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Economics of Sorghum (Sorghum bicolor(L) Moench) Production in Bauchi Local Government Area of Bauchi State, Nigeria

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43- ECONOMICS OF SORGHUM (*Sorghum bicolor*(L) *Moench*) PRODUCTION IN BAUCHI LOCAL GOVERNMENT AREA OF BAUCHI STATE- NIGERIA.

By

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ABSTRACT

The study was conducted in Bauchi Local Government Area of Bauchi State- Nigeria, to examine the economics of sorghum production. Sixty farmers were randomly chosen and data were collected using a well prepared questionnaire supplemented with oral interview between April and May,2011. The data were analysed using simple descriptive statistics, farm budgeting model and Cobb Douglas production model. The result showed that majority (51%) of the farmers fell between the ranges of 40-49 years, 53% had one form of education or another and 98% of them were married. The result also revealed that farmers in the study areas obtained a net farm income of ₦ 14, 400 per hectare and ₦ 1.79 as return per Naira invested with an operating ratio, gross ratio and fixed ration of 0.47, 0.55 and 0.08 respectively. The regression analysis revealed an R^2 value of 64.0% and the coefficients of labour, fertilizer and herbicide were found to be significant ($P<0.05$) with positive signs, while seed was found to be significant ($P<0.05$). In conclusion, sorghum has been found to be profitable in the area and therefore may serve as a means of poverty reduction. However, the major constraints identified in sorghum production were high cost of inputs, low prices of produce, inadequate provision of credit and inadequate storage facilities amongst others. Therefore, intervention such as provision of inputs, soft loans, and good storage facilities will go a long way to increase production and profitability.

Keywords: Economics, Sorghum, Production, Bauchi

1.0 Background Information

The importance of agriculture to an economy can never be over-emphasized. Prior to independence, agriculture contributed more than 74% percent of the Gross Domestic Product (GDP) of the nation and also contributed to the sociological and cultural needs of the people living in Nigeria. It provides raw materials for agro-allied industries as well as income to the farmers, also serving as a source of foreign exchange (Ogazi *et al.,* 1997). But with advent of petroleum, a great shift was observed, giving rise to huge neglect of the sector which resulted in decline in productivity (yield), low income to farmers, unemployment, high rise in food prices and threat to food security among others.

FAO (1995) reported that sorghum is an annual and warm weather crop which comprises 600 genera. The species are native to tropical and sub tropical regions of all continents in addition to the South - west pacific sorghum is similar to corn (maize) in its early stages, with corn-like leaves and stalks but varies considerably from it in later stages. The inflorescence and grain is a panicle, characterized by spikelet's borne in pairs. It has more shots than corn and produces several head bearing culms from the nodes. It has more extensively branched root system, waxy coating on leaves and stems which helps to retain water even under intense heat.

In Nigeria, the most common land races of sorghum are: *Kaura, Fara-fara* and Guinea . They are variously tolerant to striga (a parasitic weed) in all the Savannah zones (Ogbonna, 2007). Improvement by breeding started in 1956 in Nigeria, however, years of selection at the Institute of Agricultural Research (IAR), Samaru Nigeria have resulted in the development and release of sorghum varieties suited to specific ecological zones (Aba, *et al*, 2004). Some of the improved varieties are; SAMSORG-3 and SAMSORG-40 (Sudan savannah ecology) SAMSORG-13 and SAMSORG-24 (Northern Guinea Savannah Ecology), and SAMSORG-17 and SAMSORG-16 (Southern Guinea Ecology) among others.

Similarly, FAO (2007) also reported that 440,000 square kilometres were devoted worldwide to sorghum production. In Nigeria 50% of the total area devoted to cereal crops is occupied by sorghum, with estimated area of 6.86 million hectares extended north-wards from Latitude 8°N to 14°N (Aba, *et al.,* 2004).In 1978, the total sorghum production in Nigeria was 4.8 million tons annually (Obilana, 2005). Nigeria among the West African sub region is the highest sorghum producer accounting for 71% of the regional total output. In the world, the country leads in sorghum production for human

consumption which has risen from its fifth position in 1995 (FAO, 1995) to be the second largest producer in the world after USA and India where more than 90% of their sorghum harvest is used for animal feed (Obilana, 2005). Sorghum is one of the most important staple food crops in Nigeria and its production surpasses all other crops. According to FMEST (1984), sorghum in the Nigerian savannah zone is grown on an estimated area of 4.5 million hectares with annual production output of about 6 million tons. The leaves and grains are also used for livestock feeds and the stalks for thatching houses and making fences (NAERLS, 1997). Sorghum is a very valuable industrial crop for brewing alcoholic and non alcoholic drinks as well as in the baking and confectionery industries in Nigeria.

According to Samson *et al (*1981), sorghum has greater untapped potentials than any other crop. It even postulated that if the twentieth century was the century of wheat, rice and maize, then the twenty-first century could become the century of sorghum. So of all the cereal crops, sorghum contributes about 50% of the calories in Nigeria generally and about 73% in the savannah regions of the country in particular (Samson *et al.* 1981). The potential for sorghum to be the driver of economic development in Africa especially Nigeria cannot be over emphasized. Therefore, this work is focused on unleashing sorghum's capacity to be the cornerstone of food security through investigating the profitability, socio-economic characteristics, costs and returns, resource-use efficiency as well as the constraints militating against sorghum production in the study area.

2.0 The Study Area

The study was carried out in Bauchi Local Government Area of Bauchi State, Nigeria. It lies between Longitude 9^0 50 and 10^040^0 N and Latitude 9^030 and 10^015E with an altitude of 609.3m above sea level. The Local Government is bounded in the North by Darazo Local Government Area; East by Alkaleri Local Government Area; South and West by Dass and Toro Local Government Areas, respectively. The vegetation is Guinea savannah, with estimated land area of 3354.7km^2. According to National bureau of statistics (2008), the census figure of Bauchi Local Government Area was 493,810 people. BSADP (1996), reported that April is the hottest month of the year with temperature rising to about 40^0C. The coldest months are December and January, when the temperature may fall as low as 17^0C to 22^0C. The mean annual rainfall ranges between 1000-1200mm. The raining season extends from May/June to September/October. The dry season starts September/October, to April/May. The maximum humidity may increase drastically during the middle of raining season to about 96% in August and drop sharply to about 10% during

harmattan around December. The major occupation of the inhabitants of the Local Government is farming, practiced under traditional system. Major crops cultivated include; maize, millet, rice, cowpea, sorghum, among others.

2.1 Sampling Technique

A random sampling technique was adapted for the selection of 60 farmers from the study area. The significance of this technique was in line with the assertion of Eboh (2009), that simple random sampling enables every individual element in the population, the same non-zero probability of being selected.

2.2 Method of Data Collection

Data were collected through the use of questionnaires administered to respondents sampled from Zungur, Birshi-Miri, Galambi and Bauchi all in Bauchi Local Government Area. The farmers were asked questions on the size of their farms, farm resources, output, and quantity of sorghum consumed, socio-economic characteristics and other production constraints among others. The secondary data were obtained from journals, textbooks, projects thesis and other documented information.

2.3 Method of Data Analysis

Data were analyzed using descriptive and inferential statistics such as frequency, percentages, farm budgeting and production function.

2.3.1 Farm Budget Model

One of the most familiar tools of analysis in production economics is the farm budgeting (Olukosi and Erhabor,1988). It is used as an aid in defining in the context of a given problem, the economic implications of a particular resource or enterprise combinations. According to Robertson (1988), the three common objectives of farm budget are;

1. To estimate the profitability of a particular pattern of organization.
2. Determine the change in profits that are likely to follow a particular change in organization, and

3. Compare different patterns or alternative changes in organization on profit basis.

The farm budget techniques used in the study can be specified as follows:

NFI= GFI – TC ..... (1)

Where; NFI= Net Farm Income

GFI= Gross Farm Income

TC= Total Cost

And, TC= TFC+TVC

Where; TFC= Total Fixed Cost

TVC= Total Variable Cost

2.3.2 Production Function Model

Production function model was used to examine the input-output relationship in sorghum production and it was given as:

$Y= f(x_1, x_2, x_3, x_4, \ldots_E)$ .....(2)

Where y = Output of sorghum in kg

X_1= Seeds

X_2= Fertilizer

X_3= Herbicides

X_4= Labour

E=Error disturbance term.

The relationship was expressed in explicit Cobb-Douglas production form (Double log) as follows:

$\text{Log}y= \log a_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + e$ ..... (3)

3.0 RESULTS AND DISCUSSIONS

4.1 Costs and Returns Analysis of Sorghum Production

The costs and return Table 1 showed that cost of sorghum production per hectare was ₦18, 020 among the respondents. The total cost is made up of the total variable cost and the total fixed costs. Variable cost consist of expenses on labour, seeds, fertilizer and herbicides, while the fixed costs in the study is limited to cost of farm land and implements.

Table 1: Summary of Costs and Returns in Sorghum Production

Cost item	Value (₦/ha)	Percentage
Variable Cost:		
Seeds	663	3.68
Labour	5,956	33.01
Fertilizer	6,315	35.05
Herbicides	2,284	13.23
Total Variable Cost	15,318	
Fixed Cost:		
Depreciation on:		
Land	2,019	11.20
Implements	681	3.78
Total Fixed Cost	2,700	
Total Cost of Production	**18,018**	**100**
Returns:		
Sales of grains	21,971	
Sales of residue	974.46	
Home consumption	9,474	
Total returns	**32,420**	
Net income	**14,400**	
Measures of Financial Success:		
Return per naira Invested	1.79	
Gross ratio	0.55	
Operating ratio	0.47	
Fixed ratio	0.8	

The total variable costs accounted for 85% of the total cost of production, while the cost of labour accounted for 33.05% and the cost of fertilizer accounted for 35.05%. This shows that labour and fertilizer were the most costly inputs in the whole production. Seeds and herbicides accounted for 17% of the total cost. The fixed costs constitute only 15% of the total cost of production approximately.

3.3.2 **Gross farm income**

The gross farm income is the total returns of all respondents which is obtained by multiplying the total physical product by the unit price for all respondents. The average gross farm income among the respondents was found to be ₦32, 420 per hectare.

3.3.3 Net farm income

The net farm income was gotten by subtracting the total cost from the gross farm income, found to be ₦14, 400 per hectare. The return on every naira invested was ₦1.79 that is the gross income divided by the total cost per hectare. This means that, for every naira invested by the farmers, a profit of ₦1.79 was obtained.

Table 2: Distribution of respondents according to their net farm income in Naira (₦) per Ha

Net Farm Income(₦)ha	Frequency	Percentage
<5,000	30	50.0
5,001 – 10,000	7	11.7
10.001 – 15,000	9	15.0
15,001 – 20,000	4	6.7
20,001 – 25,000	3	5.0
25,001 and above	7	11.7
Total	60	100

Source: Field Survey, 2011

Table 2 shows that, 50% of the respondents made a profit of less than ₦5,000 in the production of sorghum, 11.7% made between ₦5,001 – 10,000, 15% of them realized profit of between ₦10,001 – 15,000 as their net farm income, 6.7% made between ₦15,001 –

₦20,000 and only 5% made ₦20,001 – ₦25,000 while 11.7% of the obtain more than ₦25,001. The average net farm income per hectare for all respondents was ₦14, 400. This shows that though sorghum production in the study area is profitable, but not sufficient enough to compensate for the time, money and labour expended during the course of production. It could be attributed to the fact that most of the farmers sell their produce immediately after harvest when prices are low.

3.2 Production function Analysis for Sorghum Production

The R^2 which is the coefficient of determination was 64.0%. This means that 64.0% of the variation in output of sorghum production was determined by the explanatory variables included in the model. The coefficients for labour, herbicides, fertilizer, all have positive signs. This implies that an increase in units of the same inputs will result in increase in output but in the case of implements, it was found not to be significant. Amongst all the variables used, seed is the only variable with a negative coefficient which disagrees with that of rice production as reported by Abakar (2003) in Bauchi Local Government Area of Bauchi State with seed having a positive sign. This implied that it has reached its third stage in the production process (diminishing returns) and any increase in its unit will lead to decrease in the total output to about -0.4083kg.

Table 3: Regression analysis of inputs with Cobb-Douglas Model

Variable	Regression Coefficient	Standard Error	T- ratio	P
Constant	0.093	1.660	0.06	0.000^{***}
Seed x_1	-0.4083	0.1979	-2.06	0.044^{**}
Fertilizer x_2	0.2393	0.2786	0.86	0.034^{**}
Herbicide x_3	0.0341	0.1008	0.34	0.003^{**}
Labour x_4	0.9080	0.3749	2.42	0.012^{**}

R^2 = 64.0%: R^2 (adj) = 62.0%

***= Significant at 0.01% (P<0.01)

** = Significant at 0.05% (P<0.05)

NS = Not significant

3.3 **Constraints Impending against Sorghum Production**

Among the constraints identified, high cost of inputs, inadequate credit facilities, low prices of produce and untimely disbursement were found to greater capacity thereby affecting the production of sorghum in the study area.

Table 4: Distribution of respondents according to constraints

Constraints	Frequency	Percentage
Small farm size	13	21.7
High cost of inputs	59	98.3
Lack of improved variety	8	13.3
Inadequate provision of credit	52	86.7
Untimely delivery of inputs	45	75.0
Poor extension services	2	3.3
Inadequate storage	40	66.7
Untimely disbursement of loans	50	83.3
Low prices of produce	59	98.3
Incidence of striga	45	75.0

Source: Field Survey, 2011

Table 4 shows the major problems faced by farmers in the study area. High cost of inputs (98.3%) and low prices of produce (98.3%) were identified as the major constraints to sorghum production. Other factors such as lack of adequate storage (66%), disbursement of loans (83.3%) and inadequate provision of credit (87.7%) limits the acquisition of capital items identified as major problems impeding expansion. Also, untimely delivery of inputs (75%), incidence of striga (75%), small farm size (21.7%) and poor extension services in the study area.

4.1 Conclusion

Sorghum ranks among the top three important grains in the country while its industrial demand is increasing particularly in the food, beverage, and livestock feed industries. Significant efforts have gone into research and development of improved sorghum varieties and production practices by both the public and private sectors. In spite of this, the producers-mainly smallholder farmers-are yet to achieve a significant increase in their incomes due to high cost and adulteration of inputs, lack of credit, inadequate extension services and poorly developed market linkages (USAID, 2008). An average farm income of ₦14, 400 per hectare was realized with an average of ₦ 1.79 return on every naira invested which was quite profitable though opportunities exist for increased profit through resource readjustment.

4.3 Recommendations

Government should ensure timely and adequate provision of inputs to producers, provision of affordable credit to farmers and fund extension services adequately. Adequate storage and infrastructural facilities should be provided as these will minimize cost and hence, increase profit. Also, products should be bought from farmers at reasonable prices to encourage production and ensure steady all year round supply to the markets.

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