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ANALYSIS OF PROFITABILITY AND RESOURCE USE-EFFICIENCY IN MAIZE PRODUCTION AMONG RESOURCE POOR FARM HOUSEHOLDS IN SELECTED LOCAL GOVERNMENT AREAS OF KWARA STATE, NIGERIA

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ABSTRACT

Maize production in Nigeria is faced with high cost of inputs which hampers productivity and profitability. This study examined the profitability and resource-use efficiency in maize production in selected local government areas of Kwara State, Nigeria using 180 representative maize farming households. Descriptive statistics, budgetary analysis, multiple regression and efficiency ratios were the analytical tools. The average yield per hectare in the study area was 1.77 tonnes with average net farm income per hectare of ₦37,140. The return on capital employed also shows that maize farming enterprise was profitable in the study area with return on capital employed of 0.74 indicating a return of 74kobo per every naira invested. The production function estimate shows that land, labour and quantity of maize seed used were significantly important in explaining the variation in maize output in the study area. The efficiency ratio analysis however shows that these resources were underutilised. The study therefore recommends increase in the use of these inputs for optimal level of resource use to be attained.

Keywords: Profitability; resource use efficiency; maize production

INTRODUCTION

Cereals like rice, maize, and wheat are the major staples in the world accounting for 60% of the world's food energy intake (Food and Agricultural Organisation (FAO), 2015). Maize is of particular importance to man and livestock especially in sub-Saharan Africa where it is second only to rice in terms of consumption and the first in terms of hectares cultivated to it (FAO, 2015). In the year 2013 alone the total metric tonnes of maize produced in Nigeria was 9.4 million metric tonnes making her the 11th major producer of maize in the world (FAOSTAT, 2014). The high energy content of maize particularly makes it to be important as a cheap source of energy for man and livestock.

Maize (*Zea mays*) is grown in virtually every geo-political zone in Nigeria especially during the raining season. The need for fertilizer application whether in form of organic or inorganic however, has continuously be a constraint in its production especially by resource poor farm households. The short gestation period of maize and its importance in man and livestock diets can however make it a good source of income to resource poor

farm households in Nigeria. This of course could only be achieved if the high cost of fertilizer and inefficiency in resource use are overcome.

Ibrahim *et al.* (2014) measure the technical efficiency in maize production as well as socio-economic factors affecting efficiency of its production in different agro ecological zones of northern Nigeria. The study rests on the premise that there is a relationship between inefficiency in the use of inputs and some socio-economic factors. Stochastic frontier production function and Tobit regression were the analytical tools. It was established that relationship exists between technical efficiency and some socio-economic factors in the study area. The study concludes that farmers need to be more rational in the use of inputs to attain higher level of technical efficiency. Adesiyan (2015) examines the performance as well as factors influencing maize production in Osun state, Nigeria using one hundred representative farmers with budgetary analysis and multiple regression as analytical tools. The result shows that maize production is profitable in Osun State with a net farm return of 22 kobo per every naira invested. Factors influencing maize production in the study area include farm size, level of labour used, quantity of fertilizer and level of education of the farmers. The study recommends focus on these variables for improvement in maize production in Osun State Nigeria. Urassa (2015) examines the factors influencing maize crop production at household levels using Rukwa region in southern highlands of Tanzania. Both the importance of maize crop and the determinants of its productivity were examined in the study. The findings show that maize crop plays an important role in households' livelihood in the study area although its production level is still very low. The major factor influencing maize crop production in the southern highland of Tanzania was education, because of its importance in raising yield. The constraints to maize productivity however include difficulties in getting fertilizers, improved seeds and other chemical inputs. The study recommends improvement in maize productivity for improved level of welfare for the farm households. Esham (2014) examines the technical efficiency of smallholder maize farmers in Sri Lanka using stochastic frontier production technology on 130 maize farmers. The results reveal that the level of use of seeds and hired labour as well as the extent to which land was used positively influenced maize production in the study area. The mean technical efficiency was 72% implying that there is room for improvement in maize productivity in the study area with the present level of technology. Production efficiency at the farm level was determined by access to hybrid seeds, age of the farm household heads and ownership of irrigated lowland. The study recommends production of quality hybrid seeds for improved level of efficiency in the study area. Ajah and Nmadu, (2012) examine the socio-economic factors influencing small-scale farmers' output in Abuja, Nigeria using 160 maize farmers. Descriptive statistics and multiple regression analysis were used to analyse the data for the study. The results show that farm size, fertiliser usage, rent, farm experience and household size were the socio-economic factors influencing maize output in the study area. The use of extension services was recommended to keep farmers informed of these factors for improved production and better decision making. Sadiq, Yakasai, Ahmad, Lapkene and Abubakar (2013) examine the profitability of small scale maize production in Niger state, using budgetary analysis on 200 representative farmers in the state. The costs and returns analysis show that maize production is profitable in the study area with average net farm income of ₦48, 109.00 per hectare. Taphee, Gaji, Luka and Joungur (2013) examined the socio-economic and profitability of maize farming in Karim-Lamido Local Government Area of Taraba State,

Nigeria using 100 representative farmers and budgetary analysis as analytical tool. A return of 20 kobo per every naira invested was realised on maize farming in the study area.

This present study examines the profitability and resource use efficiency in maize production in some selected local government areas of Kwara state, North Central, Nigeria. The specific objectives of the study is to examine the socio-economic characteristics of the maize producing households in the study area based on gender of the household heads; determine the costs and returns as well as profitability of maize production in the study area based on gender of the household heads. The study also tries to estimate the production function for maize as well as the efficiency in the use of resources in maize production for improved level of well-being for maize farming households in the study area. The choice of the analytical tools was based on their simplicity. The findings emanating from the study will inform policy appropriately.

MATERIALS AND METHODS

The Study Area

The study was conducted in selected local government areas of Kwara State, North-Central Nigeria. The state has a population of 2,365,353 people (National Population Commission, 2006). It lies between latitudes $7^0 45'$N and $9^0 30'$N and longitude $2^0 30'$E and $6^0 25'$E. Wet and dry seasons are the two main seasons in the state and a short period of harmattan haze that occurs towards the end of the year and ends in the early part of the following year. The annual rainfall ranges from 800mm to 1,500mm and varies from 1,000mm to 1,500mm in the South-Western part of the state. Maximum average temperature is from 30^0 C to 35^0C across the state with a minimum of 21.1^0C to 25^0C.

Sampling and Data Collection

A multi stage sampling technique was used to select the farm households for the study. The first stage involves a random selection of three Local Government Areas in the state. The second stage involves a random selection of two villages in each of the chosen LGAs to give a total of six villages in all. The last stage was a random selection of 30 farm households from the six selected villages to give a total of one hundred and eighty farm households for the study. Information on socio-economic, demographic and farm operations were obtained from the farm households with the aid of structured questionnaire.

Data Analysis

Budgetary analysis and multiple regression were used to analyse the data generated from the survey. The budgetary formula is presented in equation (1) as follows:

NFI = TR - TC .....(1)

Where NFI = Net Farm Income

TR = Total Revenue

TC = Total Cost.

The implicit form of the multiple regression model used for the study is stated in equation (2) as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, e_i)$ .....(2)

Where Y = Output of maize in kilograms
X_1 = Farm Size (Ha)
X_2 = Maize seeds (kg)
X_3= Fertiliser (Kg)
X_4= Labour (Mandays)
e_i= Stochastic error term

Resource-Use Efficiency in Maize Production

The efficiency of the resources used in maize production in the study area was calculated using efficiency ratio as stated in equation 3.

$r = \frac{MVP}{MFC}$ .....(3)

Where r = efficiency ratio

$MVP = Marginal\ Value\ Product\ of\ variable\ X_i\ and\ is\ given\ as:$

$MVP = MPP_{xi}\ x\ P_q$

P_q= Unit price of maize output (tonnes)

MPP_{xi} = Marginal Physical Product of input Xi and is given as $MPP = \frac{dy}{dx} = b_i \frac{\bar{Y}}{\bar{X}}$

$\bar{Y}$ = Arithmetic mean value of maize output

$\bar{X}$ = Arithmetic mean value of the respective input X_i

MFC= Marginal Factor Cost of variable Xi which is the unit cost of variable Xi.

The prevailing market price for each of the variables was used as the corresponding Marginal Factor Cost (MFC) since the farmers were assumed to operate under a perfectly competitive input market. When the calculated efficiency ratio (r) is less than one, then the resource is said to be over utilised; r greater than one implies the resource is underutilised and r equals one or MVP = MFC indicates the resource is efficiently utilised (Olorunsanya, 2015). The double log form of the implicit function specified in equation 2 with its explicit form specified in equation 3 (in its linearised form) allows for the estimation of the resource use efficiency.

$\log Y = a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4$ .....(3)

The dependent variable Y and explanatory variables X_i are as explained before.

RESULTS AND DISCUSSION

Socio-economic Characteristics

The socioeconomic characteristics of maize farming households in North Central, Nigeria is presented in this section. As is usually the case only 17% of the farm households were headed by female and 82% of the households were married. In terms of age, 64% of the heads of the farm households were between 41-60 years of age indicating a middle aged population were into farming in the study area. There is the likelihood that this category of households can still adopt modern method of farming (Olorunsanya, 2015). In terms of education, 50% of the heads of the farm households had no formal education. This finding agrees with what obtains in the study area (NBS, 2010 and Olorunsanya and Omotesho, 2014). Members of rural farm households in Nigeria usually have low level of education but the situation is changing (Olorunsanya, 2014 and NBS, 2014). Interestingly however,

more than 43% of the heads of the female-headed households had no formal education. Similar finding was reported by Olorunsanya and Ugbong, (2014) among rice marketers in Niger State, Nigeria.

Table 1: Socio-economic characteristics of Maize farm households

Variable	Male-Headed	Female-Headed	Combined
Gender	149 (83)	31(17)	180 (100)
Marital Status			
Yes	138 (77)	11(6)	149 (82)
No	11 (6)	20 (11)	31 (17)
Age			
21-40	31 (17)	7 (4)	38 (21)
41-60	97 (54)	18(10)	115 (64)
>60	21 (17)	6 (3)	27 (15)
Highest Educational Qualification			
No Formal Education	77 (43)	13(7)	90 (50)
Arabic Education	8 (4)	1 (1)	9 (5)
Primary	21(12)	7 (4)	28 (16)
Secondary	28 (16)	7 (4)	35(19)
Tertiary	15 (8)	3 (2)	18 (10)
Household Size			
1-5	19 (11)	14 (7)	33 (18)
6-10	78 (43)	17 (9)	95 (53)
>10	52 (29)	-	52 (29)
Farm Size			
<1	8 (4)	1 (0.5)	9 (5)
1-2	122 (68)	29 (16)	151 (84)
>2	19 (10.5)	1 (0.5)	20 (11)
Cooperative Membership			
Yes	54 (30)	11 (6)	65 (36)
No	95 (53)	20 (11)	115 (64)
Access to Input			
Yes	73 (41)	16 (8)	89 (49)
No	76 (42)	15 (8)	91 (51)
Amount of Credit Utilisation			
Nil	86 (48)	18 (10)	104 (58)
1-100,000	53 (29)	13(7)	66 (36)
>100,000	10 (6)	-	10 (6)
Extension Access			
Yes	46 (26)	9 (5)	55 (31)
No	103 (57)	22 (12)	125 (69)

In terms of credit utilisation, 58% of the households did not have access to credit while only six per cent utilised more than one hundred thousand naira. No household in the female-headed category utilised more than one hundred thousand naira.

Labour Cost Structure for Maize Production

The cost structure for labour utilisation in maize production in some selected local government areas of Kwara State, North Central, Nigeria is presented in Table 2. The male-headed households utilised 9.5 mandays for land clearing and preparation while the female-headed households used 8.5 mandays. All together, the male-headed households utilised 20 mandays for all operations while the female-headed households utilised 18.5 mandays for the same operations.

Table 2: Cost structure for labour utilization in Maize production

Labour Structure		Male-Headed		Female-Headed		All Households	
	Unit Cost/ Ha	Quantity/ Ha	Total Value	Quantity	Total Value	Quantity	Total Value
Labour in Mandays							
Land Clearing	800	4.5	3600	4	3200	4.5	3600
Land preparation	800	5	4000	3.5	2800	4	3200
Planting	800	3.5	2800	4	3200	3.5	2800
Fertiliser Application	800	1	800	1	600	1	600
Weeding 1st and 2nd	800	3	2400	2.5	2000	3.5	2800
Harvesting	800	3	2400	3.5	2800	3.5	2800
Total		20	16,000	18.5	14,600	20	15,800

Costs and Returns to Maize Production

Table 3 presents the costs and returns to maize production in the study area. As expected variable cost constitute the bulk of the total cost of production. The fixed cost as usual in arable production in the study area is negligible due to the rudimentary way in which farm operations are still being carried out.

Cost of fertilizer constitutes 37% of the total cost of production followed by cost of labour 30%. Total variable cost was 80% for the male-headed households and 77% for the female-headed ones. Yield of maize obtained in the study area was still very low, 1.832 tonnes per hectare and 1.490 tonnes per hectare for male and female headed households respectively. A tonne of maize in the study area at the time of the survey was ₦55,000. Net farm income for the two categories of households was positive, ₦36,050 and ₦22,930 respectively for the male and female-headed households. Return on capital employed show that maize production was profitable in the study area for the two categories of households but with a higher return per capital employed for the male-headed households (0.65) than for the female-headed ones (0.48). Indicating that for every naira invested in maize farming enterprise in the study area, the male-headed households will get 65kobo while the female-headed households will obtain 48kobo respectively. All households return on capital employed was 0.68 indicating 68 kobo return on every naira invested in maize farming enterprise in the study area. This shows that maize farming enterprise is profitable in the study area. Adesiyan, (2015) reports similar finding in Osun State, Nigeria.

Table 3: Costs and returns in Maize production

Cost Item	Male-Headed			Female-Headed			All Households		
Budget Item / Ha	Quantity/ton	Price/Ton(1000Kg)	Amount (₦)	Quantity	Price/ ton	Amount ₦	Quantity/ton	Price/ton	Amount (₦)
Revenue									
Maize Yield in Kg per Ha	1.832	50,000	91,600	1.490	47,000	70,030	1.770	49,500	87,615
Variable Cost									
Maize Seeds	4.5kg	₦250/Kg	1,125	5	₦250/kg	1,250	4.5kg	₦250/kg	1125
Fertilisers	4bags	5,500/bag	22,000	3bags	5,500/bag	16,500	3.5kg	5,500	19,250
Labour Cost	20mandays/Ha	800	16,000	18.5mandays/Ha	800	14,800	20mandays	800	16,000
Miscellaneous Cost			5,500			3,800			4850
Total Variable Cost			44,625			36,350			41,225
Depreciated value of fixed item			925			750			850
Rent			10,000			10,000			10,000
Total Cost			55,550			47,100			52,075
Net Farm Income			36,050			22,930			35,540
Return on Capital			0.65			0.48			0.68

Results of the Estimated Double Log Function for Maize

Table 4 shows the regression results of the double-log production function for the study. Three of the four fitted variables were significant while only fertiliser was not. The coefficients show the magnitude by which output will be increased for every unit increase in the respective variables.

Table 4: Regression results of the double log production function for Maize

Variable	Coefficients	t-test
Maize Seeds	0.172	2.08**
Fertiliser in bags	0.092	1.85
Labour in Mandays	0.206	4.21*
Farm Size in Hectares	0.543	4.2*
Constant	0.308	4.26*
Adjusted R^2	0.62	

In the case of labour, a manday increase in labour will increase output by 0.2055 all things being equal. The same level of argument goes for all other variables because they all have positive relationships with level of output (Table 3). A unit change in level of use of each variable will increase total output by the corresponding values of the variables' coefficients all things being equal. The adjusted R^2 of 0.62 indicates that 62% of the variation in maize output is explained by the fitted variables.

Resource-Use Efficiency in Maize Production

The efficiency ratio analysis shows that all the resources were underutilised including farm land because their marginal value product were more than their unit factor cost. For instance MVP of ₦990 with unit factor cost of ₦800 indicates underutilisation of labour resource in the study area (Table 5). The same level of argument goes for other significant resources such as farm size and seeds in kilogramme.

Table 5: Efficiency of resource-use in Maize production

Farm Input	Production Elasticity	MPP	P_q	MVP	MFC	MVP/ MFC	Remark
Farm Size	0.5426	0.641	55,000	35,255	10,000	3.526	Underutilised
Labour	0.2055	0.018	55,000	990	800	1.238	Underutilised
Maize Seeds	0.1717	0.057	55,000	3,135	250	12.54	Underutilised
Return to scale	0.920						
Average Output	1.773tonnes						

There is therefore the need for the farmers to increase the use of all these resources until their value marginal product are equal to their unit factor cost. This is when optimum level of resource utilisation is obtained.

CONCLUSION

Maize farming is increasingly faced with myriads of challenges ranging from high cost of inputs to poor access to improved resources in Kwara State. Despite these challenges however maize production is still a profitable enterprise in the study area with a net farm income of ₦35,540 and return on capital employed of 68kobo per every naira invested. Farmers in the study area however, still need to be more efficient in the use of land, labour and maize seeds for optimality to be attained. With more efficient use of these resources, maize production enterprise can aid in the improvement of welfare of resource poor farm households in the study area.

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