EFFICIENCY OF LABOUR AND FERTILIZER USE IN SUGARCANE PRODUCTION BY SMALLHOLDER FARMERS IN GBAKO LOCAL GOVERNMENT AREA OF NIGER STATE.

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ABSTRACT

This study examined efficiency of labour and fertilizer usage in sugarcane production by smallholder farmers in Gbako Local Government Area of Niger State. Primary data was collected from 110 randomly selected farmers using structured questionnaire. The data were analyzed using descriptive statistical tools, the gross margin analysis, multiple regression analysis and resource use efficiency ratio. The result shows that 10.9% of the sampled farmers fall below 30 years of age and 96.3% are married, 40% of the farmers had Quranic education. About 90.9% of the sample farmers had over 30 years of farming experience. 68.1% of the sample farmers had farming as their primary occupation. The predominant system of land tenure in the area is by inheritance. The estimated gross income gives an average value of ₦ 87,550 per annum while the net farm income was estimated at ₦ 50,500 respectively. The production function analysis show that seedling (X_2) and agrochemical (X_5) were significant factors influencing the output of sugarcane production at 1% and 5% level of probability respectively. The efficiency ratio (r) indicates that farm size was underutilized while fertilizer and labour were over utilized. The major problems facing farmers include high cost of transportation, price fluctuation, Farm input, Input Incentives and Lack of adequate modern facilities.

INTRODUCTION

Sugar cane (*Saccharum.sp.*) is believed to have become established as domestic garden crop around 800B.C.by neolithic horticulturalists in what is now New Guinea according to some accounts (Alkulola, 1978). Sugar cane was first brought to a village along the western and eastern coast of Nigeria in the 15th century by European Sailors. Although few farmers planted it then as a backyard garden crop, it was noticed that it required a relatively higher amount of water to grow, its cultivation spread into wet lands and swamp patches in flood plains.

Following the development of a new technique of making honey from sugarcane around the beginning of the 18th century, further interest in the crop was generated and it rapidly spread from the coast to other parts of the country, even to the drier northern areas. By the end of the first world war, the technology for the production of crude sugar cakes or *Mazarkuailla* (Hausa) had been developed some mills were imported during the second world war to increase the output of cakes for consumption by African soldiers. Today, mazarkwailla is still a common sugar product in the northern part of Nigeria, where it is used as traditional sweetener over the years, the sugar-cane crop had adopted itself to a variety of soil and climatic conditions such that it is now grown widely across Nigeria. Although, it actually started in the late 50s (Oguntoyinbo 1978).Today, the two types of canes are grown in commercial quantities all over Nigeria But while large scale cultivation of industrial cane is limited to 3 or 4 major estates at Bacita (6000ha) Numan (500ha) and Lafiagi (300ha) Chewing cane is grown by thousands of local farmers cropping between 0.2-2.0 ha of land each all over the country.

The total land area currently under care cultivation is not known but is estimated at 25-35,000ha out of which industrial cane cultivation of the two types of sugar-cane is witnessing a drastic change, albeit it opposite direction. While the production of industrial cane on the estimate is witnessing a decline, more farmers especially in the northern part of Nigeria are getting in to chewing cane cultivation. Admittedly, through the effort of both NCRL and NSDC, states like Jigawa, Bauchi, Kano, and Katsina are also devoting large expanses of land to industrial cane production with a view to established mini Sugar plants. The efforts are however still at their infancy stage and do not substantially contribute to the overall cane production.

In some countries, Sugar cane is considered as a type of fruit, being used for fresh juice extract. However, it is raw material that it is produced by small-scale farmers and particularly, by the sugar industry. Because of the practical difficulties that small farmers in India, China, Colombia and Philippines etc. have in growing the crop, Sugar cane can be grown in the Tropics, the sub-Tropics or the Equatorial areas of the world where the ecological factors are favorable. Frost and water availability are the main technical constraints that affects the growing of canes and the main economic limits on its cultivation are the protective measures that may be imposed by the governments.

Sugar cane is a strongly growing grass with a C4 carbon cycle photosynthetic pathway and a high chromosome number recent research has shown that sugar cane which has been crossed with other saccharum SPP. Has potential yields of up to 400

tones of green matter per hectare per year, equivalent to 160 tones of dry matter obviously, this type of cane will have a much lower sucrose content (Blume, 1985). A sugar cane has tillers or steams, bunched in to stools and usually erect with at harvest, a sucrose content of 10-18% and a fibred content of 10-15%. When the steam is cut into pieces with a number of buds of each piece, they are called stem cuttings or sets and can be used for propagating the crop. Stems develop from the buds grown into stalks or canes are ready for harvesting 10 to 24 months later. After a first harvest, which can be for production of sets or for processing at the factory, the underground buds on the tool develop to give a second, third or even more crops is similar or slightly shorter growth period. These are known as Raton crops. Raton cane (the cane which re-grows after each unit) can, with care, give profitable yield that are less costly to achieve because of the reduction in soil preparation and planting costs. Sugar cane is a pluriannual plant with a cycle that can last 4 to 10 years.

In all aspects of crop production the issue of fertilizer and labour are of critical importance to output and productivity.Iin sugar cane production in particular, the level of fertilizer use is a factor that cannot be ignored if higher production levels are to be obtained. Similarly, the production of sugar cane is very labour intensive therefore the issue of availability and cost of labour is also very critical. Therefore, the two resources are central and critical in sugar cane production (Okorie, 2000). The constraint to the rapid growth of food production in Nigeria is the low crop yields and resource productivity. The low agricultural productivity in Nigeria, if revealed by the actual yields of major crops compared with the potential yields.

The following are some of the specific research questions relating to efficiency in sugarcane production which this study seeks to find answers to.

1. What are the socio-economic characteristics of farmers in the study area?
2. What are the factors affecting the efficient utilization of resources use in sugar cane production in the study area?
3. What is the profitability of sugar cane production in the study area?
4. What determine the efficiency of the utilization of resources in sugar cane production in the study area?

The main objective of the study focus on the efficiency of labour and fertilizer usage in sugar cane production among small scale farmers in Gbako Local Government Area of Niger State. The specific objectives of the study are to:

i. describe the socio-economic characteristic of farmer in the study area,
ii. evaluate the level of profitability of sugarcane production in the study area.
iii. determine the factors affecting resource use efficiency in the study area,
iv. determine the efficiency of the utilization of labour and fertilizer in sugar cane production in the study area

This study is crucial in examine the resource use efficiency of farmers in sugar cane production, since increased output and productivity are directly related to production efficiency. Contributions by research institutes and extension organizations to improve the efficient use of fertilizer and labour in the production of sugar cane. However, studies in both NCRI and NSDPC shows that Nigeria could in fact do better than what they are presently producing if fertilizer and labour are properly used by farmers, it is hoped that this study will generate imperial research information to the extension agencies and government for possible policy action the information generated from this study is also expected to serve as eye opener for future programme implementations in the area.

METHODOLOGY

Niger State was created on 3rd of February 1976. It lies between latitude 9.360° North and longitude 6.22° east. The State lies in the Guinea savanna vegetation of the country with favorable climatic condition for crops and livestock production. About 85% of Niger State populations are farmers while the remaining 15% engaged in other vocations such as business, white collar Jobs, etc.Niger State experience distinct dry and wet seasons with Annual rainfall varying from 1100mm in the northern part to 1600mm in the southern parts of the State respectively. The State has a population of about 3,950,249 peoples according to the 2006 census. The State covers a total land area of 85,733.17 km^2 or about 8.6 million hectares which represent 9.3 percent of the total land area of Nigeria (FRN, 2007). Niger State has twenty-five Local Government Areas. Gbako LGA is characterized by two seasons, the dry and wet seasons. The annual rainfall varies from about 1,200mm – 1500mm the raining season is between June and October, average temperature of about 23°c 25°c, soil types Alfisol. Major crops grown in the region are sorghum, rice, sugarcane, maize and groundnut.

Primary data for this study was collected from the field with the aid of objectively structured questionnaires. Secondary data was obtained from journals and conference proceedings.

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farmer that can read and write to be fill by them while those that are not educated an interpreter was employed to assist in interviewing and filling the questionnaires.

The data collected was analyzed using descriptive statistics such as arithmetic means, frequency, distribution, etc. the technique was used to group and summarize the data obtained from the field. Gross margin(GM) analysis and Net Farm Income (NFI) were used for analysis to achieve objective 2. Gross margin is the deference between the gross farm income (GFI) and the total variable cost (TVC). It is useful planning tool in situation where fixed capital is a negligible portion of the farming enterprise as is the case of small scale subsistence agriculture (Olukosi and Erhabor, (1988)

GM = GFI –TVC
GM = Gross margin
GFI = Gross farm income
TVI = Total variable

$$NFI = \sum_{i=1}^{n} PyiYi - \sum_{j=1}^{m} PxjXj - \sum_{k=1}^{k} Fk$$

Where:
NFI = Net farm income
Yi = Enterprise product (s) (Where i=1,2,3 .n Products)
Pyi = Unit Price of the product (s)
Xj = Quantity of the Variable input (Where j=1,2,23.....m Variable input)
PXj = Unit Price of the variable input (s)
Fk = Cost of fixed inputs (Where k=1,2,3.....k fixed inputs)
$\sum$ = Summation (addition) sign.

Regression model was used to examine input-output relationship. This was used to determine the extent to which the inputs used explain the variability in sugarcane output. To estimate the production function, the four major regression functions was employed, these are linear, semi-log, Cobb-douglas and exponential models. The equation of best fit or lead equation was determined by the level of coefficient of multiple determination (R^2) the level of significance of the over all equation CF – statistics and correct signs, of the coefficient relative to prior expectation (Olayemi and Olayide, 1981) the implicit form of the model is:

$$Y = f(X_1, X_2, X_3, X_4, X_5, U_1)$$

Where Y = output from sugar production (kg)
X_1 = farm size (hectares)
X_2 = quantity of seedling (kg)
X_3 = quantity of fertilizer (kg)
X_4 = labour input (man day)
X_5 = agrochemical (liters)
U = Error term.
The explicit forms of this model are
(a) Linear: $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + u$
(b) Semi-log: $Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + u$
(c) Cobb-douglas: $Y = \log a + b_1x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + u$
(d) Exponential: $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + u$

Efficiency of resource use was determined by the ratio of marginal value product (MVP) to marginal factor cost (MFC) of inputs based on the estimated regression coefficients. Following Rahman and Lawal (2003) and Iheanacho et-al (2003) efficiency of resource ® is given as:

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

The rule provides that when r = 1, there is efficient use of resource; r > 1 and r < 1 indicate underutilization and over-utilization of a resource respectively. The values of MVP and MFC were estimated as follows:

$MVP = MPP.\ Py$
$MFC = Px_1$

Where MVP = Marginal Value Product of a variable input;
MPP = Marginal Physical Product;
Py = Unit Price of Output;
Px_1 = Unit Price of Input X_1
r = Efficiency ratio

RESULTS AND DISCUSSION

Table 1: Distribution of respondents by Socio economic characteristics

Characteristic	Frequency	Percentage
Gender		
Male	107	9.27
Female	03	2.72
Marital Status		
Single	4	3.64
Married	106	96.36
Age		
21-30	12	10.91
31above	98	89.09
Educational Level		
Primary Education	37	33.64
Secondary Education	25	22.72
Tertiary Education	3	2.73
No Formal Education	1	0.91
Quranic Education	44	40
Mode Of Land		

Acquisition		
Inheritance	103	93.64
Purchase	2	1.82
Borrowing	5	4.54
Types Of Labour Used		
Family Labour	7	64.55
Hired Labour	5	4.55
Communal Labour	28	25.45
Family And Hired Labour	6	5.45
Family Size		
1-10	24	21.82
11-20	64	58.18
21 Above	22	20.00
Mode Of Land Cultivation		
Hand Tools	110	100
Tractors	-	-
Sizes Of Farm Land Cultivated		
1-3	81	73.64
4-6	29	26.36
Source Of Capital		
Personal Saving	101	91.82
Loan From Family/Friend	9	8.18
Loan From Formal Sources	-	-
Farming Experience (Years)		
16-30	10	9.09
31 And Above	100	90.91
Occupation		
Farming Only	7.5	68.18
Trading	16	14.55
Civil Servant	10	9.09
Student	9	8.18

Source: Field survey 2009

According to table 1 above, 2.72% of the respondent are female, the rest of 97.27% are male. This implies that few percentages of women help men in terms of fertilizer application, harvesting, in sugarcane production in the study area, because of the tedious nature of production process which most women are not accustomed to. The distribution of respondents according to marital status shows that 3.64% of the respondents are reported that they are single, 96.36% confirmed that they are married. This implies that marriage is a very important institution especially internal setting. A part from uplifting the status of a man, it also provides additional hands (wives and children) to help in the farm work thereby reducing the cost of hired labour.

Results indicate that majority (89.09%) of sugarcane producer fall between the age ranges of 31 years above. This implies that sugarcane productions in the study area are dominated by mid-age and the old age. Farmers who are still active in terms of Agricultural production and constitute the working force of the populace,of 31 years above, this result envisage prospects to increase sugarcane production in the survey area. The distribution of respondents in educational level show 40% of the respondents have Quranic education. This indicates that awareness about the importance of education to farmers in the locality should be improved upon and encourage possibly by introducing some incentive along side. Following this group are those that had complete primary school education of about 33.64% and tertiary institution of about 2.73% these proportion of the respondent of this present age. Also, farmers that had complete secondary school education and those that didn't are 22.72% and 0.91% respectively. This result indicate that extension workers should do more by making the important of education known to the farmers.

Results indicate that almost all the respondents inherited the land on which production takes place, 93.64% of the total respondent acquire land by inheritance. This implies that most respondents produce sugarcane at a subsistence level and limited their size of production to what is obtainable from such fragmented inherited pieces of land which make expansion difficult, the nature of the farmer is not supportive to their output through production may be efficient. The value of family labour in the study area which represents about 64.55%. This implies that sugarcane production as an efficient motives required more than family labour enough hands (people) or machinery will be used to boast output and make production more technically efficient. Communal labour also gives an average performance with about 25.45%. This implies that more importantly, labour is highly the factor that determines the efficiency of sugarcane production, Hired labour constitute about 4.55%, this implies that farmer do not have a sufficient capital to embark on Hired labour,

All the respondents use hand tools for cultivation. This is reasonable since almost all of them are small scale farmers and it will be uneconomical to purchase modern equipment like tractors for cultivating one or two hectares of land. Results reveals that only 93.64% of the respondents have 1-3 hectares of farm lands. About 26.36% of the respondent asserted that the size of their farm land is between 4-6 hectares. Which implies that most of sugar cane farmers in the study areas are small scale farmers, compared to other sugar cane producing area? Majority of the respondents (91.82%) sources their capital for sugarcane

production through personal savings while sources from cooperative bank are not embraced by the respondent except from family and friend who accounted for about 81.8%. This implies that majority of farmers prefer to source capital through their personal saving and money lend from family and friend due to the ease of accessing such capital.

Table 1 above shows that majority (90.91%) of the farmers had experience in sugarcane production activities of 31 years above which implies that sampled producers had required good sugarcane production skill. Majority (68.18%) of sugar cane farmers take farming as their primary occupation. Also 14.55% of the sampled farmers were civil servants this implies that farming only is the dominant occupation of sugar cane farmers in the study area which is the major source of their livelihood. 58.18% of the respondents have a household size of 11-20. This implies that family labour is important source for farming operation and that most of the farmers have a large family size. This is according to (Oyekanmi, 2004), farmer in the rural areas are predominantly large families this is due to what is contributes to the total farm labour required in production.

Table2: Estimated Gross margin and Net Farm Income for sugarcane production

Cost Item	Cost (N/Ha)
Fertilizer	11,200
Planting Material	6,200
Herbicide	4,400
Hired Labour	9,000
Seeding	5,000
Transportation	1,250
Total Variable Cost	37,050
Gross Income	87,550
Net Farm Income	50,500

Source: Field survey, 2009

Results from Table 2 implies that an average sugarcane farmer in the study areas makes an average Gross margin of ₦87, 550 and an average net income ₦50, 500 in the last cropping season. This implies that sugarcane cultivation is quite lucrative in the study area given the high returns on investment especially for small scale farmers.

Table 3: Multiple regression analysis

Variable	Exponential
Constant	3.829
	(57.229)***
Land Size (X1)	3.500e - 02
	(1.580)
Seedling (X2)	2.108e -02
	(2.544)**
Fertilizer (X3)	1.752e-05
	(0.198)
Labour (X4)	1.311e - 03
	(0.859)
Agrochemical (X5)	5.285e - 07
	(4.203)***
R^2	0.789
Adjusted R^2	0.779
F Ratio	77.666***

Source: Computed from Field survey data 2009

NB: *** Implies significance at 1% level
** Implies significance at 5% level
* Implies significance at 10% level

Figures in parenthesis are the respective t ratio the production function that was used to determine the nature of inputs relationship in sugarcane production is shown in the (table 16 exponential production function). The value of coefficient of determination R^2 indicated that about 78.9% of the variation in output in sugar cane production is explained by the inputs included in the regression model. The regression coefficient of land size (X1) land size (X2) seedling (X3) fertilizer that an increase in any of these inputs will lead to an increase in gross output implying that the variables significantly explained variation in the gross output. Seedling significant at 5% level of probability. Agrochemical (X5) and F-ratio are both significant in 1% level of probability.

Table 4, Resource use efficiency

VARIABLES	MPP	MVP	MFC	EFFICIENCY RATIO
Land size (X1	0.63	9450	4,500	2.1
Labour (X4)	0.039	585	800	0.73
Fertilizer (X3)	0.014	210	2000	0.11

Source: Field survey 2009.

Table 4,, Revealed that the estimated efficiency ratio (r) shows that two significant inputs in the model were over utilized i.e. (X3 and X4) while X1 is underutilized. This implies that the resource X1 is not efficiently utilized, this finding is in consonance with the finding of Nwosu (2005) who showed that land was underutilized while labour was over utilized by both ADP and non ADP farmers in Orlu agricultural zone of Imo State, Nigeria.

Table 5: Production problems encountered by sampled farmers

PRODUCTION PROBLEM	FREQUENCY	PERCENTAGE
Inadequate capital input	66	60.00
Lack of rainfall at the right time	17	15.45
Lack of extension services and	27	24.55

credit		
TOTAL	110	100.00

Source: Field survey 2009

Table 6: Marketing problems encountered by sampled farmers

MARKETING PROBLEM	FREQUENCY	PERCENTAGE
Price fluctuation	53	48.18
Dubious act of middle men	32	29.09
Purchased Problem	25	22.73
TOTAL	110	100.00

Source-: Field survey 2009.

Table 5 indicates 60% of sampled farmers had inadequate capital input, also 15.45% of sampled farmers complained of lack of rainfall at the right time while 24.55% of sampled farmers had lack of extension services and credit. Table 6 reveal that marketing problems encountered by sampled farmers, this include price fluctuation (48.18%), dubious act of middlemen (29.09%) and purchased problem (22.73%) respectively.

CONCLUSION AND RECOMMENDATION

In the study, various efforts geared at determining the efficiency of labour and fertilizer use among small holder farmers in Gbako Local Government Area of Niger State were critically undertaken. The result indicates that despite the various problems faced by the respondent farmers, sugar cane production is still efficient in the study area. Although the efficiency ratio reveals that labour and fertilizer were overutilized, with adequate subsidized farm inputs, capital, good infrastructure. Resources available tofarmers especially land and capital have affected the farmers from realizing feasible optimal sugarcane output. Sugarcane production has a very large profit margin and could serve as viable avenue for poverty alleviation to the youths. Farm inputs should be made available to the farmers in the study areas at the right time and at affordable prices. Farmers are price responsive in the use of inputs. Therefore, government should endeavor to remove all distribution bottlenecks which affect the availability and prices at the grass root level of these inputs especially fertilizers and agrochemicals, research efforts should be intensifies to redevelop improved small medium scale farm technologies suited to the small-scale nature of farming and favored by farmers, Extension agents should be posted to the study areas to educate the farmers on the Importance of adopting new ideas and technology, to improve on sugarcane Production, Government should provide and expand tractor-hiring scheme and offer services to reduce high cost of labour.

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