RESOURCE USE EFFICIENCY IN MAIZE PRODUCTION IN MOKWA LOCAL GOVERNMENT AREA OF NIGER STATE, NIGERI

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ABSTRACT

This paper examined resource – use efficiency in maize production in Mokwa Local Government Area of Niger State. Multi-stage random sampling technique was used in selecting 80 farmers from two districts in Mokwa Local government Area. Descriptive statistics, production function and farm budgeting analysis, gross margin were used for the analysis of data. The result revealed that maize production in the study area was profitable with an estimated gross margin of ₦11,297.53 per hectare. Quantity of fertilizer (X_1), expenses on Agro-chemical (X_4) and labour inputs (X_5) were the significant variables influencing maize output in the study area and they were under utilized. This could probably be explained by the high cost of inputs and also lack of information on innovations. However, more awareness should be created through seminars and extension services to encourage farmers, to engage in maize production due to its enormous potentials.

Keywords: Resources, Profitability, Efficiency and Maize Production.

BACKGROUND

Globally maize (Zea mays .L) is the most important cereal after wheat and rice and also the most widely distributed crop occupying double the area of any other crop (*Daramola et* al. 1999). Maize provides nutrients for humans and animals, and serves as basic raw material for the production of starch; oil and protein; alcoholic beverages; food sweeteners and more recently fuel (FAO.2003). Its production is improving and its uses are equally increasing. Maize is used for three main purposes as: (i) staple human food in the tropics (ii) as feed for livestock in the temperate regions and (iii) raw materials for industrial products and other subsidiary uses (Daramola et *al*. 1999).

Dowswell et al. (1996) stated that about 20 percent of the global maize harvested is consumed directly as food and the remaining 80 percent is processed for secondary uses. In Africa, more than half of all maize is utilized directly as human food. The commercial value of the grains is the greatest in the developing world compared to other cereal grains (Walton, 1979). Maize contributes 15 percent (more than 50 million tones) of protein and 19 percent of the calories derived from food crops in the world's diet. For twenty developing countries, mainly in Latin America and Africa, maize is the single largest source of calories for poor and is a primary weaning food. Per capita demand for maize will continue to rise in sub-Saharan Africa where it is the dominant food grain. Elsewhere, decline in demand for food maize is offset by dramatic increases in demand for feed maize and other industrial uses (Ado, 1999).

Growth in maize utilization has been driven by the rapidly increasing demand for maize as livestock feed and industrial food and non-food products. The demand for maize as livestock feed in Nigeria for the past two decades has been on the increase. This could be attributed to the fact that consumption patterns have changed leading to a sharp increase in demand for livestock and poultry products, and consequently, leading to increase in demand for maize by the livestock feed industries (Islam and Kaul, 1986). Abubakar (2002) reported that maize production and utilization in Nigeria is still at infancy in contrast to what is obtained in the developed nations. The supply-demand gap for maize in Nigeria has long been on the increase due to increasing demand from population growth, poor farming technique and inadequate supply of input to farmers. Agriculturists have therefore been challenged to find ways to boost Nigeria's maize production to meet the growing demand. To achieve this, production resources have to be used more efficiently. This paper examines the resources use efficiency in maize production in Mokwa Local Government Area of Niger State. The specific objectives are to: (i) describe the socio-economic characteristics of maize farmers in the study area (ii) determine the profitability of maze production in the area (iii) determine the resource use efficiency in maize production in the studies area and (iv) Identify the major constraints to profitable maize production in the area of study.

METHODOLOGY

Mokwa Local Government Area consists of six districts namely Mokwa Central, Muwo, Kudu, Takuma, Kede-tiffin and Kede-tako. Out of thes

districts, Mokwa Central and Muwo districts were selected for this study. This is because of high concentration of maize farmers in this district. Mokwa Local Government Area lies between latitudes $8^0 18 - 9^0$N and longitudes $5^0 03 - 7^0$E. It covers an area of approximately 1500km^2 with an average rainfall ranging between 700 – 1400mm per annum, and a dry season of four months (NADP, 2006). The area is endowed with abundant arable land and wet land, as contained in an insight into agricultural activities in Niger State 1993 edition. The provisional 1991 census put the human population of Mokwa Local Government Area at 135,215, which is 5.58 % of the State's population (NPC, 1991).

A multi-stage sampling procedure was used in selecting two districts from the six districts. Four villages were then purposively selected from each of the two districts and 10 maize farmers were randomly selected from each of the villages making a total sample size of 80. All the selected farmers were maize growers. The primary data were collected using well structured questionnaire.

***Production function analysis*:** Regression model was used to determine the extent to which the inputs used explain the variability in maize output (Olayide and Heady, 1982). For the regression, the linear function, semi-log, quadratic and Cobb-Douglass were employed to estimate the production function. The model in its general form is:-

$Y = F(X_1, X_2, X_3, X_4)$

Where Y = Yield of maize (kg/ha),
X_1 = Quantity of fertilizer used (kg/ha),
X_2 = Quantity of seed used (kg/ha),
X_3 = Labour input (man day/ha),
X_4 = Expenses on chemicals (₦/ha),

The explicit form of this function takes the following forms:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + U_i \quad \text{(linear)}$$

$$Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + U_i \quad \text{(semilog)}$$

$$\ln Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + U_i \quad \text{(double log)}$$

$$\ln Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + U_i \quad \text{(exponential)}$$

Where a = intercept
$b_1 - b_4$ = regression coefficients to be estimated
U_i = Error – term

Gross margin: This is the difference between the gross farm income (GI) and the Total Variable Cost (TVC). It is a useful planning tool in situation where fixed capital is negligible portion of farming enterprise as in the case of small scale subsistence agriculture (Olukosi and Erhabor, 1988).

GM = GI – TVC

Where: GM = gross margin, GI = gross income, TVC = total variable cost

Resource use efficiency was computed as follows:-

$$\frac{MVP}{MFC} = r$$

Where r = efficiency ratio
If r = 1, efficient utilization
r > 1, under utilization
r < 1, over utilization of resource
MVP = Marginal value product
MFC = Marginal factor cost

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the respondents

Several indicators were used in this study to identify the socio-economic status of maize farmers in the study area. The variable analysed in this study include age, marital status, mode of land acquisition, years of farming experience, level of education and household size (Table 1). Majority of the sampled farmers planted maize sole. The north central part of Nigeria is known to be characterized with sole cropping of cereals like maize, mixtures of cereals and leguminous grains and fibres. In the southern part of Nigeria, the cropping system is reported to consist of root crops, trees and occasional stand of maize and vegetable (Olukosi and Ogungbile, 1991).

Table 1 shows that 88.75% of the sampled farmers were within the age bracket of 1-50 years. This reveals that majority of the sampled farmers were of middle age. This implies that the farmers are still in their economically active age, which could result in a positive effect on production. The result agrees with other findings like Rahman *et al.*, (2002), which reveal that farmer's age may influence adoption in several ways. The nature of influence of age on adoption is indeterminate. On the other hand, older farmers may have more resources that make it more likely for them to try new technologies. On the other hand, it may be that younger farmers are more likely to adopt new technologies than older farmers because of better education and their exposure to new ideas. About 86.25% of the sampled farmers had one form of formal education or the other. Njoku (1991) pointed out that formal education has positive influence on adoption of innovation. Furthermore, 59% of the respondents inherited the land they farmed. Others hired or were permitted to use the

land by the owners without any charges. Similarly, 40% of the sampled farmers have been in farming for between 11 and50 years. This implies that they must have acquired good experience in the production of maize. Also, 96.25% of the sampled farmers were married. The household sizes were large, with majority having between 4 and17 members. Rahman *et al*., (2002), stressed that the adoption index may be either positively or negatively related to the family size depending on the age structure and the amount of labour contributed among members.

Estimation of Regression Analysis Results: The results of the production function that was used to determine the influence of the inputs on maize production are presented in Table 2. Cobb-Douglas production function was chosen as the leading equation on the basis of R^2 value, t – value, F – value as well as the signs on the estimated parameters. The R^2 value obtained in this study implies that 42% of the variability in maize yield was explained by the independent variables included in the model. Quantity of fertilizer used (X_2) and expenses on chemical (X_4) were significant at ($P<0.05$). The quantity of labour used (X_3) was significant at ($P<0.01$). The coefficient of fertilizer is positive and significant which implies that increase in quantity of fertilizer applied will result to increase in maize output. The coefficient of Labour input is also positive and significant which implies that increase in quantity of labour used by 5% will lead to about 2.5% increase in the output of maize. Similarly, the coefficient of chemical input is positive and significant which implies that chemical is efficiently utilized by most farmers this was justified by its influence on production and which will go along way in complimenting labuor input. While coefficient of seed input is positive and insignificant which may be attributed to lack of access to improved seeds and direct purchased of seeds from market of newborns.

Table 1: Socio-economic characteristic of sampled maize farmers in Mokwa Local Government Area

Variables	Frequency	Percentage
Age in year		
21 – 30	16	20.00
31 – 40	34	42.50
41 – 50	20	25.00
Over 50	10	12.50
Level of education		
Islamic	10	12.50
Primary	05	6.25
Secondary	30	37.50
Tertiary	24	30.00
Non-formal	11	13.75
Mode of land acquisition		
Inheritance	59	73.75
Hired	03	3.75
Gift	18	22.50
Year of farming experience		
1 – 10	48	60.00
11 – 12	06	6.25
21 – 30	16	20.00
Over 40	10	12.50
Marital status		
Married	77	96.25
Single	03	03.75
Household size		
1 – 5	16	20.00
6 – 10	38	47.50
11 – 15	26	32.50
Total	**80**	**100.00**

Source: Field survey, 2003.

Table 2: Estimate of Cobb-Douglas production function for maize production in Mokwa Local Government Area

Independent variables	Estimated co-efficient	t-ratio
Constant		2.33
Fertilizer (X_1)	0.195	2.157**
Seed (X_2)	0.199	1.66^{Ns}
Labour (X_3)	0.253	2.335**
Chemical (X_4)	0.843	6.698***
R^2	0.421	
F	13.610***	

Source: Field survey, 2003.
N = 80
Ns = not significant
*** = Significant at 1%

Cost and Returns: The various cost incurred on different types of resources used and the revenue obtained from sales were estimated based on the prevailing market prices as at the period of survey. Because the sampled farmers were peasant small holder, their fixed costs are negligible so only the

variable costs were considered. The total variable cost gives an average value of ₦11, 193.37 per hectare. The gross income estimated gives an average value of ₦22, 390.90 per hectare. The findings indicate that maize production in the study area was profitable. Among the variable costs, the cost of labour input alone constituted 34.82% of the total cost of production. This suggests that labuor inputs are the most costly single item in crop production in the study area. This again, is in agreement with the findings of Baba (1989), Baba *et al* (1995) who in separate studies in Bauchi State and Sokoto State, found that labour input constituted 67.77%, 98% respectively of the total cost of production under small scale irrigation. While tractor hiring, fertilizer and land preparation constituted 18.65%, 15.18% and 14.15% respectively. The study also found out that seed, chemical, manure and transportation each constituted less that 10% of the total variable cost of maize production in the study area.

Table 3: Annual average variable cost and returns

Variables	Cost per hectare (₦)	% of total
Fertilizer	1583.9	14.15
Seed	716.30	6.40
Chemical	182.53	1.63
Manure	147.30	1.32
Tractor hiring	2087	18.65
Land preparation	1698.70	15.18
Transportation	880.16	7.86
Labour	3897.53	34.82
Total variable cost	**11,193.37**	
Gross income	**22,297.90**	
Gross margin	**11, 297.53**	
Yield (kg)	1545.37	

Source: Field survey, 2003.

Efficiency of resource used in maize production: The result of the economic efficiency of resource use based on the ratios of marginal value product (MVP) to marginal factor cost (MFC) showed that fertilizer (X_1), seed (X_2) and labour (X_3) were underutilized (Table 4). The marginal value products (MVPS) of the entire variable were positive implying that using more of those resources would increase the total value product. The MVP for fertilizer was ₦53 implying that increasing fertilizer by 1 kg would increase total value product (TVP) by ₦53, if other inputs are held constant. The marginal factor cost (MFC) for fertilizer was ₦18.3, which was lower than the MVP. Hence, fertilizer was being used below economic optimum level. Therefore, increasing the amount of fertilizer input would increase profit. The MVP for seed was ₦213. This implies that increasing seed by 1 kg would increase TVP by ₦213, if other inputs are held constant. The MFC of seed was ₦38.7, which was lower than the MVP. This implies that seed input was being used below economic optimum level. Therefore the maize farmers could increase profit by increasing seed input. With respect to labour, the MVP was ₦280. Implying that increasing labour input by 1 man-day would increase TVP by ₦280, if other inputs a held are constant. The MFC of labour was ₦19.97 which was lower than the MVP. This implies that labour input was being used below economic optimum level. Therefore, maize farmers could increase their level of profit by increasing labour. So, increasing the quantities of the three inputs in maize production in Mokwa will increase maize output and in turn increase maize revenue in the study area. This finding is in agreement with those of Aye and Oboh (2004) and Alabi *et al.* (2004) who in separate studies found that resources like land, Labour and herbicide are under utilized, so increase

Table 4: Efficiency of resources used in maize production

Inputs	MPP	MVP	MFC	MVP/MFC ratio
X_1 (fertilizer)	3.80	53	18.5	2.9
X_2 (seed)	15.19	213	38.7	5.5
X_3 (labour)	19.97	280	238.8	1.3

Source: Field survey, 2003.

CONCLUSION AND RECOMMENDATION

The study has shown that maize production in Mokwa Local Government Area of Niger State was profitable with a gross margin of ₦11, 297.544 per hectare. It was revealed from the production function that regression co-efficient of the entire variable used for maize production were positive. Therefore, increase in the use of each input would lead to increase in yield. The findings also revealed that the marginal value product for the inputs was more than their marginal factor cost signifying that they are used below economic optimum level. Based on these findings, the following recommendations are made; maize farmers should direct more of their resource to the production of maize in Mokwa; farmers should also be educated on how to use their resources efficiently to overcome the problem of under utilization; government should provide farm inputs like chemicals, fertilizer and seed at the right time and at subsidized rate to farmers. Workshop, seminars and field demonstrations should be organized for farmers by extension workers. Also there is urgent need for feeder road to facilitate

transportation of output to market from rural area, this will ensure efficient marketing of maize and facilitate dissemination and utilization of the technology at the grass root levels.

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