Resource Use Efficiency in Maize Production among Small-scale Farmers in Biu Local Government Area, Borno State Nigeria

B.A. Zongoma, Y. M. Bulama, B. G. Shettima[*] and Umar A.S.S.

Department of Agricultural Economics, University of Maiduguri, Nigeria

Abstract

This study was conducted to determine efficiency of resource use in Maize Production among Small-scale Farmers in Biu Local Government Area of Borno State, Nigeria. Primary data were collected through multi-stage random sampling, where 60 respondents were sampled. Analytical tools used include descriptive statistics, budgetary techniques using Gross Margin analysis and Regression Analysis. Results of the socioeconomic characteristics from the data collected showed that majority of the respondents (67%) were males and only 36% were females. Majority of the respondents (75%), were youth aged between 21-40 years, while only 3% were above 50 years of age. Maize production is profitable in the study area with Gross Margin of N28, 1741.00 per ha and a Total variable Cost of N12, 001.20 per ha. Semi-log function was the lead equation chosen with R^2 0.81 ie 81 % of the changes in output is attributed to changes in the independent variables. Fertilizer and quantity of seed has coefficient of 0.426 and 1.336 and significant at 5% and 1% respectively. The result also indicates that size of the farm, labour, fertilizer and seed were excessively utilized with resource efficiency level of 0.01, 0.07, 0.23 and 0.10 respectively. Major problems of the farmers in the study area include, lack of finance, high cost of inputs, transportation problem and the problems of pest and diseases. In conclusion, from the findings in the study area, maize production can be improved if resources like chemicals, labor and farm size are adequately utilized. Based on the findings, seminars or workshops should be organized to enlighten farmers on the proper use of resources and the importance of record keeping was suggested to ensure increased production,

Key words: Resource use, Profitability, Maize Production, Small-scale farmers, Borno State

Introduction

The development of agriculture in Nigeria has not met the demand of its teaming population despite the country's endowment with abundant diversified range of natural resources; it has remained one of the poor countries of the world (UNDP, 2009). Although agriculture is practiced everywhere, small holder farmers are still engrossed in abject poverty. These farmers are characterized by low productivity, low income, large family size, lack of formal education, low savings and investment, lack of access to credit facilities, inefficient use of abundant resources and continued use of crude implements (Panwal *et.al.,* 2006).

Maize is one of the most important crops in Nigeria and the world at large. It is a high yielding crop with multiple uses for food and industrial purposes. It is one of the most important crops in Nigeria owing to its suitability to various ecological zones of Nigeria. There has been rapid expansion in the production of maize and its uses are equally increasing (Odojoma, 1990). Maize is the most important staple crop in the study area and is utilized in varieties of ways. Fresh corn can be roasted or boiled and taken as snacks. Ripe and dried maize can also be milled into flour for preparation of various local dishes. In Nigeria at large, maize led to the expansion of the industrial sector especially the feed industries that use maize and maize products. Examples are flour mills, animal feed mills, confectionary companies etc.

The term resource is used to describe or refer to those means available for producing goods and services. These goods in turn are used to satisfy wants. Major resources used are; land, labor, capital and management. Agricultural inputs include seeds, fertilizers, chemicals etc., (Olukosi and Erhabor, 1988). Resource management is the effective and efficient deployment of organizations resources when they are needed and where needed. Such resources may include finances, human skills, and production resources like seed, chemicals or information technology. (Project Management Institute, 2004). The importance of management cannot be over emphasized because its effect could either be positive if properly done or negative if carelessly done.

Biu Local Government Area has quiet a number of small scale farmers who are faced with inadequate or lack of access to basic farm inputs such as improved seed, chemical etc. They are also faced with the problems of inefficient utilization of their limited resources hence low produce at the end of the harvest. Poor management practices, as well as quantities and qualities of these resources used also contribute to the general low level of their productivity. The objectives of this study were to determine the socio-economic characteristics of farmers in the study area; evaluate the cost and returns associated with maize production in the study area; determine the relationship between inputs and outputs; measure the efficiency of resource use in maize production in the area and identify the problems faced by maize farmers in the study area.

Methodology

The study area

Biu Local Government Area is located in the southern part of Borno State, Nigeria. It lies between latitudes 10° 40' and * north and longitudes 12°03 ' and * east. The local government is bordered to the north-east by Damboa Local Government Area, to the North-west by Kwaya kusar Local Government Area, to the south-east by Hawul Local Government Area and to the east by Askira Uba Local Government Area. The area has an estimated population of 176,072 inhabitants and a total land mass of 3,352 square kilometers, (NPC. 2006).

The area has favorable weather condition for most part of the year though relatively cold from December to February. The rainy season lasts for about five months (June – October) with an average rainfall of about 700 - 1000mm per annum (BOSADP, 2009). Biu Local Government Area is characterized by physical features that are predominantly plateaus. There are also creeks and streams. The soils are high in organic matter. The area is a characteristic Guinea savanna vegetative zone with grass cover, bushes and orchards. The areas along the creeks' and hill sides are green all year round. These climates are favourable for cultivation arable crops.

Major ethnic groups include Bura and Babur and very few Hausas and Fulanis. People in the area are predominantly farmers. Major crops grown include cereals (maize, rice, and) sorghum), legumes (cow-pea, groundnut, bambara nuts), vegetables (tomatoes and okras), cash crops (cotton), and fruits (mango, guava, pawpaw and oranges). Livestock found in the area include cattle, sheep, and goats. Poultry are also reared.

Sources of data

Data were collected from both primary and secondary sources. The primary data were collected through the use of structured questionnaires administered to farmers and through oral interviews. Secondary data were obtained from annual reports of the Ministry of Agriculture and Borno State Agricultural Development Program (BOSADP), journals and other relevant literature.

Sampling procedure

The data were collected using multi stage random sampling procedure. Three districts namely; Biu, Dadin kowa and Miringa were selected at random, and from each of these districts two villages were selected at random. From the six villages ten farmers were selected at random making a total of 60 respondents. 60 questionnaires were distributed but two were wasted therefore only 58 questionnaires were retrieved.

Analytical Technique

The analytical techniques used include descriptive and inferential statistics were used to analyze the data obtained. The descriptive used include frequencies, mean and percentages, distributions to satisfy objectives i and ii.

The inferential statistics used includes gross margin and regression analysis. Gross Margin analysis was used to determine costs and returns. It forms the basis for farm

cost and returns (Olukosi and Erhabor. 2005). This method was used to satisfy objective ii

of the study. It can be expressed as;

GM=GI-TVC

Where

GM = Gross Margin (N\ha)

GFI = Gross farm income or Gross farm revenue (N\ha)

TVC = Total Variable Cost (N\ha)

The Gross Margin method of analysis is used under the assumption that fixed cost is negligible (Olokosi and Erhabor, 1988).

Regression analysis was used to determine the relationship between resource use and productivity. This was used to satisfy objective (iii). The explicit form of the model is given as follows;

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e$$

Y = output of maize (kg\ha)

Xl = farm size (ha)

X_2 = labor (N paid per unit)

X3 = fertilizer (kg)

X4 = chemicals (liters)

X5 = seed (kg)

β_{0-5}= parameters to be estimated

e = error term

Four functional forms namely; Linear, Semi-log , Double-log and Exponential functions were tested

and the best was selected based on the co-efficient of determination, statistical significance of the variables, sign of the co-efficient and conformity with economic theory. A priori expectations of the variables; farm size, quantity of seed, labor, chemicals and fertilizer are expected to be positive, i.e. a unit increase in anyone of the variable will lead to a corresponding increase in output.

Resource use efficiency among the small-scale farmers was determined using the marginal value product (MVP) of each resource used is compared with cost of one unit of particular resource (MFC). The was expressed as;

$$r = MVP / MFC$$

Where

r   = efficiency of resource used

MVP = Marginal Value Product

MFC = Marginal Factor cost

Hence, it is expected that if:

r = 1, resource is efficiently utilized;

r = < 1, resource is excessively utilized

r = > 1, resources is underutilized.

Results and Discussion

Socio-economic characteristics of respondents

One of the objectives of this study was to determine the socio-economic characteristics of the respondents and how it affects their production. The socioeconomic characteristics examined were sex (gender), age, marital status, family size, educational level, years of farming experience, farm size, production goal and land tenure system or land acquisition. Table 1 present the distribution of socio-economic characteristics of the respondents in the study area.

The results in Table 1 showed that majority of the respondents (67.3%) were males while 32.7% were females. This explains that male folks are the major participants in maize production in the study area. This could be due to the fact that maize production is somewhat strenuous and requires a lot time and an appreciable amount of finance to successfully achieve maximum output. Maize is an important crop in the study area because it is a staple crop and also provides farmers with immediate cash when sold. According to Alimba and Igberi (2005) gender affects production in terms of input requirement. Men do better in land clearing and tilling while women do better in fertilizer application and weeding.

Age distributions from the Table 1 also revealed that majority of the respondents (76%) were youths in the study area and are aged between 21 - 40 years. They are in their active age and because maize farming is a strenuous activity, the older men do not take part much in it. Only 3% of the respondents were above 50years. This favors maize farming in the study area since the youths are able to participating regardless of the strenuous nature of maize farming.

Majority (81 %) of the farmers in the study area were married. This showed the fact that married farmers are faced with the responsibility of providing food to their family, they tend to be more involved in maize farming than the singles and widowed or divorced farmers.

Table 1: Distribution of Socioeconomic Characteristics Respondents

Variables	Frequency	Percentage
Gender		
Male	39	67.3
Female	19	32.7
Age(years)		
21-30	21	36.2
31-40	23	39.7
41-50	12	20.7
>50	02	03.0
Marital status		
Married	47	81.0
Single	08	13.3
Widow	01	01.7
Divorcee	02	03.4
Family size		
1-5	19	32.4
6-10	27	46.6
11-15	10	17.2
>15	02	03.5
Educational level		
Primary	14	24.1
Post primary	16	10.3
Tertiary	11	19.0
Qur'anic	05	08.6
No formal education	22	37.4
Farming experience		
1-10	11	19.0
11-20	24	41.3
21-30	17	29.3
>30	06	10.3
Farm size		
0.1 1.0	23	39.66
1.1-2.0	22	37.9
2.1-3.0	12	20.7
>3.0	01	01.7
Production goals		
Food security	15	25.9
Profit	02	03.5
Food security and profit	41	70.7
Land acquisition		
Inheritance	32	55.2
Leased/rented	24	41.4
Others	02	03.4

Source: Field survey 2012

      Family size is an important socio-economic characteristic due to the fact that availability of family labor contributes immensely to agricultural production. From Table 1, majority of the respondents (46%) have family size of 6 - 10 persons. The higher the productive household size the larger the area of land cultivated and the higher output. This agrees with the findings of Parikh and Shah, (1994) They pointed out that readily available family labor provides timely execution of important farm activities such as fertilizer application, weeding and harvesting, thus contributing to higher yield.

      Studies by Amaza (2000) have shown that farmers efficiency in using information on new production techniques increase with education and thus, their productivity. Table 1 revealed that, majority of the respondents (62%) had attempted at least one form of formal education (primary, post primary, tertiary and qur'anic), while (38%) have no formal education at all. This means farmers in the study area can easily adopt new innovations and can easily improve their farming and management practices due to their educational level.

      Majority of the farmers in the study area (41 %) had between 11 - 20 years of farming experience. This follows by 29 % had farming experience of 21-30 years, 19% had experience of 1-10 years of farming experience and only 10% have farming experience of above 30 years. The more the years of farming experience,

the more likely for the farmers to get use to certain managerial practices and tackling of some problems that have regular cycle.

Farm size has been reported to have a positive and significant relationship with technical efficiency (Dawson 1985; Bravo-Ureta and Rieger 1991,; Wilson *et. al.*, 1998; Rahman, 2003). The larger the farm size the greater the output. Table1indicates that majority of the respondents (39%) fall among farmers with farm size between 0.1 - 1.0 (ha). About 38% had 1.0 - 2.0 (ha). Only 2%1 and 1% have more than 2.1 and greater 3.0 hectares of farm sizes respectively. Respondents in the study area may enjoy the economy of size just to a certain extent because very few have farms above 2 hectares.

Agricultural production is mainly for the purpose of providing food, profit maximization or both. Table 1 also revealed that the majority of the farmers (71 %) produce for both food security and profit, while 25% produce solely for food security. Only 4% produces maize for profit purposes. This can be explained as a result of the fact that majority of the farmers depend on their farms for food and the little marketable surplus to earn some money for other domestic uses.

Farmers that own land tend to have an edge over farmers renting lands. The amount that will be paid as rent would be channeled to other farm activities. Majority of the farmers (55%) own lands as personal belongings obtained through inheritance and 41% rented their farmland from the owners of farm. Only 3% fall in the categories others, which include lending for free from friends and family. Rahman (2003) stated that pattern of land ownership by inheritance and purchase tends to promote security, motivation and management to farmers for efficient utilization of resource than land acquired through lease or hire.

Profitability of Maize Production

The distribution of gross margin per hectare is presented in Table 2

Table2: Estimates of costs and returns\ha of maize production in the study area

Items	Amount(₦/ha)
Gross revenue	**40,175.00**
Variable cost	
Seed	243.10
Fertilizer	5315.62
Chemical	199.98
Labor	6242.50
Total Variable Cost	**12001.20**
Gross Margin	**28174.80**

Source: field survey, 2008

Table 2 showed gross revenue per hectare of N40,175 and total variable cost per hectare of 12001.20. The value of gross margin obtained showed that production in the study area is profitable with margin of 28,173.80.

The relationship between inputs and output in maize production in the study area

This measure the impact of inputs on the quantity of outputs produced in the production of maize in the study area.

Table 3: Distribution of inputs-outputs relationship in maize production

Variables	coefficients	t-value	significance
Farm size (x_1)	.006	.084	0.934
Labor (X_2)	.073	.720	0.475
Fertilizer (X_3)	.426	2.461	0.017*
Chemical (X_4)	- .135	- 1. 106	0.275
Seed (X_5)	1.336	7.798	0.000 **
Constant	-	- 1.857	0.069
R^2	-	.81	
Adjusted R^2		.79	
F - ratio	45.6		

Source: field survey, 2008

** = significant at 1%, * = significant at 5%

The functional form chosen was semi-log function. It gave the highest R² value of 81 % (Table 2). The Table also reveals that farm size and labour has a positive coefficient of 0.006 and 0.073 respectively but both are not statistically significant. This may be due to the fact that maize required much of nutrient and enough moisture for its optimum performance. The result implies that even with small pieces land the crop can

performed better provided the other requirements were present. Labor was also positive. This is conformity with the apriori expectation that an increase in labour will lead to increase in output. It also means labour was properly utilized.

The coefficient of fertilizer was positive (0.426) and significant at 5%. This means fertilizer has great impact on maize production in the study area. This may not be unconnected with the fact that maize requires heavy fertilizer application. Therefore, fertilizer is very important to the overall yield of maize in the study area.

Seed also has a positive coefficient (1.336) and statistically significant at 1 %. This means the quantity and quality of seed planted greatly determines the level of total maize output in the study area. Thus, the more the quantity and qualitative seeds planted, the greater the yield obtained "ceteris paribus"

Resource use efficiency

The level of utilization of different inputs is determined by measure of efficiency of resource use. Table 4 present the estimate of resource use efficiency in maize production in the study area.

Table 4: Estimate of resource use efficiency of maize production

Variable	MPP	MVP	MFC	r
Farm size (x_1) .	004	12.00	1000	.01
Labor (X2)	.01	40.00	600	.07
Fertilizer(X_3) .	20	16.27	70	.23
Chemical (X_4)	-	-	-	-
Seed(x_5)	.003	10.21	100	.10

Sources: Field survey, 2008.

The result in Table 4 reveals that farm size, labour, fertilizer, and seeds were excessively utilized with resource use efficiency of 0.01, 0.07, 0.23 and 0.10 respectively. This implies that the farmers were getting optimum yield in maize production in the study area.

Problems of maize farmers in the study area

Table 5 present the problems associated in production of maize in the study area

Table 5: Rank order of major problems of farmers

Problems	Rank	Frequency	* Percentage %
Lack of finance	1	47	81.03
High cost of inputs	2	35	60.34
Pest and diseases	3	37	63.79
Lack of hired labor	4	24	41.37
Transportation	5	22	37.93
Lack of family labor	6	17	29.31

Source: Field survey, 2008.

*percentage total exceeds 100 due to multiple responses (Rank) in descending order of magnitude]

Small scale farmers are faced with various problems in Nigeria which poses a lot of threat to successful agricultural production. The major problem of the farmers was lack of finance which tends to limit their ability to purchase adequate quantity and amount of inputs. High cost of inputs (60%), pest and diseases (63 %), are other major problems of the farmers in the area.

Conclusion and Recommendations

Resource management is not properly coordinated, hence inefficiency in resource use. The effect is low productivity and consequently low output. This constraint coupled with problems of lack of finance and high cost of input made the situation worst. Maize production will be a very profitable enterprise if finance improves and inputs sold at low cost.

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