers had secondary school as educational qualification, belonged to organization and had contact with extension agents; however, majority never received any subsidy from the

government. In a similar Vein, Ajibola *et al.*, [2] studied Socio-economic status of women vegetable farmers in Kwara State the north central region of Nigeria. The findings showed that the mean age of vegetable farmers was 34.5 years and were well experienced (10- 14 years) in vegetable production. The result also showed mean family size of 12 people and a mean farm size of 2.45 ha. A large proportion of the farmers (78.4%) were males and married as well as attended one form of education or the other (88.0%). Majority of the vegetable farmers were non-indigenes constituting 87.0%. About 84.0%, 68.0 and 63.2% of the farmer sampled cultivated leafy, roots and fruit vegetables respectively.

In another dimension, many authors have reported the status of vegetable farm productivity in Nigeria. In the South eastern region of Nigeria, Ibekwe and Adesope [23] confirmed the significant important of the cost of labour, cost of fertilizer, cost of planting materials, cost of irrigation, level of education, size of household, farming experience and farm size on vegetable production in the area. In Borno State the northern region of Nigeria, Ibrahim *et al.*, [24] estimated significant inelastic coefficients of seeds, farm size, agrochemicals and fertilizer in vegetable production function. Their findings also include the decreasing marginal returns to scale in vegetable production in the area. Similarly, Shettima, *et al.*, [33], analyzed the efficiency of irrigated vegetable production farms in Borno State, Nigeria. They discovered inelastic and significant relationships between respondents' farm size, family labour, hired labour, organic and inorganic fertilizers, quantity of agrochemical, seedling, irrigated water and quantity of vegetables produced among vegetable farmers in the State. Also, increasing rate of returns was estimated for onion, tomato and pepper crops respectively. In a related study conducted by Akpan *et al.*, [10] in the southern region of Nigeria, on factors affecting the total factor productivity of fluted pumpkin found that, education, social capital formation, farming experience, agricultural extension visit, farm income, gender and farm size had positive impact while farmers' household size had negative effect.

From the reviewed literature, it is observed that no literature is found for the south – south region of the country on factor productivity of vegetable farmers. Owing to the fact that, the region's climate, soil features and demand preference slightly differs from the other regions, the research findings available in the literature for the other regions might not be sufficiently applied to the conditions of the south – south region of the country, hence the main reason to initiate this investigative study.

MATERIALS AND METHODS

Study Area

The study was carried out in Oruk Anam Local Government Area of Akwa Ibom State in the southern region of Nigeria. The area lies between latitude $4^{o}\ 40^{1}$N and 5^{o} N, and longitude $70^{o}\ 30^{1}$E and $70^{o}\ 50^{1}$E. It has a land mass of 511.73 km sq. representing 7.23% of the State total land mass of 7,081 km sq. The area is characterized by a typically humid tropics climate with a distinct dry and wet seasons. The agricultural season last for up to 9 months. The mean annual rainfall is heavy and lies between 2,000mm to 4,000mm and a temperature range of 26^{0}C – 28^{0}C per annum. The rainy season last from March to November and it's characterized by high relative humidity and heavy cloud cover while the dry season last from December to February. Its inhabitants are mostly farmers, Craft men and civil servants. The population of the local government is about 172,654 out of which males are 86,239 and females are 86,415 [29]. It is predominantly agrarian with notable food crops like yam, cassava, cocoyam, maize, fluted pumpkin, okra, melon, oil palm, plantain and banana among others.

Sampling Technique, Sample Size and Sources of Data

Combination of sampling methods was used to select vegetable farmers in the study area. The study area consists of 9 clans (Inen, Obio Akpa, Ibesit Nung Ikot, NungIkot, NungIta, Ndot, Ibesit, Ekparakwa, and Abak/Midim). The first stage involves random selection of 5 clans out of the 9 clans in Oruk Anam. In

second stage, two villages were randomly selected from each clan. A total of 10 villages were used in the study. The third stage involved random selection of 10 fluted pumpkin farmers from each of the selected village. A grand total of 100 fluted pumpkin farmers was randomly selected in the study area. Cross sectional data were then collected from randomly selected fluted pumpkin farming household heads in the study area.

Method of Data Collection

Data were collected using structured questionnaire and was complemented by personal interviewed to ensure consistency and accuracy of collected data. The structured questionnaire was administered to 100 farming household heads in the study area. Series of cross sectional data were collected, scrutinized and use for data analysis.

Analytical Techniques

Objectives of the study were analyzed using appropriate econometric and or descriptive tools. The Cobb Douglas production function specified was used to relate the fluctuation in output of fluted pumpkin and farm resources. The production parameters such as APP, MPP and production elasticity generated from the production function were used to analyse the level of resource used among fluted pumpkin farmers. Explicitly, the Cobb-Douglas production function envisaged in the research is specified as thus:

$$FLU = f(LAN, HHL, HIL, SED, FER, MAN) \ldots (1)$$

Implicitly, it is expressed as thus:

$$LnlNFLU = \varphi_0 + \varphi_1 LnLAN + \varphi_2 LnHHL + \varphi_3 LnHIL + \varphi_4 LnSED + \varphi_5 LnFER + \varphi_6 LnMAN + \mu_1 \ldots . (2)$$

Note, the model was adopted on the assumption of constant factor productivity such that,

$\varphi_1 + \varphi_2 + \varphi_3 + \varphi_4 + \varphi_5 + \varphi_6 = 1$ ($constant\ return\ to\ scale$)
$\varphi_1 + \varphi_2 + \varphi_3 + \varphi_4 + \varphi_5 + \varphi_6 > 1$ (Increasing return to scale)
$\varphi_1 + \varphi_2 + \varphi_3 + \varphi_4 + \varphi_5 + \varphi_6 < 1$ ($decreasing\ return\ to\ scale$)

where:

FLU = Output of fluted pumpkin of i^{th} farmer measured in Kg

φ_0 = Total factor productivity

LAN = Land size of farmers in ha

HIL = Quantity of hire labour used by i^{th} farmer measure in Mandays

HHL = Quantity of household labour measure in Mandays

SED = Quantity of fluted pumpkin seed used in the current farming season measure in Kg

FER = Quantity of fertilizer used (measure in Kg)

MAN = Quantity of manure used (measure in Kg)

The average physical product (APP}, marginal physical product (MPP) and elasticity (ELA) of inputs with respect to fluted pumpkin output was used to assess the level of input productivity among farmers in the study area.

RESULTS AND DISCUSSIONS

The socio- economic characteristics of fluted pumpkin farmers

The analysis of the socio-economic characteristics of fluted pumpkin farmers was done with respect to age, sex, household size, farming experience, farming experience, membership of social organization, farm income, and mode of farm land acquisition, secondary occupation of the farmers, educational qualification and farm size. The detail analyses of the socio economic features of fluted pumpkin farmers are as described below.

Gender Composition of Respondents

As revealed in Table 1, the result shows that majority of the fluted pumpkin farmers (72.00%) in the study area are females and only 28.00% are males. This finding contradicts the report submitted by [30, 2]. This implies that more female population in the study area is involved in *Telfairia* production compared to the male counterpart. It's suggested that female involvement in *Telfairia* production is related to the need for additional income to the family so as to

augment or complement other family income sources.

Age Distribution of Respondents

The age distribution of fluted pumpkin farmers as shown in Table 1 indicates that, 17.00% of the farmers fell in the age range of 20 to 30 years; about 26.00% fell in the age range of 41 to 50 years and 22.00% were above 50 years. The mean age among them stood at 42.97 years. This research finding is within the range submitted by [18, 14]. This result implies that; the labour force involved in the cultivation of fluted pumpkin are active and that most of the farmers in the study area are fast aging, as a result of this, output is less expected to increase in a sustainable manner. Given this scenario, it is pertinent that youths should be encouraged to cultivate fluted pumpkin as a business in the study area.

Marital Status and Farming Experience of fluted pumpkin Farmers

The findings show that only 1.00% of *Telfairia* farmer are separated, none is divorced, only 5.00% is single, 8.00% are widower about 12.00% are widowed and 74.00% are married.

This result corroborates [15]. This implies that most of the fluted pumpkin farmers in the study area are married and do so to comply with the culture and norms of their respective farming communities.

The finding further confirms that, the proportion of farmers with farming experience in the range of 1 to 5 years is 20.00%, 6 to 10 years is 18.00%, 11 to 15 years is about 25.00%, 16 to 20 years is 23.00% and greater than 20 is 14.00%.

The mean family experience is about 14.96 years. The finding of this study is in line with the report submitted by [2]. This result implies that; vegetable farming is a long surviving business in the study area.

Membership of Social Organization

As presented in Table 1, it is revealed that about 96.00% of fluted pumpkin farmers are not members of any social organization, while about 4% of these farmers belong to one form of social organizations.

This result implies that; majority of the *Telfairia* farmers do not belong to any social organization. This means that, the social capital formation among *Telfairia* farmers in the study area is very low and might likely hindered the extent of agricultural innovation adoption among them. Social gathering is known to be one of the best sources of information available to a rural farmer.

Table 1. The Socio-economic characteristics of *Telfairia occendentalis* farmers

S/N	Characteristic	Frequency	Percentage
1	Gender (number)		
	Male	28	28.00
	Female	72	72.00
	Total	100	100.00
2	Age Distribution (Years)		
	<20	0	0.00
	21- 30	17	17.00
	31– 40	26	26.00
	41– 50	35	35.00
	>50	22	22.00
	Total	100	100.00
	Mean	42.97	
3	Marital Status of Farmer (number)		
	Single	5	5.00
	Married	74	74.00
	Divorced	0	0.00
	Widowed	12	12.00
	Widower	8	8.00
	Separate	1	1.00
	Total	100	100.00
4	Farming Experience (Years)		
	<1	0	0.00
	1-5	20	20.00
	6-10	18	18.00
	11-15	25	25.00
	16-20	23	23.00
	>20	14	14.00
	Total	100	100.00
	Mean	14.96	
5	Membership of Social Organization (years)		
	<1	96	96.00
	1-5	0	0.00
	6-10	4	4.00
	>10	0	0.00
	Total	100	100.00
	Mean	0.36	

Source: compute by author, data from field work 2017.

Family Size of Respondents

The distribution of household size among fluted pumpkin farmers is shown in Table 2. The household size distribution of *Telfairia* farmers in the study area reveals that majority (67.00%) have 6 to 10 members' household size; while 33.00% of the farmers have family size of range 1-5 members.

An average household size of 6 persons was obtained for all fluted pumpkin farmers in the study area and is in agreement with the findings of [34].

This indicates that *Telfairia* farm families in the study area have moderate family size with

good proportion of family labour perhaps less demand for hired labour

Table 2. The Socio economics characteristics of *Telfairia occendentalis* farmers

S/N	Characteristic	Frequency	Percentage
6	Family Size of Respondents (number)		
	1-5	33	33.00
	6-10	67	67.00
	>10	0	0.00
	Total	100	100.00
	Mean	6.00	
7	Farm income per year (Naira)		
	<10,000	0	0.00
	10,001-20,000	0	0.00
	20,001-40,000	0	0.00
	40,001-60,000	0	0.00
	60,001-100,000	12	12.00
	>100,000	88	88.00
	Total	100	100.00
	Mean	188,560	
8	Mode of farmland acquisition		
	Inheritance	43	43.00
	Leased	47	47.00
	Contract	0	0.00
	Purchase farm	10	10.00
	Cooperative farm	0	0.00
	Community farmland	0	0.00
	Other	0	0.00
	Total	100	100.00
9	Distribution of Secondary occupation		
	Civil Servant	7	7.00
	Pensioner	3	3.00
	Artisan	1	1.00
	Okada / Bus driver / Keke driver	1	1.00
	Trading on Large Scale	0	0.00
	Petty Trading	27	27.00
	Others	61	67.00
	Total	100	100.00
10	Educational Qualification (Years)		
	No schooling	0	0.00
	Primary	63	63.00
	Secondary	25	25.00
	Tertiary	12	12.00
	Total	100	100.00
	Mean	7.89	

Source: compute by author, data from field work 2017.

Farm income per year (Naira)

The result for farm income reveals that majority of the fluted pumpkin farmers (about 88.00%) make above ₦100, 000 per year (about 262.33US$/year), while 12.00% earned income in the range of ₦60, 001 to ₦100, 000 per annum. The result gave a mean annual income of ₦188, 560 among the farmers. The size of the mean annual income indicates gradual evolution of vegetable farmers from subsistence to commercial or business oriented production.

This means that majority of farmers in the study area produced fluted pumpkin for commercial purposes and make considerable level of farm income (Note, tabulated result is shown in Table 2).

Mode of Farmland Acquisition

The finding further unveiled the mode of farm land acquisition among fluted pumpkin farmer in the study area. It is shown that about 43.00% of farmers acquired their lands for *Telfaria* production through inheritance, 47.00% acquired their land through lease arrangement, and only 10 .00% of farm land was acquired through direct purchased. This reveals greater percentage of the farm land used by vegetable farmers in the study area is gotten through lease arrangement (Check Table 2 for breakdown of results).

Distribution of Secondary Occupation

In the distribution of secondary occupations, the result reveals that majority (61.00%) of *Telfairia* farmers are involved in several unidentified occupations, followed by petty trading with 27%, civil servant with 7% and pensioner with 3%. This means that *Telfairia* farmers in the study area are not only engaged in farming but also into other occupations in order to use the income generated to finance their primary occupation and augment family income. The result also indicates that, there is likely high incidence of agricultural diversification among fluted pumpkin farmers in the study area.

Educational Qualification

The educational qualification of the fluted pumpkin farmers showed that majority (63.00%) of them went through primary school; 25.00% had their secondary education while 12.00% of the farmers had attended higher education. The result further reveals the mean year of formal education of 7.89 years. This finding is in agreement with [34]. The findings indicate that, *Telfairia* farmers are moderately educated meaning that, they have the ability to read and write and this implies that there is high probability to access agricultural technology and assimilation same as well. The positive relationship between educational status and farm productivity is an indicator that farmers with higher educational status enjoyed higher productivity compared to their counterparts with lower status as asserted by [14].

Analysis of the quantity of leafy fluted pumpkin produced by farmers in southern Nigeria

Categorization of the quantity of fluted pumpkin produced by farmers is presented in Table 3. The result revealed that, only 1.00% of farmers produced less than 1,000 Kg or 1 ton of leafy pumpkin per production cycle. About 20.00% produced in the range of 1.01 to 2.00 tons per annum, while 37.00% of them harvested from 2.01 to 3.00 tons of leafy fluted pumpkin per annum. Also, 27.00% produced from 3.01 to 4.00 tons and 13.00% as well 2.00% were able to produce from 4.01 to 5.00 tons and 5.01 to 6.00 tons per annum respectively.

Table 3. Level of Production of Leafy Fluted pumpkin (Kg) in the Study Area

Category (Kg)	Frequency	Percentage (%)
≤ 1,000	1	1.00
1,000.01 – 2,000.00	20	20.00
2,000.01 – 3,000.00	37	37.00
3,000.01 – 4,000.00	27	27.00
4,000.01 – 50,000.00	13	13.00
5,000.01 – 6,000.00	2	2.00
Total Number	100	100.00
Mean	**2,823.90**	
Minimum	**975.00**	
Maximum	**5,700.00**	

Source: computed by author, data from field work 2017.

The mean value of 2.823 tons per annum was obtained across all respondents while the minimum and maximum values of leafy output stood at 975.00 kg and 5,700.00 kg per annum respectively. The result shows that, majority of farmers in the region produced around 2.0 to 3.00 tons of leafy fluted pumpkin per year. Given the peculiar land issue in the area such as; low productivity due to continuous cropping, land fragmentation and increase urbanization leading to land scarcity; it is expected that, fluted pumpkin farmers have make the best use of their resources as revealed by the average output in the study area.

Investigating the Level of farm-inputs productivity among fluted pumpkin farmers in the study area

This objective was analyzed by using production parameters such as APP (Average Physical Product), MPP (Marginal Physical Product) and production elasticity generated from the Cobb Douglas production function. Table 4 presents the estimates of the production function and the diagnostic statistics. The estimated form has the R^2 of 0.582 and F- ratio (F-cal. = 19.97) that is statistically significant at 1% level probability level. This implies that, the estimated R^2 is significant and the overall equation has goodness of fit. Also, the normality test for the estimated equation was 18.57 and is significant at 1% probability level. This justifies the used of Ordinary Least Squares method of estimation.

The empirical results revealed that, all the coefficients of explanatory variables (farm inputs) in the production function were positive and significant at various levels of probabilities. (Note, the coefficient of farm inputs in Cobb Douglas production function represents the elasticity of production with respect to the corresponding input). This implies that, household labour has a positive production inelastic relationship with output of fluted pumpkin in the study area. The result revealed that, as household labour increases in the production process, the output also increases. It further showed that, the rate of change in household labour is greater than the corresponding change in output. The result corroborates [23, 33].

Similarly, increase used of pumpkin seed lead to increase in leafy fluted pumpkin. The coefficient is positive inelastic and is statistically significant at 5% probability level. It also implies that the percentage change in quantity of seed used is greater than the corresponding percentage change in output across farming households used in the study. Similar results have been reported by, [23, 33] elsewhere in Nigeria.

In the same Venn, increase use of hired labour impacted positively on the fluted pumpkin farmers' output in the region. The estimated coefficient is positive and inelastic in nature and is statistically significant at 1% probability level. Increase in mandays of hired labour would lead to increase in output of leafy fluted pumpkin crop produced. Similarly, it implies that, 1% increase in hired labour would result in less than corresponding 1% increase in output. The result is in consonance with the research finding of [33].

The coefficients of farm land and manure are positive, inelastic and statistically significant at 1% level of probability respectively. This means that, as quantity of land input and manure used in the production process increase, more of the leafy fluted pumpkin will be produced by farmers in the region. The finding suggests that, these farm inputs are crucial in the production of leafy *Telfairia* in the southern region of Nigeria. [33, 24] found similar result elsewhere in Nigeria.

Table 4. Estimates of Cobb Douglas Production function of *Telfairia* farms

Variable	Coeff.	Std. Error	t- value	Prob.
Constant	7.6946	0.3963	19.416***	0.0000
Factors of production				
HHL	0.0407	0.0105	3.876***	0.0010
HIL	0.1531	0.0206	7.432***	0.0009
SED	0.0142	0.0059	2.407**	0.0380
FER	1.1011	0.1581	6.965***	0.0010
MAN	0.0159	0.0052	2.944***	0.0071
Farm size	0.4597	0.0573	8.023***	0.0001
Diagnostic statistics				
RESET test		3.338**	R^2	0.5823
F-cal.		19.9775	White test	81.9***
Normality test (Chi-squares)			18.5762***	

Source: Extract from computer analysis *results.* The figures in brackets are t-ratio*** Significant at 1%, ** significant at 5% and * significant at 10%. (L) is the lead equation.

The increase use of fertilizer in *Telfairia* production impacted positively on it output. Alternatively, as the quantity of fertilizer used increase, the quantity of output produced also increase. However, the coefficient of fertilizer revealed elastic relationship with the level of output. This implies that, the change in output is far greater than the corresponding change in the quantity of fertilizer used in the production process. The result reveals conspicuous inadequacy in the used of fertilizer in fluted pumpkin production in southern region of Nigeria.

Production Parameters derived from the Cobb Douglas Production function

Table 5 shows the production parameters derived from the estimated production function presented in Table 4. (Note, the average productivities of farm inputs were calculated using summary of variables and marginal rate of substitution estimated at the average points of variables). The production parameters of interest were: production elasticity with respect to each farm factor, average productivity and marginal productivity of farm factors. The result revealed that, the production elasticity with respect to farm land was inelastic, while its average productivity stood at 6,505.048 and its marginal productivity stood at 4,150.63 units. This implies that, land utilization rate by fluted pumpkin farmers in the study area is in stage II in the classical production surface. The inference derivable from the result is that, farm land is rationally used by fluted pumpkin farmers in the region. The same relationship is applied to hired labour, family labour, quantity of seed and quantity of manure used. Their levels of utilization are depicted in stage II in the classical production surface because their production elasticity is less than unity and is positive and their average productivities are greater than their respective marginal productivity.

Hence, given these production parameters, it implies that, farm land, hired labour, family labour, quantity of seed and quantity of manure are rationally used by fluted pumpkin farmers in the production of fluted pumpkin in the study area, as such their level of utilization should be maintained. The implication is that a unit increase in farm land, hired labour, family labour, quantity of seed and quantity of manure used will lead to significant percentage increase in *Telfairia* output. Based on these findings, it is attestable that the utilization of most farm factors in *Telfairia*

production occurs in the rational stage in the classical production surface.

Table 5. Production Parameter for Fluted pumpkin production

Variable	MPP	APP	Elasticity	Input Utilization Stage
HHL	1.4389	35.356	0.0407	II
HIL	7.2177	47.144	0.1531	II
SED	0.0339	2.389	0.0142	II
FER	72.5427	65.882	1.1011	I
MAN	0.0659	4.145	0.0159	II
LAN	14,150.6	6,505.0	0.4597	II
Scale of Production and Marginal Rate of Substitution of factors of production				
Scale of production	1.7847			
$MRTS_{HHL, HIL}$	0.1994			
$MRTS_{HIL,HHL}$	5.0161			
$MRTS_{MAN,FER}$	0.00091			
$MRTS_{FER,MAN}$	1,100.7997			

Source: Computed by authors using 2017 field data; HHL represents household labour and HIL represents hired labour. Parameter computed at the average values.

On the other hand, the output of fluted pumpkin produced had positive but elastic relationship with respect to the quantity of fertilizer used. This means that, increase in fertilizer used will add irrational more to farm output compared to other farm inputs used in the model. By implication, the extent of utilization of fertilizer inputs shows that they are in stage I in the classical production surface. The inputs elasticity is greater than unity and its marginal productivity is greater than average productivity. Several reasons could be linked to these findings. They include high cost of fertilizer and increase land intensification as well as the cultural believes attached to the fertilizer utilization in the region. These constraints can negate the good intention of using fertilizer by fluted pumpkin farmers in the region. The result also showed the scale of return of 1.7847 and is greater than unity, hence depicting increasing return to scale. This means that, increase use of farm inputs by vegetable farmers would increase more the level of output produce by them.

Furthermore, the computed Marginal rate of technical substitution (MRTS) of household labour for hired labour is 0.1994. That is, for every unit of household labour, a farmer will require about 0.1994 units of hired labour. This implies that, fluted pumpkin farmer must give up 0.1994 unit of hired labour to obtain one unit of household labour. This means that, more household labour is substituting for hired labour in the production of leafy *Telfairia* in the region. Alternatively, the marginal rate of substitution of hired labour for household labour is 5.0161. That is, for every unit of hired labour, a farmer will require about 5.0161 units of family labour. That is, farmers will give up about 5 units of household labour to obtain one unit of hired labour. This confirms the previous result and still upholds that; more family labour is substituting for hired labour in the production of leafy fluted pumpkin in the region. This result suggests increasing incidence of wage rate for hired labour in the region. In the similar Vein, the marginal rate of substitution of manure for fertilizer is 0.00091 and is less than unity, meaning that more manure is currently being used instead of inorganic fertilizer in the production of leafy fluted pumpkin in the region. Alternatively, the MRTS of fertilizer for manure is 1,100.7997. This means that, about 1,100 units of manure will be given up to obtain a unit of fertilizer. This also confirms the previous result. The result showed one sided proportion of manure- fertilizer usage among farmers in the region. This disproportion is usually attributed to scarcity and probably high price of fertilizer in the market and sometimes the cultural believes of the people.

CONCLUSIONS

Leafy fluted pumpkin is more of cultural crop as it constitutes one of the major components of the daily dietary requirement of the south – south populace in Nigeria. The production of this crop provides reliable avenue to combat rural poverty and unemployment in the southern region of Nigeria. It is consumed by all classes of individuals in the society; hence the demand for the commodity is ever guaranteed. It is pertinent to note that the gap in vegetable consumption chain is mostly created by the supply side which is tailored to

efficient used of farm resources. Since the crusade for agricultural land expansion has made with hindrances such as increase urbanization and population pressure among others; hence targeting the most efficient small scale individual farm management is the key to sustainable vegetable production in the region. Based on this assertion, it is importance to generate workable agricultural framework established on sound empirical analyses to identify policy variables and also design sustainable framework aimed at achieving increase productivity of vegetables in the State and country at large.

Given the present economic predicament and deepen poverty incidence mask with insecurity in our rural areas, sustainable vegetable production might be just an illusion. Thus it is strongly recommended that governments at all tiers should initiate and implement workable policies to improve the socio-economic qualities of fluted pumpkin farmers in the State. Also, they should be implementation of a good policy on fertilizer subsidy programme for vegetable farmers in the region.

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