Economic Analysis of Costs and Returns of Vitamin A Cassava Production in Anambra State, Nigeria, West Africa

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Received:- 05 August 2021/ Revised:- 17 August 2021/ Accepted:- 24 August 2021/ Published: 31-08-2021

Abstract— *The study investigated the costs and returns of vitamin A cassava production in Anambra State, Nigeria. Multi-stage and simple random techniques were adopted in selecting one hundred and thirty eight respondents for the study. Data were collected using well structured questionnaire and analysed using descriptive statistics, multiple regression, budgetary technique and benefit cost ratio. The specific objectives were to ascertain costs and returns on vitamin A cassava based production; ascertain influence production costs have on the financial value of the crop's output and to identify the constraints to production of the crop. Findings on costs and returns showed that gross margin, net farm income and net return on investment were ₦41,128.00, ₦41,097.00 and 1.6 respectively. This implies that for every 100 kobo invested in the production, 160% was gained. The result of Benefit Cost Ratio is an indicator that the venture is a profitable business. The findings also revealed that out of the five predictors included in the model, three namely cost of planting material, cost of labour and cost of renting land statistically and significantly influenced production returns earned by the farmers. High cost of labour, poor access to yellow stem, poor access to capital, poor pricing of yellow cassava tubers and poor transportation infrastructure were perceived as the most serious constraints encountered by vitamin A cassava production. Farmers should be encourage to form cooperative in order to enable them access or purchase tractors which should be made available and affordable to farmers to ease the cost of labour, government and other stakeholders should be encourage to multiply vitamin A cassava stems and investors should be encouraged to set up industries that would enter into contracts with vitamin A cassava farmers in the State in order to buy off their produce and process them into value added products were recommended.*

Keywords— Cassava, Vitamin A, Production, Profitability.

I. INTRODUCTION

Cassava (*Manihot esculenta***)** is a major staple food, a major source of energy in the diet of many Nigerians and can easily adapt to wide range of climatic and soil conditions (Ekpunobi, Nwigwe and Nkamigbo,2020). Nigeria is currently the largest producer of cassava in the world and the largest cassava market in Africa. (Ijigbade, Fatuase and Omisope, 2014 and Epkpunobi *et al*, 2020).

Nigeria produces approximately 45 million tonnes of cassava annually and the system is highly dominated by small-scale farmers' holding, cultivating average of 0.5 hectares. Cassava which is the major food consumed by Nigerians, though inexpensive and good source of carbohydrates has low protein content and lacks vitamin A. As a result, Nigerians who are restricted to the consumption of cassava based diet could be at risk of being exposed to having diseases associated with vitamin A deficiency (VAD) (Eguonu, 2014, Eze, Nwibo, 2014 and Ekpunobi, 2020). According to (Bouis, Hoty, McClafferty, Meenakshi and Pfeiffer (2011), the deficiency of this all important micronutrient – vitamin A, is a leading cause of morbidity and mortality, especially in young children, pregnant and lactating mothers. Vitamin A deficiency has continued to be a significant public health problem in Nigeria despite improving diets as a result of rising incomes and administration of vitamin A capsules over the years (Ilona, Bouis, Moursi, Palenberg and Oparinde, 2017). To address the challenges associated with vitamin A deficiency and its severity, Nigerian government embarked on supplementation program with vitamin A for children within the ages of 6 months to 5 years during immunization and went ahead to mandate the fortification of some food item like wheat flour, sugar, vegetable oil with Vitamin A since year 2000 (Adeola, Ogunleye and Bolarinwa, 2017). However, the recurring transportation and administration cost associated with these efforts seems unsustainable especially for those in rural areas due to prevalence of poverty[5]. It is estimated that Nigeria losses over 1.5 billion dollars to vitamin and mineral deficiencies [8]. This is quite enormous for a developing country like Nigeria that is still grappling with poverty and unemployment. Animal foods that are good sources of Vitamin A are not affordable by the poor communities thus leaving food of plant origin as important source of pro-vitamin A in developing countries (World Bank, 2018). Vitamin A cassava has also been reported to be high yielding, resistant to major pests and diseases, and have shown delay in the onset of post-harvest deterioration (Tumuhimbise, Namtebi, Turyashemerwa and Muyong, 2013). However, variance in the colour of vitamin A cassava to that of other cassava varieties, which are traditionally white, raises question on whether the crop would generally be accepted by both the farmers and consumers in the State. Cases have been reported in the past where farmers and consumers rejected improved variety of a crop like maize, due to variance in colour (Ekpa and Linneman, 2018). This is one major issue that would determine the prospects of vitamin A production of the crop and its sustainability, in the State. Even though study carried out by (Nzeh and Ugwu,2014) on the cost and return on cassava production showed that cassava production and marketing is profitable, the researcher however observed that there is paucity of research study on the cost and return on vitamin A cassava production in the State. Hence, with the changing social characteristics of cassava farmers; changes in economic decisions they make; changes in economic realities; the costs and returns on vitamin A cassava production in Anambra State is called to question. As vitamin A cassava is increasingly being pushed to get to more smallholder farmers in Nigeria, it became important to ascertain the costs and returns of its production, identify the influence of production cost on financial value of the output and identify constraints to production of the crop.

II. MATERIAL AND METHODS

The study was carried out in Anambra State. The predominant occupations in these areas include farming, fishing, trading, craft, etc. It is situated on a generally low elevation on the eastern side of the River Niger sharing boundaries with Delta State to the west, Imo, Abia and Rivers State to the south, Enugu state to the East and Kogi state to the North. The state occupies an area of about 4,844 Km^2, lies within longitude $5^0 55^1$ and $6^0 42^1$N. The annual rainfall ranges from 1400 mm in the North to 2500 mm in the south with temperature of 25^0C- 35^0C. The population of the State is 4,182,232 with 863 Sqkm density (NPC, 2006). It consists of twenty-one (21) Local government areas (LGAs) and four agricultural zones.

The Population of the study was vitamin A cassava producers in Anambra State. According to the Anambra State Agricultural Development Programme, the state has eight thousand five hundred (8500) registered cassava producers. However, the list is not categorised into the different varieties of cassava produced. Pre- survey test carried out showed that about 5% (425) of the farmers produced vitamin A cassava. Multi-stage sampling technique was adopted in selecting sample for the study.

Stage one, simple random sampling technique was used to select three agricultural zones from the four agricultural zones of the state.

Stage two, simple random selection technique was used to select four Local Government Areas from each of three agricultural zones totaling twelve LGAs.

Stage three, simple random technique was used to select three communities from each of the twelve LGAs making a total of thirty six communities.

Stage Four, respondents were selected from each of the thirty six communities except in Anambra zone where only two respondents each were selected in three communities due to paucity of yellow cassava producers, while others were four. This made it a total of one hundred and thirty eight respondents (138) which formed the sample size.

TABLE 1
SAMPLE SIZE ALLOCATION

One plot (100 x 50Ft)			
Agricultural Zones	**LGAs**	**communities**	**Sample size allocation**
Anambra Zone	Anambra West (6.4902^{o}N, 6.7922^{o}E)	Miata	2
		Umuewelum	2
		UmuezeAnam	2
	Anambra East (6.3093^{o}N, 6.8673^{o}E	Umueri	4
		Aguleri	4
		Igbariam	4
	Oyi (6.2246^{o}N, 6.8887^{o}E)	Nteje	4
		Awkuzu	4
		Ogbunike	4
	Ayamelum (6.553553^{o}N, 6.986939^{o}E)	Omor	4
		IfiteOgwari	4
		Igbakwu	4
Awka Zone	Awka North (6^{o}12^{1}45.68N, 7^{o}0419”E)	Mgbakwu	4
		Isuaniocha	4
		Achala	4
	Awka South (6^{o}09^{1}60.00”N, 7^{o}0360.00”E)	Awka	4
		Amawbia	4
		Nibo	4
	Dunukofia (6^{o}16’20”N, 6^{o}5738”E)	Ukpo	4
		Nawgu	4
		Ukwulu	4
	Njikoka (6^{o}11’3.12”N, 6^{o}58’35.58”E)	Abagana	4
		Abba	4
		Enugwu-ukwu	4
Aguata Zone	Orumba North (6”02’46N, 7”12’36E)	Ajali	4
		Ufuma	4
		Awa	4
	Orumba South (5^{o}58’0”N, 7^{o}13’0”E)	Umunze	4
		Ihite	4
		Ibughubu	4
	Aguata (6^{o}01’0”N, 7^{o}05’0”E)	Umuchu	4
		Uga	4
		Umuona	4
	Nnewi South (6^{0}0’37.8684”N, 6^{o}54’37.2420”E)	Otolo	4
		Uruagu	4
		Umudim	4
Total			138

Values in parenthesis represent the Global position of the site

2.1 Method of Data Collection

Primary data used for the study were derived from set of structured questionnaire and also subjected to descriptive and inferential analysis- mean, standard deviation percentages, frequency, multiple regression, budgetary technique and benefit cost ratio.

2.2 Model Specification

The regression function analysis was used in four functional forms from which the lead equation was chosen on the basis of the values of the coefficient of Multiple Determination (R^2) as well as the signs and significance of the regression parameters. This is stated explicitly as;

$Y = a + b_1X_1 + b_2X_2 + e$; as described by (Akinbile, 2015).

Y= Output

The regression function postulated for cassava production in the study area is shown in the explicit form using four functional forms; the linear, semi log, double log and exponential. The four functional forms were evaluated using ordinary least square method. The explicit forms of the functional forms are as follows:

Linear function

log Y = b0+b1COLAB+b2COFERT+b3CPM+b4COSTPEST+b5COSTLAND+e

Exponential function

LogQ= b0+b1COLAB+b2COFERT+b3CPM+b4COSTPEST+b5COSTLAND+e

Semi-log function

Q= b0+b1logCOLAB+b2logCOFERT+b3logCPM+b4logCOSTPEST+b5logCOSTLAND+e

Double log

LogQ= b0+b1logCOLAB+b2logCOFERT+b3logCPM+b4logCOSTPEST+b5logCOSTLAND+e

Where Y is the total output in kg

Where

Q	=	Total output (in kg)
Py Q	=	Value of total output (in naira)
COLAB	=	Cost of Labour (in naira)
COFERT	=	Cost of fertilizer (in naira)
CPM	=	Cost/amount spent on planting material (in naira)
COSTPEST	=	Cost of pesticides and herbicides (in naira)
COSTLAND	=	Cost/amount spent on renting/leasing land (in naira)
E	=	Stochastic error term (error term assume to have a zero mean and constant variance).

Profitability was estimated using budgetary tool, which measured the difference between total revenue (TR) and the total cost (TC). Net return is given as *TR-TC*

Where; TR = Total Revenue =P.Q (P=Price, Q=Quantity); TC= Total cost.

III. RESULTS AND DISCUSSION

3.1 Cost and Returns of Vitamin A Cassava Production in Anambra State

The analysis of profitability of vitamin A cassava production using enterprise budgeting and benefit cost ratio is shown in Table 2. Total revenue (TR) from yellow cassava production was ₦ 66,726.00 while total variable cost (TVC) and total cost of production were ₦ 25,598.00 and ₦ 25, 629.00 respectively. The cost of labour (35.5%) and fertilizer (28.1%) constitute the major cost in the production of vitamin A cassava in the study area while hoe and cutlass (35.5%) has the least annual depreciation value. The analysis further revealed that gross margin, net farm income and net return on investment were ₦41,128.00, ₦41,097.00 and 1.6 respectively. This implies that for every 100 kobo invested in the production, 160% was gained. From the result, investors are encouraged to go into the production of the crop as they are sure of making profit. This agrees with (Nkamigbo, Atiri, Gbughemobi and Obiekwe, 2015) who reported a mean rate of return of 153% of hybrid maize in their study area. The implication of this is that vitamin A cassava production in the study area is a better investment.

TABLE 2
COST AND RETURNS ON VITAMIN A CASSAVA FARMERS IN ANAMBRA STATE

Variables	Amount (₦)	Percentage (%)
Total Revenue	***66, 726.00***	
Cost of planting material	4, 160.00	16.3
Cost of labour	9,526.00	37.2
Cost of fertilizer	7,190.00	28.1
Agro chemicals	2,814.00	10.1
Cost of land renting	1,908.00	7.5
Total Variable Cost (TVC)	**25,598.00**	**100**
Fixed Cost		
Depreciation on wheelbarrow	10.00	32,3
Depreciation on hoe	5.00	16.1
Depreciation on cutlass	5.00	16.1
Depreciation on sprayers	11.00	35.5
TOTAL FIXED COST	31.00	100
Total Cost (TVC+TFC)	25,629.00	
Gross Margin (TR-TC)	41.128.00	
NFU (TR-TC)	41,097.00	
NROI (NFI/TC)	1.6	

Also the analysis of profitability of vitamin A cassava production using Benefit Cost Ratio is shown below.

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Total Revenue}}{\text{Total market Cost}} = \frac{₦66{,}726.00}{₦25{,}629.00} = 2.6$$

BCR > 1 = Profitable.

From the result of the analysis, yellow cassava production in the study area with BCR > 1 indicator that the venture is a profitable business.

3.2 Influence Production Costs have on Financial Value of Vitamin A Cassava Output in Anambra State

Table 3 shows outputs of the four functional forms of the regression model for predictors of the influence production cost have on the financial value of yellow cassava output in the study area. The result indicated that output of the Exponential function gave the best result in terms of number of significant predictors, signs and sizes of the predictors as well as the value of F- statistic, R^2 adjusted and was chosen as the lead equation. The coefficient of multiple determination (R^2) 54.6% meant that 54% of the variation in the profit was explained by the variations in the independent variables while the remaining 46%

was due to error. The F-statistic value of 31.70 was significant and confirms to overall significance of the regression analysis. The equation is given as:

log Y = b0+b1COLAB+b2COFERT+b3CPM+b4COSTPEST+b5COSTLAND+e

log Y = 4.549+2.873COLAB+0.115COFERT+1.965CPM+0.68COSTPEST+1.989COSTLAND+e .

Out of the five predictors included in the model, three namely cost of planting material, cost of labour and cost of renting land statistically and significantly influenced production returns earned by the farmers. The cost of planting material was positive and highly statistically significant at 1% probability level. This implies that unit increase in the cost of procurement of planting material will result in increase in the financial value of vitamin A cassava output in the study area. This is in consonance with (Ekpunobi, *et al*, 2020) who stated that increase in planting material is bound to increase output and producers could procure additional planting material for available land space. The effect of cost of labour was also positive and highly statistically significant suggesting that it is a crucial input in vitamin A cassava production. The positive sign of the co-efficient of cost of renting/leasing land suggests a direct relationship between farm size and output level. The implication of this is that the more farm acquired will generate a higher output (income) to the farmer. This agrees with the report of (Okeke, Nkamigbo and Chukwuji, 2013) that farm size has a direct relationship with the output and larger farm size generate higher income to the farmer.

TABLE 3
INFLUENCE PRODUCTION COSTS HAVE ON THE MONETARY VALUE OF VITAMIN A CASSAVA OUTPUT IN ANAMBRA STATE

Influence Production Costs have on Monetary Value of Vitamin A Cassava Output in Anambra State					
Variable	**Linear**	**Semi log**	**Exponential[1]**	**Double log**	**Decision**
Constant	-92811.457 (-1.477)	200732.312 (0.302)	4.549 (104.915)***	3.086 (6.276)***	
Cost of plant. Material (CPM)	-0.200 (-0.215)	-89068.393 (-0.597)	1.965 (3.062)***	0.332 (3.011)***	Reject
Cost of fert. (COFERT)	0.097 (0.57)	33386.058 (1.112)	0.115 (1.761)	0.046 (2.082)**	Accept
Cost of pest and herb (COPEST)	9.715 (0.632)	41873.519 (1.048)	0.068 (0.921)	0.032 (1.072)	Accept
Cost of Lab. (COSTLAB)	2.300 (3.040)***	1.2052.147 (0.195)	2.873 (5.501)***	0.004 (0.0087)	Reject
Cost of renting/ Leasing land (COSTLAND)	20.265 (5.570)***	63547.053 (2.395)**	1.989 (7.919)***	0.060 (0.003)*	Reject
R^2 F statistics Sample size	0.261 9.310*** 138	0.085 1.931** 138	0.546 31.701*** 138	0.297 8.795*** 138	
Figures in parenthesis are t- ratios. *** Significant at 1%; ** Significant at 5%; * Significant at 10%.					

Source: Computed from the Field Survey Data, 2020

3.3 Constraints to Vitamin A Cassava Production in Anambra State

The constraints associated to vitamin A cassava production were shown in Table 4. High cost of labour, poor access to vitamin A stem, poor access to capital, poor pricing of vitamin A cassava tubers and poor transportation infrastructure were perceived as the most serious constraints encountered by vitamin A cassava production with high percentages of 62.3, 54.3, 50.7, 43.5 and 43.5 respectively. High cost of fertilizer (39.1%) and insecurity challenge/fear of herdsmen attack (36.2%) also affect its production. Yakassai (2010) and Emmanuel (2013) highlighted finance as a factor impeding emergence of modern cassava production system. Other constraints of less importance were high cost of transportation (16.7%), difficulty in accessing large expanse of land (15.9%), pest and diseases (8.7%) and poor access to extension services (4.3%). This is contrary to (Nkamigbo, Nwoye, Makwudo and Gbughemobi, 2018) who reported inadequate extension and pest and disease infestation as the major constraints to maize production.

TABLE 4
CONSTRAINTS TO VITAMIN A CASSAVA PRODUCTION

Constraints	Frequency	Percentage
Poor access to yellow cassava stem	75	54.3
High cost of fertilizer	54	39.1
Poor pricing of yellow cassava tubers	60	43.5
Pest and diseases	12	8.7
Poor access to capital	70	50.7
High cost of labour	86	62.3
Insecurity challenge (fear of herdsmen attack)	50	36.2
Difficulty in accessing large expanse of land	22	15.9
Poor transportation infrastructure	60	43.5
High cost of transportation	23	16.7
Poor access to extension services	6	4.3

Multiple responses **Source: Field survey, 2020**

IV. CONCLUSION

The result of costs and returns of vitamin A cassava production from one plot (100 x 50Ft) revealed that gross margin, net farm income and net return on investment were ₦41,128.00, ₦41,097.00 and 1.6 respectively. This implies that for every 100 kobo invested in the production, 160% was gained. The cost of labour (35.5%) and fertilizer (28.1%) were the major cost in the production of vitamin A cassava. Multiple regression analysis revealed that cost of planting material, cost of labour and cost of renting land statistically and significantly determined net farm income earned by the farmers while cost of fertilizer and cost of pest were not significant. . High cost of labour (62.3%), poor access to vitamin A cassava stem (54.3%), poor access to capital (50.7%), poor pricing of vitamin A cassava tubers (43.5%) and poor transportation infrastructure 43.5%) were perceived as the most serious constraints to vitamin A cassava production in the study area. It was recommended that farmers should be encouraged to form cooperatives in order to enable them access or purchase tractors which should be made available and affordable to farmers to ease the cost of labour, government and other stakeholders should be encouraged to multiply yellow cassava stems and investors should be encouraged to set up industries that would enter into contracts with vitamin A cassava farmers in the State in order to buy off their produce and process them into value added products.

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