Estimation of Profit Potentials for Sugarcane Production Among Rural Farmers in Nigeria: Empirical Evidence from Madagali Local Government Area, Adamawa State, Nigeria

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ABSTRACT

Economics of sugarcane production was carried out in Madagali Local Government Area of Adamawa State, Nigeria. A total of 120 respondents were randomly selected from a list of sugar cane growers in the study area. Primary data were collected using structured questionnaires and oral interviews. The demographic characteristics of the respondents indicated that 67% of them were youths within the age limit of 49 years with majority (96%) as males. About 85% of the farmers practice subsistence cane cultivation on farm size which range from < 1.0 – 2ha. Further, 48% of them were reported to have no con tact with extension services from the usual agencies. The results of the analysis also revealed the gross margin and net farm income of the farmers to be ₦83,811.80 and ₦75,292.34/ha respectively, which showed that it is a profitable venture. While the net return on naira invested was 0.28 the gross farm ratio was 0.58 with an operating farm ratio of 0.53. Results of the multiple regression analysis revealed the R^2 of 0.52. Variable factors influencing sugarcane output were farm size, hired labour and pesticides which were significant at $P < 0.01$, while fertilizer was significant at $P < 0.05$. The study recommends timely provision of subsidized farm inputs by the NGOS as well as the government through the local cooperatives. Bottlenecks involved in securing loan/credit facilities should be removed so that the farmers can easily have access to them. Also revitalization of the extension services and provision of adequate and affordable tractor hiring services among others to improve the farmers yield.

Keywords: Adamawa, Farmers, Production, Nigeria, Sugarcane.

Introduction

As plantation crop, sugarcane *(Saccharum spp)* is cultivated in the tropics and sub-tropics between 37^0N (Spain) and 11^0S (South Africa). Thus, it is grown

under different climatic conditions. It is one of the world's economically viable cultivated crops (Margraf, 1991). The global cultivation of the crop is said to have grown by 43.3% annually. In 1980, 13.28million hectares were cultivated whereas the figure jumped to 19.58 million hectares in 2002 while the output increased by 19% within the same period (Anon, 2008). According to Fry (1997) as cited by Wada *et al.,* (2006), about 62% of the world sugar came from sugarcane, while sugar beet *(Beta vulgaris L)* account for 38%.

Brazil is the current world producer and exporter of sugar. In the past three decades, the expansion of sugarcane in the country has been on the increase at an average of 200 – 300,000ha annually, at the rate equivalent to soybeans. This has made sugarcane breeding a profitable venture in the country (Anon, 2009). It is interesting to note that sugarcane has become a source of bio fuel that can substitute gasoline in Brazil. According to Litch, (2008) Brazil is now producing a lot of ethanol which is being exported to other countries of the world such as Japan, USA, Sweden South Korea, among others. In the recent past, up to 2.4billion liters were exported annually. Similarly India is said to have high prospects for sugarcane industry, Anon (2004) reported that the country has put 2 - 2.7 million hectares that is about 1.8% of the arable land under sugarcane production with annual output 4.26million tones of sugar annually. In the same development, Pakistan's 77 sugar factories got their cane supply from about one million hectares of sugarcane (Anon, 2008).

African continent perhaps with exception of South Africa is yet to explore their sugarcane potentials as compared to their counter part in Asia and other developed nations of the world. In 2004/2005, Africa produced 8.2 million metric tones of sugar exported 3.8 million metric tones and imported 6.6 million metric tones. The continent therefore, is a net importer of sugar. Within the same period, the worlds out put was 140.8 million tones with 47.8 million tones as record of export which showed that majority of the commodity is locally consumed (Tyler, 2008).

South Africa is the 13th world producer of sugarcane and the largest producer in African continent. In addition to sugar production, the country is also committed to biofuel production. Morris (2008) reported that the government declared that 4.5% of the nation's fuel should come from biofuel. Further the country's plan is that in the next 8 – 15 years when the current land for sugarcane might have increased to about 1.5 million hectares, South Africa will be expected to produce 7.3 billion liters of biofuel.

11

The Nigerian sugar industry is largely under developed in spite of its untapped resources and potentials. According to Bichi (2008), over 500,000 hectares of land suitable for sugarcane cultivation exist in about 40 different locations across the nation which is capable of producing 30 million tones of sugarcane or about 3 million tones of refined sugar. This will meet up the domestic demand of 1.5 million tones with surplus of 1.5 million tones that can place Nigeria among the sugar exporting countries. However, Akobundu (1987) stressed that sugarcane in the country is grown on about 25 – 30,000ha, with only 12,000 ha under commercial cane production. Majority therefore the soft sugarcane grown for chewing and for local product called *masarkwoila* on farm size which range from 0.2 – 0.5 ha (Anon, 1997). According Wada *et al.,* (2006), research and engineering effort National Cereal Research Institute (NCRI) has developed a mini processing plant that can process 10 tones of cane per day (tcd) of brown sugar. The increase in cottage mills in the sugarcane growing communities is intended to create market out let for the produce and facilitate the integration of crop – livestock sector by utilizing sugar by- products such as bagasse and molasses as livestock feeds. The two integrated sugar plants at Bacita in Kwara State and Numan in Adamawa state have a combined capacity of 105,000 metric tones of sugar annually which was meant to cover 10% of the nations sugar demand. Production however, has been oscillating around 50,000 metric tones per annum which is less than one percent of the country's current demand of 1.5 million tones per annum (Anon, 2003; Wada, *et al.,* 2006 and Abubakar, 2008). The wide gab between demand and supply can only be bridged through importation of the commodity at the expense of Nigeria's foreign reserve.

In Madagali Local Government Area of Adamawa state, a good number of farmers are involved in sugarcane production as one of the major sources of income. The crop which is grown for chewing is often seen conveyed to other Local Government Areas and neighboring States such as Borno and Yobe in long trucks and Lorries. With most of the farmers still depend on the local tools for cultivation with in-adequate farm inputs to encourage them. It is against this background that the study was carried out to describe the socioeconomic characteristics of the respondents as it affect their performance, estimated the cost and returns the respondents, assessed the influence of exogenous variables on the farmers output as well as recommendations made for policy implication.

Methodology

Study Area

The study was carried out in Madagali Local Government Area of Adamawa state. It is one of the five Local Government Areas (Michika, Maiha, Mubi North, Mubi South and Madagali) which constituted the Mubi Region or Adamawa State Agricultural Development Projects (ADADP) Zone 1. The region is located between latitude 90^0 11' north of the equator and longitude 13^0 and 13^0 45' East of the Greenwich Meridian (Abebayo, 2004). The local government is bounded by Borno State in the north and west, Michika Local Government in the South and the east the Republic of Cameroun. It has five districts which are Madagali, Gulak, Duhu, Mildu and Kirchinga. Also it has a population of 134,827 people. The mean annual rainfall ranges from 900 – 1050mm with distinct dry season and rainy season, with the beginning of the rainy season in May and ends September or October. It is located within Sudan savannah belt of Nigeria (NPC, 2006; Adebayo, 2004).

Sampling Procedure and Data Collection

Primary data were used for this study. A survey was conducted using structured questionnaire between February and March 2010. A multistage sampling technique was used for the selection of 140 respondents from the five districts of the LGA according the proportion of the farmers in each of the selected villages. However, information from 120 farmers was considered as the remaining could not provide adequate information required. The information on the farmers' socio – economic characteristics and farming activities for 2008/2009 production season were captured.

Data Analysis Technique

The analytical tools used to achieve the objectives of the study were descriptive statistics, farm budgeting and multiple regression. Specifically, descriptive statistics was used to analyse the socio-economic characteristics of the farmers while farm budgeting was employed to determine their profit/loss and multiple regression model was used to ascertain the influence of the exogenous variables on farmers output. The models were specified as below:

Farm Budget

This was used to estimate the cost and returns within the production period specified. According to Olukosi and Erharbor (1988) farm budget is a detailed physical and financial plan for farm operations for a period of time. The profit/loss therefore is as measured by Alabi and Adebayo (2008) is specified as:

GM = GFI – TVC $\qquad$ (1)

NFI = TGM – TFC $\qquad$ (2)

Where;
GM = Gross Margin in N/ha
GFI = Gross Farm Income in N
TVC = Total Variable Cost in N/ha
TFC = Total Fixed Cost in N/ha
NFI = Net Farm Income in N/ha
TGM = Total Gross Margin in N

Multiple Regression Analysis
The multiple regression models were employed to assess the input-output relationship. The explicit form of the model was given by:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e)$ $\qquad$ (3)

Where

Y	=	Output of sugarcane in (kg)
X_1	=	Farm size in hectares
X_2	=	Quantity of seed in (Kg)
X_3	=	Family labour in man- days
X_4	=	Hired labour in man-days
X_5	=	Pesticides in liters
X_6	=	Fertilizer used in (kg)
X_7	=	Fuel consumed during irrigation in litres
e	=	Error term

The functional forms used were linear, semi-log, exponential and Cobb-Douglas. The selection of the best fit function was determined by the level of R^2 the level of significance of overall equation (f-statistic); the level of significance of each coefficient (t-statistics) and correct signs of the coefficients relative to apriori expectation (Olayemi and Olayide, 1981). The explicit forms of the equations take the following;

(i) Linear $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + e$ $\qquad$ (4)
(ii) Semi-log $Y = a + b_1logx_1 + b_2log_2 + b_3log_3 + b_4log_4 + b_5log_5 + b_6log_6 + b_7log_7 + e$ (5)
(iii) Exponential $lny = bo + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + e$ $\qquad$ (6)

(iv)   Double-*log logy = a + b₁logx₁ + b₂logx₂ + b₃logx₃ + b₄logx₄ + b₄log₄ + b₅log₅ + b₆log₆ + b₇log₇ + e*

$$\text{(iv)} \quad \text{Double-}log\ logy = a + b_1 logx_1 + b_2 logx_2 + b_3 logx_3 + b_4 logx_4 + b_4 log_4 + b_5 log_5 + b_6 log_6 + b_7 log_7 + e \qquad (7)$$

Results and Discussion

Socio-Economic Characteristics of the Respondents

From Table 1, the results showed that 67% of the respondents were within the age range of < 20 – 49 years, which indicated that majority of the respondents were in their youthful age, capable of doing vigorous work in sugarcane production. About 17% were within 60 years and above. Further, the result revealed that 97.5% were males with only 2.5% as females. Furthermore, about 91.7% of the farmers were married, 7.5% were single and 83% widowed (Table 1). Also findings in Table 1 indicated that more than halve of the farmers (51.67%) had 11 and above as family members in their house holds. About 30% had 6 – 10 members whereas 18.33% had 1 – 5 as members in their households. Those that have large family members may take advantage to engage them as source of labour. More so, about 61% have attended one form of formal education or the other, however 39% did not attend any form of formal education (Table 1). Ndanitsa (2008) reported that the level of education influences the quality of skills of a farmer, his allocative abilities and how well-informed he is of the innovations and technology around him.

The distribution of the farmers according to farm size indicated that 85.0% of them are operating on farms which range from < 0.1 -2 ha an indication of peasantry agricultural practice common to less developed countries. This finding is in consonance with the findings of Akobundu (1987) who observed that sugarcane cultivation in Nigeria is mostly done on farm size which ranges from 0.2 – 0.5 ha. Also while about 67% of the respondents obtained their land through inheritance, 13.3% got their own through purchase. Those that acquired their land through rentage accounted for 20.0%, Adebayo and Onu (1999) observed that land ownership is one of the socio- economic characteristics of farmers which affect their productivity. Table 1 also revealed that 85% of the farmers engaged hired labour on their farms, with about 7% percent using family labour. About 8% engaged the services of both hired and family labour. Also the finding in Table 1 shows that about 90% of the farmers depend on their personal savings as capital. The implication of this is that farmers had little or no access to financial institutions which give out loans /credit facilities. The result agreed with Stephen *et al.,* (2006) who reported that about 95.58% of cowpea farmers within the same study area depended on their personal money as source of capital for their farming business.

Finding on extension services rendered to the farmers in the study area is discouraging, as about 47.57% of the farmers opined that they don't have contact with extension agents any longer. Some 43.33% reported that extension agents were seen only on request or special occasions (Table 1). According to Adebayo (2004) and Yusuf and Adenegan (2008), since the withdrawal of the world Bank in 1995 from funding the Agricultural Development Programs (ADP) in Nigeria, the extension services has not been effectively felt again. This a clear indication that the farmers are no longer updated with agricultural innovations as before. However, Table 1 shows that 77.5% of the farmers belong to one cooperative society or the other. This result further buttressed Olukosi *et al.,* (2008) assertion that cooperatives evolve out of need of members who want to solve their common problems by pooling their limited resources together.

Estimation of Profit Potentials of Sugarcane Production

Table 2 revealed that the average total cost of sugarcane production per hectare was ₦208,995.32 out of which ₦201,475.68 was total variable cost (TVC) which accounted for 96.4% of the total cost (TC). The high percentage of variable cost was attributed to high cost of labour and the inclusion of family labour in particular. The fixed cost FC (₦7,519.64) accounted for 3.6% of the total cost. The average out put per hectare was 21, 945.96kg, while the revenue generated per hectare was ₦285,297.48. More so, the farmers had gross margin and net returns per hectare of ₦285,297.48 and ₦76,302.20, respectively. This implied that sugarcane production is profitable in the study area. This report is in consonance with Daniel *et al.,* (2009) who found out from the same region, that in 2006/2007 farmers made profit of ₦115,153.22 per hectare. While the returns on every Naira invested were ₦0.27 with a gross farm ratio of ₦0.55, the operating cost was ₦0.52. Olukosi and Erhabor (1988) observed that a gross ratio less than one is always desirable for farm enterprise.

Results of Regression Analysis

In order to examine the relationship between farmers output and independent production variables, the data were subjected to multiple regression analysis and the results presented in Table 3. Based on the economic, statistical and econometric criteria exponential was chosen as the best fit equation. The R^2 was revealed as 0.516 which implied that about 52% of the sugarcane output is being accounted for by the independent production variables used. The F ratio which measures the combined significance of the explanatory variables was significant at $P < 0.01$. This signified that the whole equation is at its best fit

(Adebayo and Onu, 1999). Analysis of the exogenous variables shows that out the seven, four of them were significant. Farm size (x^1), hired labour (x^2) and pesticides (x^3) were significant at $P < 0.01$; while fertilizer (x^6) was significant at $P < 0.05$. This implies that these variables are significant factors in sugar cane production and in particular increase in the usage of pesticides and the size of land result to the increase in yield all things being equal.

Conclusion
Evidence from the study has shown that sugarcane production in the area is highly profitable venture with youths actively participating in the business majority of the farmers had no access to loan facilities and so depend on their personal savings to manage their farms. The extension contact which is the major source of agricultural innovations is almost out of place. Significant factors affecting sugarcane production were farm size, pesticides, hired labour and fertilizer application.

Based on the above findings, the study recommends that extension services be revitalized for the farmers to take advantage of the present innovations in agriculture similarly, provision of subsidized farm inputs to farmers through their local cooperatives at appropriate time. In addition, tractor hiring services need to be activated and made available at affordable hiring rates to the farmers which will reduce manual labour and improve productivity.

Table 1: Socio-Economic Characteristics of the Sugarcane Farmers in the Study Area

Variables	Frequency	Percentage
Age (Years)		
< 20 - 29	18	15.0
30 – 39	33	27.0
40 – 49	50	30.0
50 –59	20	16.67
60 and above	19	15.83
Total	**120**	**100.0**
Gender		
Male	117	97.5
Female	3	2.5
Total	**120**	**100.0**
Marital Status		
Married	110	91.67
Single	9	7.5
Widow	1	0.83
Total	**120**	**100.0**
Family Size		
1 – 5	22	18.33
6 – 10	36	30.0
11 and above	62	51.67
Total	**120**	**100.0**
Educational Status		
No. formal education	47	39.17
Primary education	33	27.5
Secondary education	33	27.5
Tertiary education	7	5.83
Total	**120**	**100.0**
Farm Size (ha)		
< 1.0	55	45.84
1.1 – 2.0	47	39.17
2.1 – 3.0	7	5.83
3.1 – 4.0	3	2.50
4.1 – 5.0	7	5.83
5.1 and above	1	0.83
Total	**120**	**100.0**
Land Ownership		
Hired	14	20.0
Purchased	16	13.33
Inherited	80	66.67
Total	**120**	**100.0**
Source of Labour		
Family	8	6.67
Hired	102	85.00
Both	10	8.33
Total	**120**	**100.0**

Source of Finance		
Personal savings	115	95.84
Borrowed from banks	1	0.83
Borrowed from friend	4	3.33
Total	**120**	**100.0**
Extension Contact		
No visit	57	47.51
Forth nightly	10	8.33
On request	52	53.33
Twice a week	1	0.83
Total	**120**	**100.0**
Membership of Cooperative Association		
Yes	93	77.5
No	27	22.5
Total	**120**	**100.0**

Source: Field Survey, 2010.

Table 2: Average Costs and Returns per Hectare of Sugarcane Production

	Production variables	Value (₦/ha)
A	**Variable Costs**	
	Seed cane	53,695.25
	Pesticides	2,532.08
	Fertilizer	14,530.83
	Fueling	10,662.22
	Transportation	33,949.08
	Labour	85,913.64
	TVC	**201,475.68**
B	**Fixed Cost**	
	Depreciation	1,605.65
	Rent on land	5,913.99
	TFC	**7,519.46**
	Total Cost of Production (A + B)	**208,995.14**
C	**Returns**	
	Average output/ha	21,945.96kg
	Average price ₦/Kg	13.00
	Total Revenue	285,297.48
D	**Gross Margin (GM)**	**83,811.80**
	Net Farm Income (NFI)	75,292.34
	Gross Margin on Naira Invested	0.32
	Net Farm Income on Naira Invested	0.28
	Farm Gross Ratio (GR)	0.58
	Operating Ratio (OR)	0.52

Source: Field Survey, 2010.

Table 3: Results of Multiple Regression of Sugarcane Production in Madagali Local Government Area for 2008/2009

Variable	Linear	Exponential	Semi-Log	Double-Log
Constant	10155.99	4.123***	23383.981 (1.106)	4.305 (18.567)***
Land x_1	21543.135 (8.606)***	0.213 (5.882)***	62663.611 (9.012)***	0.798 (10.466)***
Seed x_2	0.136 (0.661)	2.596E-06 (0.873)	2526.756 (0.469)	1.329E-02 (0.226)
Family Labour x_3	-1.497 (-0.778)	-1.279E-05 (-0.459)	-2493.768 (-1.974)*	8.630E-03 (-0.623)
Hired Labour x_4	-173.72 (-2.997)***	-3.368E-03 (-.4.335) ***	-965.631 (-1.056)	-4.186E-03 (-0.418)
Pesticides x_5	960.670 (3.985)***	1.101E-02 (3.155)***	565.330 (0.457)	1.813E-02 (1.336)
Fertilizer x_6	-10.432 (-2.049)**	-1.632E-04 (-2.213)**	1627.860 (1.794)	-3.944E-03 (0.396)
Fueling	-22.914 (-2.300)**	-1.172E-04 (-0.813)	2688.196 (0.870)	1.662E-02 (0.491)
R^2	0.614	0.516	0.560	0.669
F	37.066	23.155***	29.70	46.604***
S E	19638.411	0.2843	20997.083	0.2302

Source: Computer Print Out of 2010 Field Survey

*** Significant at $P < 0.01$

** Significant at $P < 0.05$

* Significant at $P < 0.1$

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