INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Analysis of Resource Use in Yam Production in Ukum Local Government Area of Benue State, Nigeria

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Abstract:
The study examined the resource use in yam production in ukum Local Government area of Benue State, Nigeria. Data were collected from 100 farmers using purposive and simple random sampling with aid of structured schedule. Multiple regression analysis was used for analyzing the data. The result shows that the coefficient of seed, farm size and labor were positive and significant, while fertilizer and chemical were insignificant. Profit level can be increased by increasing the amount of farm size, labor and quantity of seed, and decreasing the use of fertilizer and chemical. The R^2 was 0. 6516 which implies that 65.16% of the variation in output can be accounted by the input. It can be therefore, concluded that yam farmers in the study area inefficient in the use of productive resource. This has a far reaching implication for food security in the study area in particular and the country at large. So there is need for the farmers to adjust the levels of use of these resources to obtain optimal efficiency. This could be achieved through government assistance in term of provision of the necessary inputs needed by the farmers at the right time, quantities and at affordable prices.

1. Introduction

Inadequate food supply is one of the most serious economic problems facing the country (Oredipe and Akinwumi, 2002). What is observable across the country is a case of gross inability to achieve self sufficient in the production of local food such as yam, maize, rice, among others.

Yam (Dioscorea spp) has been described as one of the major staple food in west and central Africa where it provides food for over 160 million people (Orkwor *et al*, 1995). Average statistics shows that the west Africa yam belt produced 94% of the worlds output of 52million metric tonnes (mmt) of yam in 2007 and Nigeria alone produced 75% of its west African output(IITA 2008). Despite the importance of yams as staple food for rural and urban dwellers in Nigeria, its production lacks the necessary attention in the countries agricultural sector. This is attributed to costly input requirement, especially labor and planning materials (Otoo *et al*, 1987). One of the reasons conjectured to have brought about this situation is inefficiency in the use of available resources, since the production of this crop is mainly in the hands of small scale resource poor farmers who still use traditional farming techniques with low resource productivity.

In this study therefore an attempt has been made to determine the resource use efficiency of small scale yam farmers in Benue state. The specific objectives were to:

- Estimate the level of resource productivity in yam production.
- Determine the resource use efficiency of the farmers; and
- Estimate the relative resource adjustment for optimal allocation of resources.

The analysis of efficiency is generally associated with the possibility of farms producing certain optimal level of output from a given bundle of resources or certain level of output at least cost. The reason behind measure of efficiency is that farmers are not making efficient use of existing technologies and efforts designed to improve efficiency would be more cost effective than introducing a new technology as a means of increasing output (Sharpiro, 1983) it is therefore imperative for farmers to efficiently utilize the scarce resource at their disposal to maximize production.

2. Methodology

2.1. Study Area

Ukum Local Government is situated in the north eastern part of Benue, it lies between latitude 07^0 33'N and 09^0 45'E (Abu *et al*, 2010).

The local government area shares common boundaries with Taraba state to the east, Katsina Ala local government area to the South east, and Logo local government area to the south west. (http://www. benuestategov.ng). It has a land area of 1,514km^2 and a population of 216,930 per square meter based on 2006 census (CBN 2007).

2.2. Nature and Source of Data

The study used mainly primary data collected from the administration of structured questionnaires to 100 yam farmers. Purposive and random samplings were employed in the selection of the respondents. 3 wards were purposively selected, 2 villages selected randomly from each ward and 100 respondents are randomly selected.

2.3. Analytical Tools

Marginal analysis of input utilization was used to determine the resource. Use efficiency of some of the inputs used by the yam farmers. To derive the marginal product of some of the yam production inputs, a yam production function was estimated. The implicit form of the production function is presented thus;

$Y= f(X_1, X_2, X_3, X_4, X_5, U)$……. (1)

Where

- Y = Quantity of yam tubers (in hundred)
- X_1 = Quantity of setts (in hundred)
- X_2 = Labor in (Man day)
- X_3 = Quantity of fertilizer (Kg)
- X_4 =Quantity of Chemicals (Liters)
- X_5 =Farm size (hectares)
- U_1= Error term

To ensure the selection of appropriate functional forms the study experimented with four different functional forms. They are; Linear, exponential, cob - Douglass and semi - log .

They are explicitly stated as

- linear function
  $Y = B_o + B_1 X_1 + B_2X_2 + B_3X_3 + B_4X_4 + U$ ---------- (2)
- Exponential function
  $Ln\ Y = B_o + B_1 X_1 + B_2X_2 + B_3$…… + U ----------(3)
- Semi – log function
  $Y = B_o + B_1 ln\ X_1 + B_2 ln X_2$…… + U ---------- (4)
- Double – log function
  $Ln\ Y = lnB_o + B_1 ln\ X_1$ …… + U ----------(5)

The selected variable X_1, X_2, X_3, X_4 , X_5 are as defined earlier and were each expected to have a positive casual relation. They were included in the model to determine the extent to which each item explains variation in the total output. The estimation of the econometric model (2 - 5) was carried out using SPSS 11:0

The result were evaluated to select the lead equation based on the magnitude and appropriateness of signs of the estimated regression coefficient, magnitude of the adjusted coefficient of multiple determination, significance of the estimated coefficient (t - test), goodness of fit (f - test) as well as diagnostics for multiple regression such as autocorrelation and multicollinearity. Based on the forgoing, the Double -log seems to be the best functional form. The estimated coefficient of the double -log were used to compute the marginal value product (MVP) of the resource used. The MVP were measured using the formulae

- $MVP_X = B_1 ln\ X. Py$
- Where
- MVP_X = Marginal Value Product
- B_1 = regression coefficient of resource X_i
- X_i = Arithmetic mean resource X_i
- Py = Unit Price of Output

The acquisition cost of each resource was used as the marginal factor cost (MFC). This was based on the assumption that farmers operate in a pure competitive input markets (Olukosi and Ogunbile, 1989). The MVP was compared with the efficiency of use of the input (Umoh, 2006). Economic Theory State that a firm maximizes its profit with respect to an input if ratio of its MVP to its MFC is unity (Kay, 1986). The decision rule used to ascertain whether an input is over, under, or optimally utilized was interpreted as follows:

- MVP > MFC denotes that a resource is under utilized
- MVP < MFC denotes that a resource is over utilized

- MVP = MFC denotes that a resource is optimally utilized (Amaza and Anumah 2003).

Following Iheanacho *et al (2000),* the relative resource adjustment needed for optimal allocation of the inefficiently allocated resource was estimated as follows

$D_i = (1 - 1/r_i) \times 100$ …….. (7)

Where

D_i = Absolute value of the percentage change in MVP of i^{th} resource.

r_i = Ratio of MVP to MFC for the i^{th} resource.

100 = factor (Percentage)

3. Result and Discussion

The results from the estimation of equation 2 to 5 are given in Table 1. The double log was chosen as the load equation and used to determine resource productivity and resource use efficiency. The regression coefficients for all were positive as expected. The positive coefficient of setts, labor, fertilizer, chemicals, and farm size variables implies that increase in quantities used of these resources would result to increase in output of yam, ceteris paribus. The coefficient of setts, labor and farm size were significant at 5% and 10% level

Variable	Linear	Semi-log	Double-log	Exponential
Constant	20.44(2.33)*	65.793(1.803) ***	32.718(14.88)**	2.46(0.84)
Setts (X_1)	64.505(0.66)	22.805(-2.40)	1.524(-2.64) **	0.015(2.76)
Labor (X_2)	6.71(0.78)	5.874(2.01) ***	0.398(2.223) ***	0.051(2.49)
Fertilizer(X_3)	3.409(0.82)*	6.991(0.60)	0.153(2.15)	0.042(2.4)
Chemicals(X_4)	2.128(0.82)	5.04(0.50)	0.147(0.75)	0.012(1.56)*
Farm size (X_5)	2.771(0.69) **	3.776(0.99) **	0.340(1.68)**	0.12(6.156)
Adjusted R^2	0.66	0.69	0.75	0.36
F-Ratio	6041***	90.651***	65.16**	40.4***

Table 1: Estimated Parameter Of The Yam Production Functions.
Source: Computed from regression result

Variables	Marginal Physical Product
Yam Seeds (X_1)	32.29
Labor (X_2)	0.07
Fertilizer (X_3)	14.83
Chemical (X_4)	28.87
Farm size (X_5)	1154.6

Table 2: Marginal physical products (MPPs) of input used in Yam Production
Source: Computed from regression result

Variables	Elasticity
Yam Seeds (X_1)	0.708
Labor (X_2)	1.525
Fertilizer (X_3)	0.535
Chemical (X_4)	-0.307
Farm size (X_5)	0.508
RTS*	2.969

Table 3: Elasticities of production of inputs used in Yam production
Source: Computed from regression result.

Variables	MVP	MFC	MVP/MFC
Yam Seeds	1614	180.00	8.97
Labour	315.5	300.00	1.06
Fertilizer	741.45	355.00	2.09
Chemical	1443.30	600.00	2.41
Farm Size	1154.64	500.00	2.31

Table 4: Marginal analysis of input used by Yam farmers
Source: computed from regression results.

Variable	Absolute value of required adjustment
Seed	88.85
Labour	5.66
Fertilizer	52.15
Chemical	58.50
Farm Size	56.71

Table 5: Required adjustment in Marginal value products (in percentage) for optimal allocation of some variables input used
Source: Computed from regression result

4. Resource Productivity

The marginal physical product (mpp) of yam seeds was 32.29 suggest that as increase in yam seeds by one 1kilogram would result to extra 32.29 kilogram of yam, The significant and positive sign of seed variable also indicated that a moderate increase in population of sorghum on the field will increase the yield provided that, the farm is not over populated beyond the recommended sorghum ration or mixture ratio capacity that will lead to competition for nutrients which will lower the yield. This finding is in consonance with the work of Shehu *et al.* (2007a) and Ogundari (2008), who found that seed is an important factor in production. An increase in fertilizer

usage by one kilogram would also increase output of yam by 14.83kg, This agrees with comparable findings by Daniel *et al*. (2013) who reported positive relationship between fertilizer and output of farmers. Also an increase in labour, chemical and farm size would also increase the output of yam.

5. Elasticity of Production

The elasticity of production of inputs used in yam production are presented in table 3. The production elasticity of labour input was highest with a value of 1.525. This implies that a percentage changes in the use of labour input result in more than proportionate change in yam output, The implication of this is that respondents with relatively large household size have the potential to increase their total farm output in that labour needed for the execution of important farm operations such as weeding is not expected to be a limitation. Also, farmers whose main objective is household food security would be more concerned with maximizing their output per unit of resource used, especially family labour; that is, they tend to emphasize technical efficiency (Amaza *et al*., 2006).

Also an elasticity of production of 0.008 for seeds factor suggestion that 100 recent change in quantity of seeds changes output of yam by 70.8 percentage. The yam production system was observed to have increasing rate of return to scale as indicated by the sum of elasticity of production of the inputs used, which is more than unity. This indicates that yam farmers were operating at the irrational stage of production.

6. Marginal Return to Opportunity Cost

The marginal analysis of inputs used in yam production is given in table 4. The marginal value products of land, chemical and farm size were higher than their corresponding acquisition cost. This Indicate that land chemical, and farm size were used below economic optimum level. A unit increase in quantity of seed, which cost ₦180.00, increased the value of yam output by ₦1614.00 similarly an increase in quantity of chemical which cost ₦600.00 increase the value of output of yam by ₦ 1443. 30 therefore, ceteris paribus, increase in quantities used of these input (seed and chemicals) would lead increase in profit of the yam farmers

7. Adjustment in Marginal Value Production (MVP) for Optimal Resource Allocation

The necessary percentage adjustment in mvps required to attain optimal allocation of the resource used in yam production are presented in table 5. The results indicate that for optimal allocation of seed is about 89% percent increase in mvp was required, also more than 58 percent increase in mvp was necessary for optimal chemical usage. Fertilizer resource was used at sub optimal level loading to a percentage deficit of 52

8. Conclusion and Recommendation

It can be therefore, concluded that yam farmers in the study area inefficient in the use of productive resource. This has a far reaching implication for food security in the study area in particular and the country at large. So there is need for the farmers to adjust the levels of use of these resources to obtain optimal efficiency. This could be achieved through government assistance in term of provision of the necessary inputs needed by the farmers at the right time and quantities and at affordable prices

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