Allocative Efficiency of Fruited Pumpkin (Telferia Occidentalis) Production in Ayamelum L.G.A of Anambra State, Nigeria

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Abstract— *Allocative efficiency of fruited pumpkin (telferia occidentalis) production in Ayamalum L.G.A of Anambra Sate was studied using 120 farmers selected using multi stage sampling technique. Data for the work were generated through structured questionnaire and interview schedules. Percentage response, Ordinary least square regression, allocative indices and net farm income analysis were used to address the objectives. Result of the study showed that fruited pumpkin was a profitable venture in the study area. Furthermore, fruited pumpkin farmers did not achieve optimum allocative efficiency in the use of any of the farm resources. In general, the elasticity of production showed that they were operating at increasing rate of return to scale. The constraints to fruited pumpkin production included; high labour cost, high cost of fertilizer, poor access to credit and poor extension visit. To achieve optimum allocative efficiency and hence maximum profit, farmers should be encouraged to increase their use of those underutilized resources, while decreased in the use of over utilized resources Policies that would enable farmers to employ more of the resources should be put in place in order to improve their performances. More so, there is need to improve farmers' access to credit through microfinance banks and other commercial banks, use of labour saving device such as hand-driven plough and improve their frequencies to extension contact.*

Keywords— ***Allocative, efficiency, fruited pumpkin, production.***

I. INTRODUCTION

Vegetable is the most affordable and accessible source of micronutrient especially in Nigeria and other developing countries of Africa where the daily diet is dominated by starchy food. Vegetable production is a sustainable economic enterprise and feature prominently in mixed cropping systems and home gardens as secondary crops by urban and rural small holder farmers (Adaigbo and Nwadioha, 2010). Vegetable production in Nigeria constitutes about 4.64% of the total staple food production between 1970 and 2003 (Akorda, 2013). Vegetable production apart from being used for food security, it offers employment opportunities to the populace in the producing area, especially women who formed substantial producers (FAO, 2005; Mbanasor and Obiora,2005).

Nevertheless, among the vegetables, one of the most widely cultivated is telferia. *Telferia* (fruited pumpkin or *ugu*, *telferia occidentalis*) is a prominent all season vegetable in home gardens and remains the most dominant traditional port herb in southeastern Nigeria (Molzi, 2003). Telferia plant is much desired by consumers and producers because of its' succulent large leaves and the fact that it produces the pods. Telferia has beneficial effects on lipid profile, high anticipidaeonic effects on blood cholesterol, protection from associated cardiac problems, hypertension and diabetics (Omoruyi, et al 1997, FAO, 2014).

Furthermore, other uses of fruited pumpkin include; the fruit case and pulp of telferia is an important feed stuff for livestock, the pectin content of the pulp has been used in the production of marmalade, the leaf extract is regarded as blood tonic in combination with honey or milk for the anemic, the nutritive value of the leaves contain crude fibre, protein, vitamins and minerals (Nwaru and Nweke, 2010). More so, the seed can be cooked, boiled or grind to paste as soup thickener (FAO,2008).

In spite of the relevancies of this crop, low production and productivity characterized its cultivation. The low yield is as result of inefficient production technique manifested in technical and allocative inefficiencies over reliance on household resources, labour intensive agricultural technology and rapidly declining soil productivity (Tanko, 2004). Efficiency is primarily determined by the prices of inputs including time, labour, capital and technical advances (Denton, et al 2009). The farmer's productivity can be enhanced by adopting improved technology and improved efficiency in resource use, particularly allocative efficiency of the small holder farmers who produce 70% of the food consumed in the country. Allocative efficiency as put by Nwaru, (2010) is the manipulation of available scarce resources and technical know-how to achieve the highest possible economic benefits within given resource where its' marginal value product is equated to its unit price. Onyenweaku, et al (2010) posited that efforts at improving efficiency as a means of increasing agricultural output are more cost effective then introducing new technology if farmers are not making efficient use of existing technology. This paper examined the profitability of fruited pumpkin production, estimated and analyzed the production function for efficiency, elasticity of production, return to scale and problems associated with fruited pumpkin production in the study area.

II. MATERIALS AND METHOD

The study was conducted in Ayamelum Local Government Area of Anambra State. Ayamelum L.G.A is made up of 6 communities namely; Anaku, Omo, Ifite Ogwari, Igbankwu, Umumbo, and Omasi. It has a land mass of 428 square kilometers and population of 22,860 people (NPC, 2006) . Ayamelum L.G.A lies approximately between latitude 5̍˚36´ and 6˚18´ North of equator and longitude 7˚24´ and 8˚27´ East of Greenwich meridian. It shared common boundaries to the North with Uzo-Uwani Local Government Area in Enugu State and in the South by Anambra East, in the West and South by Ezeagu Local Government Area in Enugu State and Igbola Local Government Area of Benue State respectively. The Local Government Area has favourable warm climate for the growth of both cash and food crops and rearing of animals.

Multi-stage random sampling technique was used to select communities and respondents. The first stage involved the random selection of four out of five communities. In the second stage, from the list of fruited pumpkin farmers provided by the extension agent in charge of the communities and as well as their respective local leaders, twenty farmers were randomly selected. A total number of eighty respondents were selected for detailed study. Structured questionnaire and interview schedule were used to collect information on farmers' input such as fertilizer, labour, farm size, seed and capital and their outputs. More so, information was gathered on items used to compute cost and returns in fruited pumpkin production and constraints to its production. The objective 1, profitability of fruited pumpkin production was analyzed using net farm income. The net farm income can be calculated by gross margin less fixed input. The net farm income can be expressed as thus:

$$\text{Gross Margin (GM)} = \sum_{1-1}^{n} F_1 Q_1 - \sum_{1-1}^{m} r_1 x_1 \qquad (1)$$

$$\text{Net farm income (NFI)} = \sum_{1-i}^{n} P_1 Q_1 \left[\sum_{1-1}^{n} r_1 x_1 + K \right] \qquad (2)$$

Where GM = Gross margin; NFI = Net farm income; P_1 = Market (unit) price of output Y (₦); Q = quantity of output Y (kg); r_1 = unit price of the variable input (₦); x_1 = quantity of variable input (kg); x_1 = quantity of variable input (kg); Kn = Annual fixed cost (depreciation) (₦); i = 1 2 3 …….n; j = 1 2 3 …. M

Data analysis of the production function of fruited pumpkin was done using ordinary least square regression method. This can be explicitly represented as:

$$Y = f(X_1\ X_2\ X_3\ X_4\ X_5 + e) \qquad (3)$$

Where y = quantity of fruited pumpkin (₦)

X_1 = fertilizer (kg); X_2 = labour (md); X3 = farm size (ha); X_4 = seed; X_5 = capital input (₦); $b_1 - b_5$ = coefficient of the parameter; b_0 = intercepts; e = error term.

Four functional forms of ordinary least square regression model were fitted. These included: linear, semi-log, Cobb Douglas (double log) and exponential functions.

Linear function

$$Y = b_0 + b_1 x_1\ b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + e \qquad (4)$$

Semi log

$$Y = Inb_0+b_1Inx_1+b_2Inx_2+b_3Inx_3+b_4Inx_4+b_5Inx_5 + e \quad (5)$$

Double log function:-

$$InY = Inb_0+b_1Inx_1+b_2Inx_2+b_3Inx_3+b_4Inx_4+b_5Inx_5+e \quad (6)$$

Exponential function

$$InY = b_0xb_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+ e \quad (7)$$

The choice of the best functional form was based on the magnitude of the R^2 value, no of the significant, size and the signs of regression coefficient as they relate to apriori expectation. The allocative efficiency was determined by computing the marginal analysis of the inputs used by vegetable farmers in the study area. More so, the required adjustment in marginal value product (in percentages) for optimal allocation of the variable inputs used was also computed. The models were specified as follows:

$$r = MVP/MFC \quad (8)$$

$$MVP = mpp_{x1}py \quad (9)$$

(double log as lead equation)

$$Mppy_1 = {}^{dy}/_{dx} = {}^{b1y}/_{x} \quad (10)$$

Semi log form the lead equation

$$Mppi = {}^{dy}/_{dx} = b_i \quad (11)$$

(linear form is the lead equation)

$$D_1 = (1 - {}^{1}/r_1)\ 100 \quad (12)$$

r = efficiency ratio notation, MVP = marginal value product, MFC = marginal factor cost (cost of unit price of a particular input), MPP = marginal physical product and are arithmetic means of the yield, Py = unit price of output, x_1 = various input 1 to n = absolute value of % change in MVP of 1^{th} resource, r_1 = ratio of MVP to MFC for i^{th} resource, 100 = factor (percentage)

If r = 1, it implies that resources are efficiently used i.e. MVP = MFC = 1

r > 1, implies that resources are under-utilized

r < 1, implies that resources are over-utilized.

Descriptive statistics such as percentage response and frequency were used to identify the farmers' production constraints.

III. RESULTS AND DISCUSSION

Analysis in Table 1 showed the costs and return of telferia farmers in the study area based on 2014 and 2015 market price of input and output. The analysis revealed that hired labour constituted the highest (51.3%) share of the total cost of production. The effect of high cost of hired labour is the over reliance of most rural households on members of their households for labour on their farms. This result in low output, as few land areas are cultivated (Simonyan and Balogun, 2010). Fertilizer accounted for about 36.3% of the total cost. The high cost of fertilizer at farm level could be related to hoarding and black market which characterized fertilizer marketing in the study area, hence rubbishing Federal Government of Nigeria fertilizer subsidy policy (Tanko, 2004). The average total cost of production was ₦46,820 per hectare, while revenue from telferia production was ₦72,920 per hectare.. The net farm income was ₦26, 100, which indicates that telferia production was profitable in the study area. Moreso, the benefit cost ratio (BCR) was 1:1.56, indicating that for every one naira spent, about ₦1.56 was obtained in return.

TABLE 1
PROFITABILITY OF FRUITED PUMPKIN PRODUCTION

Item	Cost/Returns (₦)	% Cost
Seed	3,200	6.8
Fertilizer	17,000*	36.3
Transportation	1,200	2.6
Hired labour	24,000	51.3
Total variable cost	45,400	
Fixed cost		
Implements (hoe and cutlass)	1,820	3.9
Total cost (TVC + TFC)	46,820	100
Telferia returns (₦)	72,920	
Net farm income	26,100	
Return per naira	2.79	
Benefit cost ratio (BCR)	1:1.56	

Source: Field Survey, 2013.

Table 2 revealed that Cobb Douglas production function was selected as lead equation for further analysis based on the high value of the coefficient of determination (R^2), the significant of the coefficient of individual independent variable and signs of the coefficients. The R^2 value as presented in Table 2 was 0.897, implying that the independent variables included in the model were able to explain for about 89.7% of the variation in fruited pumpkin output, while the remaining 10.3% was due to error. All the explanatory variables considered in the model influenced positively fruited pumpkin output. The coefficient of farm size and fertilizer were significant at 1% alpha level respectively. Farm size in the opinion of Mbanasor and Obiorah, (2005) affects adoption costs, human capital and risk perception by farmers. Fertilizer is important resource that could enhance farmers' productivity. Nevertheless, the high cost of fertilizer particularly at farm level is a limiting factor to its use by poor resourced farmers Odiaka, et al 1997; Eze and Akpa, 2010). The coefficient of seed and labour were significant at 5% and 10% probability levels respectively. The positive relationship between the coefficient of labour and the dependent variable was not consistent with the finding of Onyenweaku, et al (2010). They cited the negative sign of the coefficient to the diminishing return associated with excessive use of labour in farming.

TABLE 2
ESTIMATED FRUITED PUMPKIN PRODUCTION FUNCTION

Variable	Linear	Exponential	Semi log	Cobb Douglas (Double log)
Intercept	7.041 (4980)***	4.000 (3.941)***	10..027 (5.601)***	2.062 (6.012)***
Fertilizer	0.629 (0021)	1.720 (1.006)*	0.500 (1.701)	0.342 (3.017)***
Labour	1.037 (2.004)**	0.031 (0.661)	0.137 (3.010)***	0.257 (1.750)*
Farm size	0.920 (0.007)	2.851 (2.001)**	1.071 (0.227)	0.521 (4.041)***
Seed	0.021 (0.712)	0.691 (0.400)	0.349 (2.006)	0.371 (2.727)*
Capital	0.301 (0.421)	0.717 (0.666)	0.331 (0.110)	0.240 (0.898)
R^2	0.542	0.672	0.598	0.897
F Ratio	17.760***	10.051***	5.471***	10.161***

Source: Field Survey, 2013
*******, **, * = significant at 1%, 5% and 10% respectively***
Figures in parenthesis are the t-ratio.

The allocative efficiency indices were summarized and presented in table 3. The ratio of the marginal value product of the input to their respective acquisition cost was computed to obtain the relative efficiency of fruited pumpkin farmers in the study area. Table 3 indicated that the fruited pumpkin farmers did not attain optimal allocative efficiency (K_1=1) in the allocation of any of the resources. The ratio of marginal value product to marginal factor cost of seed and capital were 359.435 and 63 respectively, indicating underutilization of these resources (K_1>1). This implied that less than profit maximization level of the input is used. The underutilization of improved okra seed according to Ume, et al 2010) could be attributed to high cost and paucity of the resource, especially during planting season. invoked poverty and poor access to credit facility by farmers in explaining the reasons for underutilization of capital input. However, the use of fertilizer (0.536), farm size (0.552) and labour (0.544) were over-utilized (K_1<1) as their efficiencies ratio were less than 1. The unlimited availabilities of these resources particularly land and labour (family labour) in the study area could be among the reasons for its over-utilization. This implied that more than the profit maximization levels of the inputs were used. Therefore, for profit to be optimized in fruited pumpkin production in the study area, fertilizer, farm size and labor inputs use should be reduced by 81.4%, 83.7% and 83.8% respectively from their current level of use. Furthermore the use of seed and capital should be increased from the current level of use by 99.7% and 98.4% respectively.

TABLE 3
RESOURCE USE EFFICIENCY OF FRUITED PUMPKIN FARMERS

Variable	$\overline{Y}$	X	b_1	MPP	MVP	MFC	R	D_1 (%)
Fertilizer	920.40	0.284	0.342	1.108	332.49	620	0.536	83.7
Labour	920.40	0.240	0.587	0.986	380.97	700	0.544	83.8
Farm size	920.40	0.521	0.521	920.4	-276.12	500	0.552	81.4
Seed	920.40	2.85	0.371	119.813	35,943.5	100	359.435	99.7
Capital	920.40	420	0.240	0.526	126,000	2,000	63	98.4

Source: Computed from Field Survey, 2012

Elasticity of production and return to scale were presented in table 4. The elasticity of production indicates the change in output relative to a unit change in input (Ume and Nwaobiala, (2012). The elasticity of production is derived directly from Cobb Douglas production function coefficients. The table showed production elasticity response of less than 1 for input resource of fertilizer, seed and labour used. This implied that these factors inputs and fruited pumpkin output have inelastic relationship and hence, increasing the utilization of each of the input by 1% will contribute to less than 1% to the fruited pumpkin output. The input of farm size showed the production elasticity response of more than one. This showed that the input, farm size and fruited pumpkin output has elastic relationship, which implied that 1% increase in the use of the input will contribute more than 1% to the output of telferia. The return to scale was derived by summing up the elasticity of production (GP) for each of resources. The return to scale for fruited production (1.741) was greater than 1 (Ex>1), indicating that the farmers were operating at increasing return to scale. This indicates that the farmers are operating at region 1 of the production process which is irrational stage. This implied that when all the factor input are varied by 1%, the responsiveness of fruited pumpkin output to such input variation will be 1.74%. This finding is in conformity to (Egwu,et al 2010). This implies that fruited pumpkin farmers in the study area can improve on their production by employing the inputs such as fertilizer, seed and labour that were under-utilized while less of farm size that was over-utilized.

TABLE 4
ELASTICITY OF PRODUCTION AND RETURN TO SCALE

Resource	Production Elasticity (Ep)
Fertilizer	0.342
Labour	0.257
Farm size	0.521
Seed	0.371
Capital	0.240
Return to scale (∑Ep)	1.741

Source: Computed from Field Survey, 2013

Table 5 showed the constraints to fruited pumpkin production in the study area. 78% of the respondents complained about high cost of labour. In vegetable production under peasant condition, labour is mainly manual and it is provided by the farmers' households and hired hands. The high cost of the latter could be because of unprecedented urban drift of youths whose services are needed most as labourer in agriculture (Unamnah, 2003). High cost and scarcity of fertilizer was reported by 68% of the respondents. The high cost and unavailability of inorganic fertilizer especially at farm level, the use of this soil amendment is hardly used by most farmers. Negative attitude towards pest and disease control was reported by 58% of the respondent. No such serious attempts are not made to control the numerous diseases and pests (Amaza and Olayemi, 2009) found in vegetables, even where symptoms of abnormalities are noticed by the farmers. 54% of the respondents complained of poor access to credit facility. This finding is in line with Ume and Nwaobiola,2012) who opined that credit helps farmers in purchasing their inputs. Poor access to extension contact was complained by the respondents and represented by 52%. The poor access to extension visits could imply poor extension outreach and in effect, lower production and productivity of the farmers' output because of none use of improved technology. Water scarcity problem was reported by 50% of the respondents. This collaborated with the findings of (Akorda, 2013) who asserted that water scarcity effects vegetable production, especially during dry season.

TABLE 5
CONSTRAINTS TO FRUITED PUMPKIN PRODUCTION

Variable	Percentage (%)
High cost of labour	78
High cost of fertilizer	68
Negative attitude towards pest and disease control	58
Poor access to credit facility	54
Poor access to extension contact	52
Water scarcity	50
Land problem	38
Theft problem	24

IV. CONCLUSION AND RECOMMENDATIONS

The major conclusions from this study are: Fruited pumpkin farmers were not allocative efficient in the use of their farm resources. Secondly, telferia is a profitable venture in the study area. Thirdly, the major problems to the vegetable production were high cost of labour, high cost of fertilizer, poor access to credit and poor extension contact.

The following recommendations were made: The frequency and quality of extension visit should be improved through provision of adequate facilities, incentives and proper supervision of extension agents in order to improve on farmers' technology adoption. Furthermore, farmers' access to credit through commercial banks and micro finance banks at lower interest rate should be enhanced. Also, diseases and pests control in vegetable production using appropriate pesticides should not be taken for granted to enhance its production. In addition, to achieve optimum allocative efficiency and hence maximum profit, farmers should be encouraged to increase their use of those under-utilized resources. This can be achieved through having access to these productions inputs and encourage the reallocation and redistribution of farm inputs.

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