American Journal of Economics, Finance and Management
Vol. 1, No. 3, 2015, pp. 171-178
http://www.aiscience.org/journal/ajefm

Economic Analysis of Small Scale Sweet Potato Production in Zaria Local Government Area of Kaduna State

Abdulkarim Yusuf, Yunana Titus Wuyah*

Department of Economics and Management Sciences, Nigeria Police Academy, Wudil- Kano, Nigeria

Abstract

The study examines the resource use efficiency in sweet potato production among small scale farmers in Zaria Local Government Area of Kaduna State. Primary data were collected from 120 small scale sweet potato producers with the aid of structured questionnaire from five villages. Based on their production strength, twenty four sweet potato farmers were chosen from each village using the simple random sampling technique. The analytical tools employed were descriptive statistics, gross margin analysis technique, correlation analysis and production function analysis. The result of the correlation analysis reveals that educational status, farm size and farming experience had strong positive correlation with sweet potato output while the result of the empirical Cobb Douglas production function reveals that the production inputs were able to explain variation in the level of output significantly by sixty eight percent [68%]. The findings of the study showed that the cost of production was N49, 069.00 per hectare with labour accounting for the highest cost item. The gross margin obtained was N44, 573.90 per hectare. The study equally shows that the factor inputs considered in sweet potato production were inefficiently utilized as demonstrated by their various efficiency ratios and with regards to return to scale, sweet potato farmers exhibited increasing return to scale.

Keywords

Small Scale Farmers, Gross Margin Analysis, Efficiency Ratio, Elasticity of Production, Correlation Analysis

Received: March 20, 2015 / Accepted: April 16, 2015 / Published online: May 8, 2015

1. Introduction

At independence in 1960, agriculture stood out as the most important sector of Nigeria's economy in several respects. It employed over eighty percent (80%) of the nation's workforce, served as the most important foreign exchange earner and constituted a major source of Government revenue (CBN, 2000).Given the vastness of the country and its diverse climatic and soil conditions, a wide variety of crops are grown for industrial use, exports as well as domestic consumption. The nation's agricultural production is still largely in the hands of the small scale farmers who are said to account for ninety five percent [95%] of the total agricultural production (Adesimi A.A.1997). At present, there are a relatively large abundance of undeveloped resources and resources being utilized at a low level of productivity, which if tapped and used effectively would result in large increases in production and thus enabling Nigeria not only to feed herself but also solving the world's food problem.

One serious problem facing Nigeria today is chronic and transitory food insecurity (World Bank, 1998).The contribution of agriculture to Gross Domestic Product (GDP) which was 65% on the average in the 60's dropped to 22.4% between 1976 and 1980. Even though it rose to 29.2% in the year 2001, it dropped further to 22% in 2014 (CBN, 2014). Although Gana (1990) described Nigeria as a food insecure country, the food problem which started in the mid 1960's, (Ojo, 1995) has continued to deepen, several decades after independence (Adesina, 1997). Opinions may differ on the

* Corresponding author
E-mail address: always_ty_2006@yahoo.com (Y. T. Wuyah)

magnitude but the nature of Nigeria's food problem has never been in doubt. At the national level, the main food problems are food supply deficits, poverty and uneven distribution of income in terms of ability to buy food. On the economic front inadequate food has resulted in reduced export earnings, large food imports, small revenue for Government, shortage of raw materials for processing industries and increased inflationary pressure (Ojo, 1995).

Sweet potato (Ipomea Batatas) has tremendous potentials to be an efficient and economic source of energy within Sub Saharan Africa. It is the third most important root and tuber crop after cassava (Manihot Esculenta) and yam (Dioscorea specie). Both root and leaves are good source of pro vitamin A, vitamin B, vitamin C, Calcium, Iron, Potassium and sodium with a small amount of protein in both root and leaves (Woolfe, 1992).

Despite the importance of sweet potato, as stated above, it is considered a minor crop in terms of production and consumption in Nigeria. Of the estimated 200,000 million tones of all root and tubers produced in Nigeria annually, from 2003 to 2005 sweet potato contributed only 0.13% (Horton, 2008). In addition to the little emphasis placed on the crop, average yield under local conditions in the country is four tones. This is extremely low when compared to other countries such as China were as much as 12 tonnes per hectare have been obtained through the use of similar labour intensive and modern technology system (Woolfe, 2002).

The poor output realized by farmers may be an indication that resources needed in the production of the crop are not being used at their optimal levels. The relatively little emphasis laid by farmers on the crop raises the question as to whether it is profitable to grow the crop or not. This situation calls for an assessment of the resources needed for its production and how these resources are managed by its cultivators. This vital information which is lacking at the moment has created a vacuum which this research has the main objective of filling. The major objective of this study is to estimate the production function for sweet potato and to determine the profitability from sweet potato production in the study area. The paper has been structure into five sections: section one is the general introduction of the research topic, the second section deal with the literature review and theoretical framework. Research methodology in the third section, presentation of results and analysis in section four and section five is the conclusions and recommendations.

2. Literature Review and Theoretical Framework

Majory, Phinea, and Stephen (2010) evaluate the efficiency of the small scale farmers for the production year 2006/2007 in Limpopo province using policy analysis matrix. A total of twelve production systems were selected. Result shows that all were profitable under market condition with existing policies and all except Dry land maize had comparative advantage suggesting efficiency in the systems. Ranking the systems in term of PRC and DRC, irrigated vegetables like Potatoes, cabbages and tomatoes had higher profitability and comparative advantages than field crops like both dry and irrigated maize, Peanut and Beans. Despite competiveness in all and comparative advantage in most systems, these was not due to policy intervention as incentive indicators, e.g. SRP, shows that all production systems are being taxed indicating little motivation from policies for small scale farmers to production.

Gbigbi, Miebi Theophilus (2011) identifies and analyses factors that influence the economic efficiency of smallholder sweet potato producers in Delta State by drawing on data from random sample of 100 smallholder farmers from Ughelli South Local Government Area. The study employed stochastic frontier and Tobit model to measure the level of economic efficiency and its determinants in sweet potato production. Empirical results show decreasing returns to scale in production. The mean economic efficiency is 0.61 with a range of 0.13 to 0.99. Education, access to extension, access to credit and membership of farmer's cooperative positively and significantly influence economic efficiency. Innovative institutional arrangements that enhance extension and farmer training accompanied with improved access to credit is likely to enhance sweet potato production efficiency.

Ogundari and Ojo (2007) examine the overall efficiency of small holder croppers in Nigeria with a view to examine the productive efficiency of in food crop production in the country. Data were collected from 200 farmers' selected using multi-stage sampling technique and analysed using descriptive statistics, stochastic frontier production and cost function models. The return to scale (RTS) for the production function revealed that the farmers operated in the irrational zone (stage I) of the production surface having return to scale (RTS) of 1.113. The mean technical, allocative and economic efficiency of 0.733, 0.872 and 0.684 respectively were obtained from the data analysis, indicating that the sample farmers were relatively very efficient in allocating their limited resources with allocative efficiency (AE) appears to be more significant than technical efficiency (TE) as a source of gains in economic efficiency (EE). The result of the analysis indicate that presence of technical inefficiency and allocative inefficiency had effects in the food crop production as depicted by the significant estimated gamma coefficient of each model, the generalized likelihood ratio test and the predicted technical and allocative efficiencies within the

farmers.

Benjamin, Elvi, Augustus, Lawrence and Mary (2013) investigated the factors that determine farmers' shift in market participation from village to regional market in Vihiga County. Market participation has a potential to increase farmers' rural incomes and employment opportunities especially if farmers concentrate on production and marketing of local crops requiring low inputs such as sweet potatoes. Cross-sectional data was collected and a multinomial logit model was used for the analysis. Participation in local town market rather than village market was influenced by credit access, total income, transport mode to market, access to extension services, age, value addition done and the quantity of sweet potatoes supplied, while; transport mode, land size, quantity of sweet potatoes and gender determined participation for the regional option. It is recommended that the local and national government should: Increase its support in the establishment of sweet potato market; improve the rural road networks to cut down transport costs, and increase support to farmer groups or associations to increase farmers' market participation.

Benjamin, Francis, Stephen, Craig, Julia (2014) argued that Sweet potato is one of the most important staple food crops with significant role for food security and also a potential commercial crop in many sub Saharan African countries. In Kenya, its production is hindered by numerous biotic, abiotic and social factors. A baseline survey study was conducted in central, eastern and western Kenya between September and December 2012, to determine the farmers' preferences of Sweet potato varieties, production constraints and farmers' coping strategies. A structured questionnaire was randomly administered to 345 farmers in five counties. Data on households' demographics, Sweet potato varieties grown, sources of seed, cultural practices, and production constraints were collected and analyzed using statistical package for social scientists (SPSS). Results indicated that 60% of the farmers interviewed were women and family sizes varied between 3-5 persons in 55% of the households. Farm sizes ranged 0.41-0.8 ha with 90% of Sweet potato being grown on 0.24 ha or less. The main food crops grown on the surveyed farms included maize, beans, Sweet potato, cassava, sorghum, and pigeon peas, while the main cash crops were; kale, banana, sugarcane, bean, maize, Sweet potato and groundnut. The average Sweet potato yield on the farms surveyed ranged from 5.5-7.4 t ha-1. The preferred Sweet potato varieties were Vitaa, Kembu 10, and Kabonde because they were orange fleshed with high beta carotene. Production constraints in the three regions were basically similar, with 35% of the farmers identifying weevils as the major pest, and Sweet potato virus disease (SPVD) as the major disease. Drought was identified by 28% of the farmers as a major production constraint. Farmers indicated the use of clean seed, high yielding varieties, high planting density, and manure application as some of the strategies they used to cope with the production constraints. To improve Sweet potato production in Kenya, these production constraints need to be addressed.

Economic theory of the firm begins with theory of production. What is a firm? The essence of a firm is to buy inputs, convert them to outputs, and sell these outputs to consumers, firms or government. Therefore a firm is poised between two markets. It is a demander in factor markets. It buys the inputs required for production in factor markets (markets that supply inputs for firms). It is a supplier in market for goods and services. It has to adjust its production to satisfy the demand curve of its customers at profit. It is assumed that the firm or the owner of the firm always strives to produce efficiently, or at lowest cost. He will always attempt to produce the maximum level of output for a given dose of inputs avoiding waste whenever possible.

The production function is the relationship between the maximum amount of output that can be produced and the inputs required to make that output. Put in other way, the function gives for each set of inputs, the maximum amount of output of a product that can be produced. It is defined for a given state of technical knowledge (If technical knowledge changes, the amount of output will change.)

3. Research Methodology

3.1. Study Area and Data Collection

The study was carried out in Zaria Local government area of Kaduna State located at the North-West region of the country. The population for the study was made up of 120 sweet potato farmers purposively sampled from five villages namely Dumbi, Pan Medina, Tunkure, Dutse Abba and Dan Mallam. The study adopted a cross sectional sample survey. The random sampling technique was used to select twenty four (24) sweet potato farmers from each village. Primary data were used for this study. These data were obtained through the use of structured questionnaire and oral interview. Descriptive statistics was used to describe the socio- economic characteristics of sweet potato farmers and gross margin analysis was used to determine the profitability from sweet potato production and the production function analysis was used to determine the extent of resource use efficiency in sweet potato production in the study area.

3.2. Data Analysis

The analytical tools utilized to capture the objectives of this study are;

1. Descriptive statistics (DS): measures of central tendency such as frequency distributions, percentages were partly

used to describe the socio- economic characteristics of sweet potato farmers in the study area.

2. Production function analysis (PFA): Linguard and Raynar (1975), Koutsoyiannis (1970), Olukosi and Ogungbile (1989), referred to production function as a physical/ technical relationship between factor inputs and outputs. Stressing further, Koutsoyiannis (1979), affirmed that the production function describes the law of proportion that is, the transformation of factor inputs into products [output] at any particular time period. The production function depicts the technology of a firm, an industry or of the economy as a whole. The production function includes all the technically efficient methods of production. It describes not only a single isoquant but the whole array of isoquants each of which shows how output varies as the factor inputs changes. Production function provides measurement of useful economic tools such as marginal productivity of factor of production, marginal rate and elasticity of substitution, factor intensity, efficiency of production and return to scale. Consequently, the production function was used to estimate the returns to scale in sweet potato production and the extent of resource use efficiency in sweet potato production in the study area.
3. Gross margin analysis (GMA): The gross margin analysis involves evaluating the efficiency of an individual enterprise or a farm firm so that comparison can be made between enterprises of different farm plans. The purpose of this analysis is to identify the cost, returns and profitability or loss per hectare. It is a very useful planning tool in situation where fixed capital is a negligible portion of the farming enterprise as is the case in subsistence agriculture (Olukosi and Erhabor, 1988). The gross margin by definition is the difference between the gross farm income (G F I) and the total variable cost (TVC) i.e G.M = GFI - TVC. The gross margin analysis was used to determine the profitability from sweet potato production in the study area.

3.3. Research Hypothesis

The following hypothesis were tested as a means of carrying out the objectives of the study

Null Hypothesis (H0): Sweet potato production is not profitable

Alternative Hypothesis (H1): Sweet potato production is profitable

3.4. Model Specification

To determine the extent of resource use efficiency in sweet potato production in the study area, we specify our model in its general form as;

This functional form is represented below as:

$$Y = ax_1^b x_2^c x_3^d x_4^e x_5^f x_6^g + U^e \quad (1)$$

$$Y = a + b\log x_1 + c\log x_2 + d\log x_3 + e\log x_4 + f\log x_5 + g\log x_6 + e \quad (2)$$

Where

Y = output of sweet potato

$X_1 - x_6$ = Quantity of input factors as defined in the general model.

A, b-g = parameters to be estimated

e = error term

4. Presentation and Analysis of Results

Table 1. Socio – economic characteristics of the respondents.

	Characteristics	Frequency	Percentages
AGE	20 – 29 Years	12	10.00
	30 -39 Years	30	25.00
	40 – 49 Years	44	36.67
	50 – 59 Years	22	18.33
	60 and Above Years	12	10.00
Educational Level	A€dult Education	08	6.67
	Quranic/Arabic Education	64	53.33
	Primary Education	16	13.33
	Secondary Education	26	21.67
	Tertiary Education	06	5.00
Farming Experience	1 – 10 Years	29	24.17
	11 – 20 Years	24	20.00
	21 – 30 Years	52	43.33
	30 and Above Years	15	12.50
Family Size	1 – 5 persons	12	10.00
	6 – 10 persons	64	53.33
	11 – 15 persons	34	28.33
	15 and Above persons	10	8.33
Family Size	0.5 – 1.4 hectares	38	
	1.5 – 2.4 hectares	36	
	2.5 -3.4 hectares	24	
	3.5 – 4.4 hectares	14	
	4.5 – 5.4 hectares	08	
Sources of income	Farming only	74	61.67
	Farming and Trading	16	13.33
	Farming/ Civil service	30	25.00
Contact with Extension Agent	Yes	10	8.33
	No	110	91.67
Land Ownership	Inheritance	100	83.33
	Purchased	11	9.17
	Rented	09	7.50

Source: Field Survey Data, 2014

Table 1 shows that 36.67percent of the respondents were between the ages of 40 – 49 years, 10 percent of them were between the 20 – 29 years while 10 percent were above 60 years. The result shows that most of the farmers were of middle age group which is in conformity with the rural- urban

migration trend which has left the aged on the farm. Illiteracy is regarded as one of the factor militating against agricultural development among farmers in Nigeria.53.33 percent of the farmers attained Quranic/ Arabic school, 6 percent tertiary education while 6.67 percent attained adult education. Most researchers use years of farming experience of farmers in lieu of management as a factor of production. It is believed that the higher the years of farming experience of a farmer, the more the management ability of such a farmer in making farm decisions (Adeniyi, 1998). 43.33 percent of the respondents had farming experience of 21 – 30 years, 20 percent between 11 and 20 years of experience. Norman (1972) defines household size as the number of people eating from one pot. It implies that the consumption unit is also the production unit. Under small scale farming, households provide most, if not all the labour requirements for farming. 53.33 percent of the respondents fell within 6 – 10 members per household, 28.33 percent fell within the range of 11 – 15members while 8.33 percent fell within 15 and above group .Farmers in the study area are generally small holders with 61.67 percent of the respondents with farms of not more than 2.5 hectares, 31.67 percent of the respondents have farm size of between 0.5 -1.4 hectares while6.67 percent had between1.5 – 2.4 hectares. 61.67 percent of the respondents were full time farmers and have no other source of income apart from farming, 13.33 percent combine farming with trading while 25 percent of the respondents combined farming with civil service job. Land acquisition is believed to constitute much constraint for efficient utilization of land especially when it is purchased or hired .The result of the study revealed that this might arise since 83.33 percent of the respondents used family land or acquired their land through inheritance .Contact with extension agents will give the farmers good opportunity to get information on better management practices, new technology and other auxiliary services (Upton M, 1998). Only 8 percent of the respondents had contact with the extension agents while the remaining did not. This shows that sweet potato farmers had relatively low chances of getting more information about new and modern production practices from the extension agents (Olagoke, 1991).

4.1. Production Function Analysis

The production function was employed to arrive at some judgement about the efficiency of the prevalent factors of production. An empirical production function enables us to do so because the marginal product of each input estimated from the production function could be compared with its marginal factor cost. Also, the elasticity of production and returns to scale are possible from the production function analysis. The results of the estimated production function are presented in table 2 and the empirical Cobb – Douglas production function is given by:

$$\text{Log Y} = 2.170 + 0.447\ \text{LogX1} + 0.367\ \text{Log X2} - 0.03\ \text{Log X3} + 0.37\ \text{Log X4} + 0.174\text{L0g X5} + e \quad (3)$$

Where:

Log Y = Output of sweet potato [kg]

Log X1 = Land area put to sweet potato production [ha]

Log X2 = Total Labour [man days]

Log X3 = Quantity of seeds/ clones [kg]

Log X4 = Insecticides [litres]

Log X5 = Chemical fertilizer [kg]

e = Random error term

Table 2. Coefficients from Cobb – Douglas production function for sweet potato production.

Variable	Regression Coefficient	Standard Error	T – Value
Farm size Log X1	0.447	0.131	3.425***
Labour Log X2	0.367	0.159	2.314**
Quantity of seed/ clone Log X3	0 03	0.158	- 0.189 NS
Insecticide Log X4	0.370	0.092	4.004***
Chemical fertilizer Log X5	0.174	0.087	1.998 **
Constant [bo]	2.170	0.329	6.598 ***

Source: Field survey Data 2014
R^2 =0.675 Adjusted R^2 = 0.657
*** = Significant at 1% Level
** = Significant at 5% Level
NS = Not Significant

From the Coefficient of Multiple Determination (R^2) of the Cobb – Douglas Production function, the specified inputs explained 68 percent of the variability in sweet potato output. This is reasonably good considering the fact that other important explanatory variables such as soil fertility, weather condition, farmer's management abilities, and timeliness of cropping operation were not included. The F – Value of a model which determines the overall significance of the entire model was 38.159 and was significant at 1 percent level of significance. This implies that all variables included in the model were collectively important and responsible for the variation in the dependent variable of the model. The coefficient of farm size Log X1 was positive and significant at 1 percent level of probability. The positive sign of the farm size suggests that a unit increase in the area of sweet potato cultivated when other explanatory variables are held constant will increase output level. This is in consonance with the a priori expectation, ceteris paribus, increase in farm size means that more inputs would be utilized and consequently more output would be expected, under good management.

The coefficient of labour (Log X2) was positive and significant at 5 percent level of probability. The positive

coefficient is in agreement with expected signs and implies that as the amount of labour in the farm was increased, the output will increase. This type of relationship is however, expected considering the labour intensive nature of production in traditional agricultural system.

The quantity of seed/ clones used (Log X3) was negative and not significant at any level of probability. This implies that the quantity of seed/ clones used is inefficiently utilized along with other resources or where there is over estimation since the farmers obtained seed from their previous years reserve. The coefficient of insecticide (Log X4) was positive and significant at 1 percent level of probability and in accordance with the expected sign. This means that the quantity of insecticide applied was directly related to output. The coefficient of chemical fertilizer (Log X5) was positive and significant at 5 percent level of probability. This is in line with the expected sign and implies that the quantity of chemical fertilizer applied was directly related to output.

4.2. Gross Margin Analysis

The profitability of any form of business can be deduced from the relationship between the cost incurred in running the farm and the returns accruing from it. The gross margin associated with sweet potato production was estimated based on the following assumptions,

1. Open market price was used for fertilizer instead of the subsidized price because subsidized price does not actually reflect the true cost (price) of input.
2. Since family labour is a substitute for hired labour in the study area, family labour was valued alongside hired labour at the prevailing market price of N400 = per man day.

4.2.1. Gross Return/ Revenue

The gross return was derived by multiplying the total quantity of produce harvested by the average market price at the period of the survey. The average gross return per hectare was N93, 642.90 (N13 times 7203.3).

4.2.2. Cost of Production

Variable cost elements were considered as the total cost of production. It was assumed that fixed cost was negligible for the small scale farmers in the study area. The variable cost of labour, fertilizer, insecticides and seed was calculated.

4.2.3. Labour Cost

The average wage rate was put at N400.00 per man day. The average cost of labour use for sweet potato production was N26, 536.00 (N 400.00 times 66.33) per hectare. From table 4.5, labour account for 47.39 percent of total variable cost in the production of sweet potato.

4.2.4. Fertilizer Cost

The price of fertilizer in the study area varied but an average price of N3600 = per 50kg was used for this analysis. Table 4.5 indicates that the average cost of fertilizer was N12, 501 = per hectare. Fertilizer cost was the second highest contributor to total variable cost (29.77) percent.

4.2.5. Seed / Clones

The average quantity of seed/ clones used per hectare was 145.00 kg and an average cost of N600. 00 for 50kg of seed / clones was used for computation. Table 4.5 indicate that farmers on the average incurred about N1, 740 = on seed / clones. This contributed about 3.11 percent of the total variable cost of production.

4.2.6. Insecticide

The price of insecticide (karate and VAE) in the study area varied but an average of N1, 600.00 per gallon of one litre was used for this analysis. Table 4.5 indicate that farmers on the average incurred about N 8,292 = on insecticide per hectare. This constitutes about 19.74 percent of the total variable cost of production.

The total variable cost of production include the cost of labour, fertilizer, insecticide and seeds and this amounted to N49, 069 =

4.2.7. Gross Margin

The gross margin per hectare represents the difference between the total value of all output per hectare and the total variable cost per hectare. Table 3 shows that the farmer earned a gross margin of N 44,573.90 per hectare.

Table 3. Average Cost and Returns from sweet potato production per hectare.

Variables	Unit per hectare	Unit price [N]	Values per hectare [N]
RETURNS			
1.Sweet potato yield (kg / ha)	7203.3	13	93,64.90
Gross Return			
VARIABLE COST			
Seed / Clones (kg / ha)	145	12	1740 .00
Fertilizer (kg / ha)	231.5	54	12,501. 00
Insecticide (litres / ha)	6.91	1200	8,292. 00
Total labour input	66.34	400. 00	26, 536. 00
C.TOTAL VARIABLE COST			49,069. 00
Gross Margin per hectare (A – C)= G R – TVC			44, 573.90
RETURN TO LABOUR (N /Man day)			671.91
AVERAGE RETURN ON GROSS MARGIN = GM / TVC			0.91

Source: Field survey Data 2014

4.2.8. Return to Labour

This gives an idea of the productivity of labour input (family and hired labour). This was calculated by dividing the sum of Gross Margin and cost of labour per hectare by the total labour input per hectare. Table 3 shows that the productivity of labour was N671.91 per man day. This result shows that it was profitable for farmers to work on their own farms considering the wage rate of N400.00 in the study area.

On the other hand, the average return on gross margin was 0.91, meaning that, for every one Naira invested; there was a gross margin of 97 kobo.

The hypothesis that sweet potato is not profitable was rejected at 1 percent level of significance. The test of significance computed (see appendix 1) shows a significant difference between cost and return. Thus, the study found that sweet potato production was profitable in the study area.

4.3. Marginal Value Product and Efficiency of Resource Use

The estimated production function enables us to evaluate the efficiency of the factors of production in agriculture. Given the prices of inputs and output, the marginal value product is the yardstick for judging the efficiency of resource use. A given resource is optimally allocated if its marginal value product is just sufficient to offset its cost. Equality of marginal value product to marginal factor cost is therefore the basic condition that must be satisfied to obtain efficient use of resources. From table 4, the highest marginal physical product (MPP) was land with 1020 and the lowest was fertilizer with 5.86 while MPP for insecticide and labour were 338 and 13.18 respectively. The marginal Value Product (MVP) for land, labour, insecticide and fertilizer were N 6,630, N85.67, N2, 197 and N 38.09 respectively. This implies that land had the highest MVP and fertilizer had the lowest.

When the Marginal Value Product of land, labour, insecticide and fertilizer for sweet potato farmers were compared with their Marginal Factor Cost (Table 4), a ratio of 3.3, 3.4, 2.8 and 1.1 for land, labour, insecticide and fertilizer were obtained respectively.

The resource use efficiency was computed for the variables that are statistically significant and as shown in Table 4, all variables were under utilized as shown by the corresponding efficiency ratio. It therefore, pays to re – allocate resources by increasing usage of such factor inputs that were under utilized for greater efficiency ratio since increasing such factor inputs will contribute more to total returns than to cost.

Table 4. Estimated Marginal Physical Product's of inputs in Sweet Potato Production.

Items	Land	Labour	Insecticide	Fertilizer
Marginal Physical Product (MPP Kg)	1020	13.18	338	5.86
Marginal Value Product (MVP N)	6630	85.67	2197	38.09
Marginal Factor Cost (MFC N)	2,000 *	25	800	36
MVP / MFC (N)	3.3	3.4	2.8	1.1

Source: Field Survey Data 2014

5. Conclusions and Recommendations

The study estimates the production function for sweet potato and also determines the profitability from sweet potato production among small scale farmers in Zaria Local Government Area of Kaduna State. Cobb – Douglas production function and gross marginal analysis were used in the estimation. The results indicate that all variables included in the model were collectively important and responsible for the variation in the dependent variable of the model. The results also show that all variables were under utilized as shown by the corresponding efficiency ratio. It therefore, pays to re – allocate resources by increasing usage of such factor inputs that were under utilized for greater efficiency ratio since increasing such factor inputs will contribute more to total returns than to cost. These results call for policies aimed at encouraging new entrants to cultivate sweet potato and the experienced ones to remain in farming. Credit and subsidy from governmental and non-governmental agencies should be made available to rural farmers, for this will go a long way in addressing their inefficiency problems

Appendix 1

Table 5. Statistical Test of Gross Margin

Items	Value	T – Value	Level of Significance
Mean of returns [N]	93642.90	T* = 16.06	0.01
Mean of cost [N]	49069.00	Tt = 2.326	
Variance of return [N]	120,896,500.00		
Variance of cost [N]	43,960,000.00		
R1 Sample of return	120.00		
R2 Sample of cost	120.00		

Source; Field Survey Data 2014

References

[1] Adeniyi J. P (1988): "Farm size and Resource Use Efficiency in Small Scale Agriculture Production,' The Case of Rice Farms in Kwara State of Nigeria". *The Nigeria Agricultural Journal 23[2]*

[2] Adesimi A. A. (1997): "Elasticity of Substitution, Return to Scale and Farm Size, empirical evidence from subsistence Agriculture". *The Nigeria Agricultural Journal 13[3]*

[3] Barrow F S (1996): "Statistical Methods for Social Science Research", *Glenview, Illinoia, USA*

[4] Benjamin K. M, Elvi N. A, Augustus S. M, Lawrence K. K and Mary C. M. (2013): "Determinants of smallholder sweet potato farmers' participation in different market options: The case of Vihiga County, Kenya". *Journal of Development and Agricultural Economics, Vol. 5(8), pp. 314-320, August, 2013 DOI 10.5897/JDAE12.13,. ISSN 2006-9774 ©2013 Academic Journals*

[5] Benjamin M. K, Francis J. M, Stephen M. G, Craig G. Y, Julia S. (2014): "Assessment of production constraints and farmers' preferences for sweet potato genotypes". *J. plant breed. genet. 02 (01) 2014. 15-29*

[6] Central Bank of Nigeria (2000): "Annual Report and Statement of Accounts", *Published by Central Bank of Nigeria*

[7] Central Bank of Nigeria (2013): "Annual Report and Statement of Accounts", *Published by Central Bank of Nigeria*

[8] Federal Office of Statistics (1994): "Demographic Report of Nigeria State", *Published by the Federal Office of Statistics*

[9] Gbigbi, Miebi Theophilus (2011): "Economic Efficiency of Smallholder Sweet Potato Producers in Delta State, Nigeria: a Case Study of Ughelli South Local Government Area" *Research Journal of Agriculture and Biological Sciences, 7(2): 163-168, 201. ISSN 1816-1561*

[10] Heady O (1982): "Economics of Agricultural Production and Resource use", *Prentice Engel Wood, New York*

[11] Horton D (1988): "Underground Crops. Long Term Trends in Production of Roots and Tubers", *Winrock International Institute for Agricultural Development Arhington, USA*

[12] Ibrahim H (2002): "Farm Organization and Resource Used Efficiency; A Case of Cotton Production in Katsina State". *An unpublished MSC Thesis*

[13] Koutsoyiannis A (2001): "Theory of Econometrics", *Second Edition, Palmgrave RG 216X5, Fifth Avenue New York*

[14] Lingard J and Rayner M (1975): "Production Growth in Agriculture; A Measurement Framework", *Journal of Agricultural Economics*

[15] Majory O. M, Phinea K. C, and Stephen A. O (2010); "The Efficiency of Small-Scale Agriculture in impopo Province of South Africa" *Poster presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010*

[16] Norman, D. W (1972): "An economic Survey of Three Villages in Zaria Province"; *Samaru Miscellaneous Paper*

[17] Ogundari Kolawole and S. O. Ojo (2007): "Economic Efficiency of Small Scale Food Crop Production in Nigeria: A Stochastic Frontier Approach" *J. Soc. Sci., 14(2): 123-130 (2007)*

[18] Olagoke, M. A (1991): "Efficiency of Resource Use in Rice Production Systems in Anambra State, Nigeria", *Published in Issues in African Development, Winrock International, Arlington, USA*

[19] Olayemi , J. K (1982): "Assessment of Technical and Economic Efficiencies in Farming", *Paper Presented at the Fourth National Training Workshop for Agricultural Planners, Ibadan, Oyo State.*

[20] Olukosi J.O and Ogungbile A. O (1989): "Introduction to Agricultural Production Economics, Principles and Applications", *Zaria, Nigeria*

[21] Olukosi J.O. (1988): "Introduction to Farm Management Economics, Principles and Application", *Publishers Ltd. Zaria.*

[22] Ojo M. O and Balogun, E. D (1993): "Sustaining Agricultural Production in a Deregulated Economy", *Economic and Financial Review, CBN Lagos, Nigeria*

[23] Olayide S. O and Heady, E. O (1982): "Introduction to Agricultural Production Economics", *University of Ibadan Press, Ibadan, Nigeria*

[24] Onwueme, I. C and Sinha, T. D (1991): "The Tropical Tuber Crops". *John Wiley and Sons Publishing, Chinchester NY*

[25] Upton M. (1979): "Farm Management in Africa: The Principles of Production and Planning". *Oxford University Press, UK.*

[26] Woolfe J. A (1992): "Sweet Potato: An Untapped Resource". *Press Syndicate of Cambridge, UK*

[27] World Bank (1998): "Delivering the Food to Africa, World Food Programme", *Journal of World Bank Agricultural Economics.*