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Productivity and Efficiency of Groundnut Farming in Northern Taraba State, Nigeria

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Abstract. The research was carried out to examine the Productivity and Efficiency of Groundnut Farming in Northern Taraba State. The objectives of the study were to:, determine the technical efficiency of groundnut farmers, analyse the influence of some socio-economic characteristics of farmers on technical efficiency. Data were collected with the aid of structured questionnaire administered to 150 randomly selected farmers in the study area. Data generated from the questionnaire were analysed using Stochastic Frontier Production Function. The study revealed that the variance of parameters gamma (γ) and sigma-squared (δ^2) of the frontier production function were statistically significant at 1 percent level of significance. The variables indicate positive and significant at 10 percent level of significance for seed and fertilizer, while farm size and family labour were statistically significant at 1 percent respectively. Mean technical efficiency index was 0.97, while minimum and maximum technical efficiency were 0.63 and 0.99 respectively.

Keywords: Groundnut, resources-usage, Productivity.

INTRODUCTION

Groundnuts (*Arachishypogaea L*) also known as peanuts, earthnuts, gobbers, Pinders, Manila nuts etc (Beghin*et. al*., 2003). It is a member of the genus Arachis in the family leguminosae (*Fabacaea*) which has replaced the traditional Bambara groundnut (*Vigna subterranean*) in many areas of the country (Ashley, 1993). Other members of this family include; Cowpea, Soyabean, Pigeon Pea, Melon etc.

Groundnut is the 13th most important food crop and 4th in oil seed crop of the world. Groundnut seeds (kernels) contain 40-50% fat, 20-50% protein and 10-20% carbohydrates (FAO, 2006). Groundnut seeds are nutritional source of vitamin E, niacin, falacin, calcium, phosphorus, Magnesium, Zinc, Iron, ribloflavin, thiamine and potassium (FAO, 2006). Groundnut kernels are consumed directly as raw, roasted or boiled kernels or oil extracted from the kernels is used as culinary oil. It is also used as animal feed (oil pressing, seeds, green materials and straw) and industrial raw material (oil cakes and fertilizer). The uses of groundnut plant make it an excellent cash crop for domestic markets as well as for foreign trade in several developing and developed countries (FAO, 2006).

Agriculture which is supplanted by mineral oil remains the panacea to unemployment, poverty alleviation and human development chain and therefore we must go back that way. It is a fact that at the time we had groundnut and Cocoa pyramids our pound was at par with British pound sterling.

The agricultural sector's contribution to the Gross Domestic Product (GDP) stood at an average of 56 percent in 1960-64 declined to 47 percent in 1965-69 and further declined to 35 percent in 2003-2004 (Amaza and Maurice, 2005).

The overall agriculture situation deteriorated creating wide gap between demand for and supply of food. Revenue from the agricultural sector dwindled and the government was faced with mounting food import bills. At the same times, industries continued to import agricultural raw materials, thus overstressing Nigeria's foreign exchange earnings. It was against the backdrop of this rudimentary economy, but abundantly-endowed with human and natural resources, that Nigeria government adopted different agricultural programmes

and policies at raising the productivity and efficiency of the agricultural sector. PROTA/CTA (2007) reported that the performance of Agricultural sector remains below expectations, with over 60% of the population are living on less than a dollar a day and another 27% being under- nourished.

In response to the dismal performance of the agricultural sector and also to avert eminent starvation due to poverty, various measures have been introduced by successive governments of Nigeria aimed at combating food shortages and poverty. These include among others: National Accelerated Food Production Programme (1972), Operation Feed the Nation (1976). The River Basin and Rural Development Authorities (1976), Green Revolution (1980). Land use Decree (1978), World Bank Assisted Agricultural Development programme (1979 and 1985), Operation Go Back to Land (1984) Directorate of Food Road and Rural infrastructure (1986), Green Revolution (1980) National Fadama Projects (1992), National Agricultural Research Project (1992) National Agricultural Land Development Authority (1991) and The Special programme on Food Security (2001) (Oredipe and Akinwumi, 2002).

However, none of these measures has been able to solve the food problem, since the desired objectives have not been achieved and productivity of food crops has remained low (Nweze, 2002). As a result the rural income is lower today than it was two decades ago and agriculture exports are almost nonexistent, thus production techniques have remained rudimentary for the main cropping system despite years of work on technology generation (FMARD, 2001). This wide food deficit has been attributed to resource productivity and efficiency (Onyenwaku, 1987; Okuneye, 1988). The aftermath of this trend has always been gross inability to attain self sufficiency in food production as the sector became dormant and neglected (Argbokan, 2001).

Groundnut production, marketing and trade served as major sources of employment, income and foreign exchange before Nigeria became independent. The groundnut sector provided the basis for the agro-industrial development and contributed significantly to the commercialization, monetization and integration of the natural rural sector.

Inspite of the availability of abundant land and human resources in Nigeria, yield per hectare from groundnut production has been on the decline over the years. It has been revealed that, there is a shortfall of over 90 percent of groundnut requirement by companies involved in processing (RMRDC, 2004). Therefore, there is a need to reverse the foregoing scenario with a view to improving the productivity and efficiency of resources used among groundnut producers through the investigation of the nature of productivity and efficiency in their production. The research was therefore designed to provide answers to the following questions.

(i) Do the socio-economic characteristics of the groundnut producers affect their technical efficiency?

(ii) Do some of the socio-economic characteristics of the groundnut farmers have influence in their technical efficiency?

The broad objective of the study is to examine the resource productivity and efficiency of groundnut farming in Northern part of Taraba State and the specific objectives were to:

(i) determine the technical efficiency of groundnut farmers

(ii) analyse the influence of some socio-economic characteristics of farmers on technical efficiency.

MATERIALS AND METHODS

Study area: The study was carried out in three selected local government areas of Northern Taraba State. The three selected local government areas include; Ardo-Kola, Jalingo and Yorro local government areas. Taraba state was created out of the defunct Gongola State on the 27th August, 1991.The state covers a land mass of 59, 400km2 with 16(sixteen) local government areas. Taraba State lies between latitude 6° 30' and 9° 36' North and longitude 9° 10' and 11°50' East. It is bounded on the North by Bauchi state and Gombe State in the North-East. It is bounded on the East by Adamawa State and by Plateau State in the North-West. It is further bounded by Benue State in the West and shares an international boundary with the Republic of Cameroon to the south and south-west.

Taraba state has a population figure of 2,300,736 people (NPC, 2006). The study area is heterogeneous in ethnic composition. The state, as an agrarian state, has a great percentage of its populace engaged in farming as an occupation. Taraba state has a tropical climate, characterized by dry and wet seasons. The rainy season commences early in April to October whereas the dry season starts from November to March. The annual average rainfall in the state ranges between 600mm in the North to over 2000mm in the south (TADP, 2007). The climate, soil type and hydrology allow for cultivation of most staple foods grazing land for animals, fresh water for fishing and forestry. The period for harmattan is a period when the dust laden North-East trade winds from the Sahara Desert have a marked effect on the climate of the state. The period is usually cold and dry and the driest months are January and February when the relative humidity is 13 (thirteen) percent.

Nature and source of data: The data for the research were mainly from primary source. These were obtained through a structured questionnaire, which were distributed to groundnut farmers in the study area. Data collected from farmer covered 2007/2008 cropping season, secondary data/information were also obtained from printed materials such as Journals, textbooks, internet, periodicals, conference proceedings as well as yearly records of production from relevant Agencies.

Sample size and sampling procedure: This study employed multi-stage, purposive, as well as simple random sampling techniques in the selection of respondents. In the first stage, three local government areas out of the six local government areas of Northern part of Taraba State were purposively selected. In the second stage, two wards each were chosen from each local government area. In the third stage, from the selected wards, two villages were selected proportional to the size of the wards selected as first sampling frame. In the final stage, a list consisting of all the names of groundnut farmers in each of the 12 villages was obtained, numbered and squeezed; this formed the second sampling frame. Then at random, farmers were chosen from each village. A total of 150 farmers were chosen for the study in a ratio proportional to the size of their population.

Analytical techniques: Stochastic Frontier Production Function was to analysed the data collected. The Stochastic Frontier Production Function Analysis was proposed independently by Aigner*et al.*, (1977) and Meeusen and Van den Broeck (1977) in Amaza (1999).The frontier production differ from production function in the sense that its disturbance term has two components. One to account for technical inefficiency and the other to permit random events due to measurement errors (Tran et al., 1993; Amaza, 1999).

Mathematically, it is expressed as follows:

$Yi = f\{Xi : B\} \exp (Vi - ui)$ I = 1,2,3, …… N ---------- (3)

Where

Yi = Production of the ith farmer

Xi = Vector of input quantities of the ith farmer

ß = Vectors of unknown parameters

Vi= Assumed to account for random factors such as risks, weather and measurement error.

Ui = Are due to technical inefficiency.

The empirical Stochastic Frontier Production Model used for the study of the analysis of technical efficiency is expressed as follows:

$\text{Log } Yi = ß_0 + ß_1 \text{ Log } X_1 + ß_2 \text{ Log } X_2 + ß_3 \log X_3 + ß_4 \log X_4 + ß_5 \log X_5 + ß_6 \log x_6$ vi-ui---------- (4)

Where

Log	Yi	=	Output (kg of groundnut of ith farmer)
	Xi	=	Farm size (in hectares)
	X2	=	Seed (kg/ha)
	X3	=	Hired labour used (in man days)
	X4	=	Fertilizer used (in kg)
	X5	=	Family labour used (in man days)
	X6	=	Herbicides used (in litres)
	Vi	=	Random noise
	Ui	=	Inefficiency effect which are non-negative, half normal distribution

The inefficiency model is defined by:-

$$Ui = \delta_o + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 \text{ ---------- } (5)$$

Where,

Ui = Inefficiency effect

Z_1 = Farming experience (in years)

Z_2 = Gender of the respondent

Z_3 = Age of the respondent (in years)

Z_4 = Literacy level (in years)

Z_5 = Family size (number of persons in farmer's household)

Z_6 = Number of contact by extension agent (in number)

$\delta o - \delta 6$ = Are parameters to be estimated.

The Maximum Likelihood Estimate (MLE) for all parameters of the Stochastic Frontier Production function and the inefficiency model defined above and the technical efficiency were obtained using programme frontier 4.1 software (Coelli, 1994, Ajibefun, 1998).

RESULTS AND DISCUSSIONS

The result shows the maximum likelihood estimates of groundnut farmers in the study area. Table I contains the estimates of the parameters of the model. It reveals that there is a positive relationship between farm size, seed, fertilizer, Hired labour, family labour and herbicides. The relationship is also statistically significant at 10 percent level of significance for seed and fertilizer and 1 percent significant for farm size and family labour. Whereas, hired labour and herbicides did not show any level of significance. Considering the coefficient of the output of groundnut farmers in Table I, farm size has the highest value of 0.79 followed by seed and fertilizer respectively.

The positive and significant relationship between farm size, seed, fertilizer and family labour indicate that if more of these variables are used in groundnut farming, there will be more than proportionate increase in the output of groundnut. Since farm size has the highest coefficient, it implies that increase can be more experienced in output of groundnut farmers by increasing the size of the farm than by increase in any other factors that influence groundnut output as specified in this model.

Table I: Maximum Likelihood Estimate of Parameters of Cobb-Douglas Stochastic Frontier Production Function for Groundnut Farmers

Variable	Parameters	Coefficient	t-ratio
Stochastic Frontier			
Constant	β_o	2.77***	13.75
Farm size	β_1	0.79***	6.47
Seed	β_2	0.12*	1.84
Fertilizer	β_4	1.097*	1.84
Family labour	β_5	0.041***	2.87
Inefficiency model			
Constant	δ_o	3.83***	2.33
Age	δ_3	-2.61**	-2.25
Family size	δ_5	-0.61***	-2.93
Contact by Ext. Agent	δ_6	0.075**	2.06
Variance Parameters			
Sigma-squared	δ^2	0.017***	5.77
Gamma	γ	0.81***	14.13
Elasticity of production		2.06	

Source: Culled out from Frontier 4.1

NB: *** - Significant at 1 percent level
** - Significant at 5 percent level
* - Significant at 10 percent level

The result of the inefficiency model shows that the coefficients of the farming experience, Age and family size have the expected signs while coefficient of variables such as gender, literacy level and contact by extension agents showed positive signs.

Age and contact by extension agents are statistically significant at 5 per cent level whereas family size is statistically significant at 1 percent level of significance. The negative and significant relationship of the variables in the inefficiency model suggests that inefficiency is less among groundnut farmers. Also the positive significant relationship of the variable contact by extension agents in the inefficiency model implies that inefficiency is more. The signs and

coefficients in the inefficiency model are interpreted in the opposite way such that a negative sign increases efficiency and vice versa.

Inefficiency parameters establish the fact that inefficiency of groundnut farming decreases with increase in age, family size, and farming experience while inefficiency of groundnut production increases with decrease in literacy level, gender and contact by extension agents. The table also shows that the estimate of variance parameter sigma-squared (δ^2) is 0.017 and statistically significant at 1 percent level of significance. This figure is also significantly different from zero. This indicates a good fit and correctness of the distributional form assumed for the composite error term.

Gamma (γ) is 0.81 which is close to one and statistically significant at one percent, shows the amount of variation resulting from the technical inefficiencies of the farmers. This means that more than 81 percent of the variation in farmers' output is due to difference in technical efficiency. Thus, it implies that the Ordinary Least Squares estimate (OLS) will not be adequate in explaining the inefficiencies on groundnut farming. That is why Stochastic Frontier Production Function is recommended and hence acceptable.

The elasticity estimate (summation of coefficients of farm size, seed, hired labour, fertilizer, family labour and herbicides is 2.06. Since the elasticity is greater than one, it suggests that the producers of groundnut are operating at Stage I in the production curve. At this stage, marginal physical Product (MPP) of groundnut is greater than average physical Product (APP) and elasticity of Production (EP) is greater than one.

This stage is considered to be an irrational zone of production because the point of diminishing returns or efficiency has not been attained. It pays the farmers only when he continues to add more of the variable inputs to the fixed input where MPP does not equal APP until APP is maximum at the beginning of Stage II, the extensive margin. At the Stage II elasticity equals to one that is a 1 percent change in input will produce a 1 percent change in output. This is the stage which concerns the farmer as it is where profit margin is maximize since the farmer is able to adjust between the extensive and intensive margins ie Stage II and Stage III.

The result indicates that majority of the groundnut farmers (98.33%) fall to the range of >0.90. While few of them fall below the range of 0.90, the mean technical efficiency for groundnut farmers was 0.97 (97%). This signifies that the groundnut producers are not efficient as their observed output is 3% less than the maximum output. This can be increased by 3% through improved resource allocation with no additional cost. The mode of the technical efficiency was 0.97 meaning that majority of the farmers have technical efficiency of 0.97.

Table II shows the frequency distribution of technical efficiency of groundnut farmers. The predicted technical efficiency varies across the respondents, ranging between 0.63 – 0.99 (on the scale of maximum one) with mean technical efficiency of 0.97. The mean technical efficiency of 0.97 suggests that groundnut producers are 97% efficient in the use of combination of their inputs.

Table II: Frequency Distribution of Technical Efficiency of Groundnut Farmers.

Range of Technical Efficiency	No of Respondents	Percentage (%)
0.61 – 0.70	1	0.83
0.71 – 0.80	1	0.83
0.81 – 0.90	0	0.00
>0.90	118	98.00
Total	120	100
Minimum	0.63	
Maximum	0.99	
Mean	0.97	
Mode	0.97	

Source: Culled out from Frontier 4.1

Conclusion

The result of resource productivity and efficiency of groundnut farming in Northern part of Taraba State shows that there is opportunity for groundnut farmers to increase their efficiency by 3 percent. Some socio-economic characteristics have influence on the technical efficiency. Based on the findings of the study, the following recommendations are proffered.

- The agricultural development programme of each state are advised to stimulate their extension staff through motivation to give the rural

farmers the best needed assistance on agricultural innovations for enhanced productivity.

- Farmers are advised to cultivate more acreages, as its coefficient was the highest towards increase in output of groundnut.

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