

Resource Use Efficiency in Sorghum Production in Lau Local Government Area, Taraba State, Nigeria.

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The study analysed Resource Use Efficiency in Sorghum Production in Lau Local Government Area, Taraba State, Nigeria. The study specifically, described the socio-economic characteristics of sorghum farmers, determined the resource use efficiency of sorghum farmers, assessed the relationship between the input and output of sorghum and identified the constraints to sorghum production. Purposive and random sampling techniques were employed to select 120 sorghum farmers for the study. Data were analysed using descriptive statistics, regression analysis and resource-use efficiency analysis. The results revealed that, sorghum farmers were not efficient in the use of resources, hence resources were either under-utilised. The result of regression analysis shows the coefficient of multiple determination (R^2) of 0.95 meaning that 95% of the variation in the output of sorghum was accounted for by the variables in the model. All the variables in the model had positive regression coefficient indicating direct relationship between each of them and output of sorghum. Majority of the sorghum farmers were small-holders who depend on their personal savings for sorghum production. Inadequate funds, inadequate extension agents, unstable price of the product and high cost of farm input were among the major constraints to sorghum production in the study area. Recommendations were made that: farmers should form or join cooperatives so as to access credit facilities from formal financial institutions, extension services should be revived so that farmers would be guided and educated on the use of recommended quantity of farm input.

Introduction

Sorghum has been, for centuries one of the most important staple foods for millions of poor rural people in the semi-arid tropics of Asia and Africa (Chindo et al., 2004). For some impoverished regions of the world, sorghum remains a principal source of energy, protein, vitamins and minerals. Sorghum grows in harsh environment where other crops do not grow well, just like other staple foods, such as cassava, that are common in impoverished regions of the world. It is usually grown without application of any fertilizers by a multitude of small-holder farmers in many countries (Food and Agricultural Organization [FAO], 1997).

According to Baiyegunhi et al., (2010), sorghum is one of the most important staple food crops in Nigeria. Its production surpasses all other crops. In terms of food contribution, sorghum is the major cereal consumed by the

majority of the population. About 73% of the total calories come from cereals and 52% of the per capita protein intakes are contributed by sorghum alone (Nigeria Agricultural Extension, Research and Liaison Service [NAERLS], 1997). It is also used extensively in Nigeria for ratio formulations for livestock, confectioneries and manufacture of beer, malt drinks and body foods (Nwufor, 2004). The leaves and grains are also used for livestock feeds and the stalks for thatching houses and making local fences. The shortfall in cereal production, particularly sorghum production has been reported in the Nigeria savannah zone, where sorghum is grown on an estimated area of 4.5 million hectares with annual production output of about 6 million tons (NAERLS, 1997).

In Nigeria, sorghum is one of the few food items whose consumption has no cultural, regional, ethnic or geographical boundary. But

unfortunately, the cultivation and production of this highly prized and very important food crops is dwindling (Baiyegunhi et al., 2010). One way these resource-poor farmers, who contribute more than 90% of agricultural output in Nigeria (Federal Ministry of Agriculture and Water Resource [FMA and WR], 2008), can achieve sustainability in agricultural production within the limit of existing resource base will be a more efficient usage of resource. To cope with the predominant menace of poverty and unemployment in Lau Local Government Area, resource use efficiency is a prerequisite for optimum farm production since inefficiency in resource use can distort food availability and security Okpe et al., 2012). Thus, the main objective of this study is to analyse efficient resource use in sorghum production in Lau Local Government Area of Taraba State, Nigeria. The specific objectives are to:

- i. described the socio-economic characteristics of sorghum farmers
- ii. assess the relationship between input and output in sorghum production
- iii. determine the resource-use efficiency by sorghum farmers and
- iv. identify the constrains to sorghum production in the study area

Methodology

The Study Area

The study was conducted in Lau Local Government Area of Taraba State. Lau Local Government Area lies between latitude $10^{\circ}18'$ and longitude $10^{\circ}48'$ East of Greenwich meridian and latitude $8^{\circ}13'$ and longitude $9^{\circ}40'$ North of the Equator. It has a landmass of 3525 square kilometers with about 68% of the landmass used for arable farming. It has a population of 96,590 people (National Population Commission [NPC], 2006).

Lau Local Government lies in the Sudan Savannah zone surrounded by rivers and streams prominent among them are river Benue, Kunini and Mayo-lope. It has a tropical climate characterized by six to seven months of rainy season with average annual rainfall of about 2000mm and average annual temperature of 27°C . The Local Government is heterogeneous in ethnic composition, among the major ethnic groups are Jenjo, Fulani, Mumuye, Nyandang and Bandawa; each with its own distinct language and dialect. The

economic activities in the area is predominantly agriculture.

Sampling Technique

Sorghum farmers constituted the study population. Purposive and simple random sampling techniques were employed to draw respondents accordingly:- five wards out of the 10 wards in the Local Government Area were selected based on their prominence in sorghum production namely: Donnada, Kunini, Abbare, Mayo-lope and Garin-dogo. In each of the five wards 24 sorghum farmers were selected using simple random technique to comprise the 120 respondents for the study.

Analytical Technique

Descriptive statistics such as: frequencies and percentages were used to analysed the socio-economic characteristics of sorghum farmers as well as the constraints to sorghum production. The production function analysis was used to determine the efficient utilization of variable inputs on the output of sorghum farmers in the study area. Marginal analysis of input utilization was also used to determine the resource use efficiency of the inputs used by the farmers.

Multiple Regression Analysis

Four functional forms, namely: Linear, Exponential, Semi-log and Double-log functions were used to determine the best fit equation. These are defined as follows:

i. Linear function

$$Y = b_0 + b_1\chi_1 + b_2\chi_2 + b_3\chi_3 + b_4\chi_4 + b_5\chi_5 + b_6\chi_6 + b_7\chi_7 + U_i$$

ii. Semi-log function

$$Y = b_0 + b_1\log\chi_1 + b_2\log\chi_2 + b_3\log\chi_3 + b_4\log\chi_4 + b_5\log\chi_5 - U_i$$

iii. Double-log function

$$\ln Y = b_0 + b_1\log\chi_1 + b_2\log\chi_2 + b_3\log\chi_3 + b_4\log\chi_4 + b_5\log\chi_5 - U_i$$

iv. Exponential function

$$\ln Y = b_0 + b_1\chi_1 + b_2\chi_2 + b_3\chi_3 + b_4\chi_4 + b_5\chi_5 + b_6\chi_6 + b_7\chi_7 + U_i$$

Where:

Y = Output of Sorghum (Kg)

X₁ = Farm size (hectares)

X₂ = Fertilizer used (Kg)

X₃ = Family labour (mandays)

X₄ = Hired labour (mandays)

X₅ = Capital (₦)

X₆ = Herbicides (litres)

X₇ = Quantity of seeds (Kg)

U_i = Error term

To estimate the resource-use efficiencies of the farmers, the values derived from the regression results were used to estimate the ratio of the Marginal Value Product (MVP) of each input to the factor price or Marginal Factor Cost (MFC) of the factor input for Sorghum farmers (Onuk et al., 2010).

Thus:

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

Where: r = Efficiency of resource use

MVP = Marginal Value Product of Resource input

MFC = Marginal Factor Cost of the Resource input

When:

$r = 1$ implies resources is efficiently utilized

$r > 1$ implies resources under-utilized

$r < 1$ implies resource over-utilized

Results and Discussion

Socio-economic Characteristics of Sorghum Farmers

The socio-economic characteristics of sorghum farmers is presented in Table 1. The result showed that 71.67% of sorghum farmers were male while 28.33% were female. This indicate that, sorghum farming is male dominated in the study area. Also, from the result in Table 1, most (85.84%) of sorghum farmers were young and below 41 years old. The preponderance of the young farmers in the farming profession means that their productivity is expected to be high since they are in their productive years (Wuranti, 2004). Table 1 further revealed that, 75.83% of the farmers have some forms of formal education. This implies that farmers in the study area may likely adopt new innovations in agricultural practices. In the same vein, Table 1 shows that most (61.67%) of the respondents were married. This implies that married people are more into sorghum production than the singles. This might be attributed more to family responsibilities by the married than singles which made them to have farming seriously in order to augment their household income.

Similarly, Table 1 indicates that, 74.17% of farmers had more than 6 years experience in farming. This implies that majority of the

farmers are well experienced in sorghum production, a situation which could result to increased yield. Experience in farming activities plays important role in decision-making relating to output increase and risk avoidance (Mohammed et al., 2009). Also Table 1 showed that most (82.50%) respondents had farm size from 1.0 to 4.0ha. This implies that most of the sorghum farmers studied were small scale farmers. Finally, Table 1 shows that 55.00% of the respondents in the study area depends on their personal savings to finance their farms, 17.50% of the farmers sourced for funds from cooperatives, 20.83% got funds from friends and relatives while only 6.67% obtained loans from Banks. This implies that majority of the farmers in the study have no access to credit facilities from formal financial institutions. This might be due to their ignorance of the existence of credit facilities and or stringent conditions that are usually required for obtaining the loan from the banks. This could negatively affect the expansion and output of the farm.

Result of the Regression Analysis

The selection of best fitting equation was based on the comparison of coefficient of multiple determination (R^2), the a priori expectation, the magnitude of standard error of the estimated parameter and statistical significance of the estimated regression coefficients. The exponential function had the best and was selected as the best fitting equation for the analysis of input-output relationship in the sorghum production. The result is summarized in Table 2. All the coefficients except the coefficient associated with fertilizer (X_2) and family labour (X_3) were positive and statistically significant at 1% and 10% respectively, these include: farm size (X_1), Hired labour (X_4), Capital (X_5), Herbicides (X_6) and Seeds (X_7). This implies that they are the main factors determining the output of sorghum in the study area. From the result in Table 2, the variable inputs: farm size (X_1) and Seeds (X_7) are highly significant at 1% level, while X_5 and X_6 (capital and herbicides) are significant at 10% level. Although, X_2 and X_3 (fertilizer and family labour) are not statistically significant, they are positively related to the output of sorghum.

The R^2 of 0.95 shows that, about 95% of the variability in the output of sorghum is accounted for by the various explanatory

variables used in the model. In addition, the F-statistic was highly significant at 1% level indicating that the equation is a good fit.

Result of the Resource-use Efficiency in Sorghum Farms

The result of analysis of resource-use in efficiency in sorghum farming is presented in Table 3. From the result, farm size, family labour and seeds were over-utilized in sorghum farms while fertilizer, hired labour, capital and herbicides were under-utilized in sorghum farms. The result implied that farmers were inefficient in the use of the resources in sorghum production in the study area.

Constraints to Sorghum Production

From the results in Table 4; the major constraints to sorghum production were identified as: inadequate funds (91.67%), unstable price of the products (84.67%), pest and diseases (80.00%), lack of improved seeds (87.50%), inadequate extension agents (94.17%), high cost of transportation (90.83%) and high cost of farm inputs (96.67%).

Inadequate funds might be attributed to the inability of sorghum farmers to have access to credit/loan from formal financial institution. This result agreed with the finding of Aduba et al., (2013). Most of the aforementioned constraints could be tackled if sorghum farmers have access to credit facilities from financial institutions.

Conclusion and Recommendations

The study revealed that sorghum farmers in the study area are not efficient in the use of farm resources. It further shows that farm input such as: farm size, hired labour, capital, herbicides and seeds are the main factors determining the output in sorghum in the study area as indicated in the regression analysis result. Also most sorghum farmers in the study area are small-holders farmers who depend on their personal savings for sorghum production. Based on the major findings of the study, the following recommendations are made:

- a. Sorghum farmers are encouraged to form or join cooperative societies so as to access credit facilities from formal financial institutions as well as from Government and NGO's.
- b. Extension services should be revived and more extension agents recruited to educate

and guide sorghum farmers on the recommended quantity of inputs to be used.

- c. Government should supply inputs to sorghum farmers at subsidized rate and at appropriate time.
- d. Government should intervene in the regulation of the prices a sorghum product by fixing a minimum guaranteed price, couple with adequate market and improved storage facilities to boost sorghum production.

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Table 1: Socio-economic Characteristics of Sorghum Farmers (n = 120)

Variable	Frequency	Percentage (%)
Gender		
Male	86	71.67
Female	34	28.33
Age (years)		
<20 – 30	38	31.67
31 – 40	65	54.17
41 and above	17	14.16
Educational level		
Non-formal education	29	24.17
Primary education	42	35.00
Secondary education	30	25.00
Tertiary education	19	15.83
Marital Status		
Married	74	61.67
Single	28	23.33
Divorced/widowed	18	15.00
Farming experience (years)		
1 – 3	31	25.83
6 – 10	63	52.50
11 and above	26	21.67
Farm size (ha)		
<1 – 2	51	42.50
3 – 4	48	42.00
5 – 6	12	10.00
7 and above	09	7.50
Source of finance		
Personal savings	66	55.00
Banks	08	6.67
Cooperatives	21	17.50
Friends/relative	25	20.83

Source: Field Survey, 2014

Table 2: Results of the Regression Analysis

Variable	β	S β	F-ratio	P	SE	R ²	F
X ₁	0.4013	0.04952	8.18	0.000	0.06543	0.95	112.65
X ₂	0.000560	0.0006562	0.09	0.932			
X ₃	0.00001053	0.0001500	0.70	0.486			
X ₄	0.00001265	0.0000384	-3.30	0.002***			
X ₅	-0.04480	0.0215	-1.78	0.081*			
X ₆	-0.002955	0.001685	-1.75	0.086*			
X ₇	-0.008984	0.00301	-2.72	0.009***			

Source: Survey Data, 2014

Table 3: Resource-use Efficiency

Resource input	MVP	MFC	Efficiency Ratio
Farm size (X ₁)	-2106	189	-11.14
Fertilizer (X ₂)	6879	163	42.2
Family labour (X ₃)	8.945	172	0.05
Hired labour (X ₄)	3871	130	29.78
Capital (X ₅)	2671	148	18.19
Herbicides (X ₆)	1816	946	1.92
Seeds (X ₇)	6.64	53	0.13

Source: Regression Result (2014)

Table 4: Constraints to sorghum production (n = 120)

Constraints	Frequency*	Percentage (%)
Inadequate funds	110	91.67
Unstable price of the product	98	81.67
Pests and diseases	96	80.00
Lack of improved seeds	105	87.50
Inadequate extension agents	113	94.17
High cost of transportation	109	90.83
High cost of farm input	116	96.67

Source: Field Survey, (2014)

¹ β = Coefficients

² S β = Standard deviation

³ * = Multiple response (10% level of sig.)

** = multiple response (5% level of sig.)

⁴ *** = Multiple response (1% level of sig.)