ESTIMATION OF RESOURCE PRODUCTIVITY IN IRISH POTATO PRODUCTION IN JOS SOUTH LOCAL GOVERNMENT AREA OF PLATEAU STATE, NIGERIA

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ABSTRACT
This study examined resource productivity and profitability of Irish potato production in Jos south Local Government of Plateau State. Primary data was used for the purpose of this study and was obtained through the use of questionnaire. A random sample of 100 Irish potato farmers was made from four major producing communities. The data obtained were analysis using Cobb-Douglas production function and farm budgeting model. Results show that Irish potato production in the area is profitable farmers having a gross margin and net farm income of N32, 869.60 and N27, 116.80 respectively. The result also, show that only farm size and quantity of fertilizer used had statistically significant influence on output and farm size have the highest marginal physical product of 4.797kg. Summation of the elasticities of production of the inputs indicates increasing return to scale. Therefore, there is need for resource adjustment in favour of increased farm size and fertilizer usage.

KEYWORDS
Resource productivity, Profitability and Return to scale.

INTRODUCTION
Irish potato is the fourth largest crop in the world in term of yield and the third most important tubers grown in Nigeria. It's production in Nigeria has increased by over 300% since organized research on potato started in 1977 (Ifenkwe et al.,1995). The plant is predominantly grown in Jos plateau, partly due to the fact that the Germans involved in mining on the plateau first introduced Irish potato into the country (Obogbesan,1990). The main determinant of the cropping calendar for potato production in Nigeria is availability of moisture for sustained plant growth. Generally, the two main production systems are rain fed and irrigation on Jos, Mambilla, Obudu and Biu plateau. It is grown around cities like Kano, Sokoto, Kebbi, Yobe, Jigawa etc.(Okonkwo, et al.,1995) .The annual rainfall is 750mm most which most fall between May and September and an average temperature not more than 34°c .Soils found in potato producing zones are generally developed on igneous rocks of the type basalt and granites. Production is possible under Irrigation during hammttan months too. It is unfortunate that potato production is dominated by small scale producers, who employed traditional practices and inadequate techniques resulting in negligible output and therefore, a fall in supply of the commodity despite increased demand (Lang , 1997).The use of inappropriate technology results in low productivity of resources on farmers farm.

Agricultural productivity can be defined as the ratio of farm output to the quantity of a farm input used in a given farm production process. The major aim of any production system is the attainment of an optimal high level of output with a given amount of input. For this to be achieved, the productivities of the resources used needs to be increased. Increasing productivity implies increase in output per unit input. The input-output relation in farm production is important for the measurement of resource productivity. The measurement could either be in monetary or physical terms. Although some studies like that of (Ifenkwe, 1986, Okonkwo, et al, 1986 and Okonkwo, et al, 1995) have been conducted on Irish potato in Jos plateau, both studies ignored estimation of resource productivity and profitability in Irish potato production. The study by Kudi, at al.(2008) on resource productivity and profitability was conducted in Barkin Ladi, Bokkos, Mangu and Riyon Local Government Areas of the state and not in Jos south Local Government Area. Therefore, this study presents the resource productivity and profitability in Irish potato production in Jos South Local Government Area of Plateau State.

METHODOLOGY
The study was conducted in Jos South Local Government Area of Plateau State. The state fall with in Guinea savanna ecological zone covering a land area of about 1695km^2. The climate is ideal for potato production as well as other vegetables like cabbage, lettuce, carrot, apple, nectarines and strawberry (Kudi,et. al, 2008). Agricultural activities in the local government area are dominated by small scale farmers. The state lies between 80^0 24" North 80^0 32"and longitude 100^0 38" East. Plateau state has boundary with Bauch state to the North East, Kano state in the north, Kaduna state in the North West and Nassarawa to the south. It has mean maximum temperature of 220C and mean minimum temperature of 180C .The mean annual rainfall varies from 131.75cm in the southern part to 146cm on the plateau and highest rainfall recorded within the months of July and August.

Four major potato producing districts which are Du,Von, Zawan and Kuru were visited for the purpose of data collection. They were purposively selected because of high concentration of potato farmers in the area in relation to other part of the local government. A random sample of 33, 22, 20 and 25 respondents were taken from Du, Vom, Zawan and Kuru respectively based on the population of potato farmers in the area given a sample size of 100. Data were collected based on 2008 cropping season through the use of questionnaire. Analysis of the data was done using farm budgeting techniques and production function estimation. The analytical techniques used are as specified as follows:

The Farm budget technique was as specified by Olukosi and Erahbor (1988). Thus, the net farm income(NFI) IS Expressed as:

NFI = TR – TC

TC = AVC + AFC

Where

NFI = Net farm income

TR = Total revenue

TC = Total cost

AVC = Average variable cost

AFC = Average fixed cost

Cobb – Douglas Production Functional form have been used by various authors like (Tarfa, 1990 and Rahman, at al, 1998) to estimate resource productivity in agricultural production. The functional form is as specified:

$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}e$

Where

Y = Output of potato(tons)

X_1 = Farm size (ha)

X_2 = Labour (man-days)

X_3 = Fertilizer (kg)

X_4 =Capital inputs (depreciation on fixed cost items in Naira).

X_5 = Other inputs (agrochemical and planting material in Naira).

B_1, b_2, b_3, b_4 and b_5 = Regression coefficients

a = Constant term

c = Error term

For practical purposes, the quadratic function was linearised through conversion into double logarithmic function expressed as:

$LnY = Lna + b_1lnx_1 + b_2lnx_2 + b_3lnx_3 + b_4lnx_4 + b_5lnx_5 + ln\ e$

The values of marginal products of inputs were estimated as follows:

$MVP_{Xi} = MPP_{Xi} * Py$

Where,

MVPxi = Marginal value product of variable xi

MPPxi = Marginal physical product input xi

Py = Price of unit output

The marginal physical product was estimated as follows:

$MPP_{X1} = dy/dxi = biY/Xi$

Where

bi = Regression coefficient of input

X_i = Arithmetic mean value of input Xi

Y = Arithmetic mean of output Y

Resource – use efficiency was computed as follows :

r = MVPxi/MFC

Where,

R = Efficiency ratio

MVP_{Xi} = Marginal value product of variable input

MFC = Marginal factor cost (unit price of input)

RESULTS AND DISCUSSION

The various cost incurred in the course of production and the revenue obtained from sales were computed based on the prevailing market price at the time of the survey and presented in table 1.The result revealed that cost of labour and seed constituted 26.75and 28.09percent respectively of the total cost of production. Some ratio indicators of profitability was computed and the results shows that Irish potato production in the study area is profitable as represented by N1.50 returns on naira invested, 0.60 operating ratio and 0.67 gross ratio. Both operating and gross ratios are less than 1 indicating profitability. Farmers producing Irish potatoes in the area an average net income and gross margin of N27,116.80 and N32,869.60 respectively which implies high profitability

The result of the estimated production function as shown in table2 revealed that 74.6 % of the variation in output is as a result of the explanatory variables included in the model. Also, the F-statistic of 55.334 significant at 1% level of probability implies that the explanatory variables (X_1- X_5) adequately explain the dependent variable. The regression coefficients for farm size and fertilizer were positive and significant at 1 and 5% respectively. This implies that increase the quantities of these inputs would result to increased output. The coefficient for labour, capital inputs and planting materials were also positive, but were not significant at the given levels of probability. This implies that the inputs do not have significant influence on the output of potatoes in the area. Resource productivity was estimated by determining the marginal physical product (MPP) for each statistically significant variable inputs used as showed on table3. The result shows that farm size has the highest marginal physical product (**4.797**) and fertilizer input (**0.0053**) has the lowest, which implies that a unit increase in farm size result to 4.797tonnes increase in output. The values of the regression coefficient estimates in Cobb-Douglas production function is the direct measures of elasticities of production of the inputs. The coefficients of production of all the inputs are less than 1 as showed on table4. This implies inelastic and decreasing rate of returns to factors of

production. The elasticity of production of farm size is the highest with the value of 0.655. This implies that 100% change in farm size will result in 65.5% change in output of Irish potatoes. The return to scale for all the statistically significant variables is slightly greater than 1 (1.023), which implies almost constant return to scale. It's also indicates that the farmers are operating in an irrational zone of production (increasing returns to land and fertilizer).This result was in agreement with the finding of(Oladeebo and Fajuyigbe,2007). Therefore, inorder for the farmers to increase output of potato in the study area there need for increased farm size and fertilizer usage

CONCLUSION AND RECOMMENDATION

From the result of the study, Irish potato production in Jos South local Government Area with net farm income and gross margin of N27,116.80 and N32,869.60 respectively and that only 74.6% of the variation in output is as a result of the explanatory variables included in the model with farm size and fertilizer inputs having statistically significant influence on the output. The summation of the individual elasticity of production of inputs indicates increasing return to scale. Therefore, there is need for resource adjustment in favour of increased farm size and fertilizer usage for increased output of Irish Potatoes in the study area.

Table1. Cost and Returns in Irish Potato Production in the study area.

Cost and Return Items	Values(N/ha)	Percentage of Total Cost
Variable cost(VC)		
Labour	14,520.07	26.75
Seed	15,251.10	28.09
Herbicide	5,864.28	10.80
Fertilizer	8,425.00	15.52
Transportation	4,475.00	8.24
Total Variable Cost	48,535.45	
Total Fixed Cost	5,752.75	10.60
Total Cost	54,288.20	
Returns		
Average Yield(kg)	5427.00	
Average price(kg)	15.00	
Gross Return	81,405.00	
Gross Margin	32,869.60	
Net Farm Income	27,116.80	
Operating Ratio	0.60	
Gross Ratio	0.67	
Return on naira invested	1.50	

Source: Computed from field survey data, 2008

Table2. Regression estimates derived from Cobb-Douglas production function

Variables	Regression coefficient	T-Values	Level of Significant
Constant	-0.746	-0.572	NS
Farm size (X_1)	0.655	3.473	0.001
Labour (X_2)	0.00969	0.71	NS
Fertilizer (X_3)	0.201	2.296	0.005
Capital input(X_4)	0.00655	0.097	NS
Other inputs(X_5)	0.151	1.560	NS
R2	0.746		
R2Adjusted	0.733		
F- statistic	55.334		0.001

Source: Computed from field survey data, 2008

Table3. Marginal Physical Product Estimates For Inputs in Irish Potato Production.

Variables	Marginal physical products (MPP)
Farm size(X_1)	4.797
Fertilizer(X_3)	0.0053

Source: Computed from field survey data, 2008

Table4. Elasticity of Productive Resource and Returns to Scale

Variables	Regression Coefficient
Farm size (X_1)	0.655
Labour (X_2)	0.00969
Fertilizer (X_3)	0.201
Capital input (X_4)	0.00655
Other inputs (X_5)	0.151
Total	1.023

Source: Computed from field survey data, 2008

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