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RESEARCH PAPER

ECONOMIC ANALYSIS OF SOYA BEANS PRODUCTION IN SAKI EAST LOCAL GOVERNEMNT AREA, OYO STATE, NIGERIA

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ABSTRACT

The study employs a stochastic frontier production function analysis to examine the productivity and technical efficiency of Soya beans production in Oyo State, Nigeria and also to identify the factors affecting the technical insufficiency using farm level survey data. The result shows that Soya beans farmers operated on a very small scale and are profitable, the productivity analysis shows that agro chemicals fertilizer, farm size and labour were all positive and significantly related to the technical efficiency. The return to scale (TRS) of 0.9904 shows that soyabean production was in rational state of the production surface. The technical efficiency varies from 0.1094 to 0.9568 with a mean technical efficiency of 0.6649, indicating that farmers were operating below the efficiency frontier. Thus, in the short run, there is a scope to increase output by 34%. The inefficiency model revealed that education of the farmers; extension visits and access to credit are the main factors that affect technical efficiency of the farmers.

KEYWORDS: Soya beans, economy analysis, technical efficiency, Nigeria.

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INTRODUCTION

Soya beans (Glycine max L.) is one of the most important oilseeds crop in the world. It is also known with various other names like ‘miracle bean’, ‘wonder bean’, ‘golden bean’, ‘meat of the field’, ‘king of bean’ and people say it is a golden gift of nature to humanity in terms of health benefits (Farooq, 2013).

Soya beans is an herbaceous annual legume with a bushy, erect and rather leafy plant structure. It originated from China around 1100 to 1700 BC but was introduced into Europe only in the 17th century (Oshoet al., 1994). It is believed that it might have been introduced to Africa in the 19th century by Chinese traders along the east coast of Africa (IITA, 2009). Now this miracle bean is cultivated in all over the world mainly for its high level of protein and oil contents, therefore, it can play an important role in fulfillment of the needs of human beings.

More than 216 million tons of Soya beans were produced worldwide in 2007, of which 1.5 million were in Africa (IITA, 2009). Nigeria is the largest producer of Soya beans in sub-Saharan Africa (SSA), followed by South Africa and Zimbabwe. According to Abraham (2013), Soya beans was introduced into Nigeria in the early 1900s while export started in 1947, with the 2007 estimate placed Nigeria as the 11th largest producer of Soya beans, 35th in cattle, and 36th in pork production and 41st in poultry. But the first successful cultivation was in 1937 with the Malayan variety, which was found suitable for commercial production in Benue State in Central Nigeria (Nyiakura, 1982; Knipscheer, 1982; Oyekan, 1985 and Root et al., 1987).

Though still largely regarded as a relatively new crop, Soya beans has made a successful incursion into the diet of many Nigerians, particularly children and nursing mothers. Improved diet and nutrition are important factors in the promotion and maintenance of good health throughout life. In Nigeria, 60% of deaths are related to protein-energy malnutrition (PEM), particularly among children (FMARD, 2006). The average Nigerian consumes about 3.2 grams of animal protein daily as against the minimum requirement of 35 grams per person per day (Abu et al., 2008; in Agada, 2014). Due to the dearth of animal protein, the low income population increasingly depends on plant food sources such as Soya beans to meet their protein and other nutrient demands (Owolabiet al., 1996; in Agada, 2014).

The most nutritious and most easily digested food of the bean family, the Soya beans is one of the richest and cheapest sources of protein. It distinguishes itself as a protein plant that contains all the eight amino acids essential for human health. Soya beans contain 42.8% high quality protein, 22.8% edible vegetable oil, 33% carbohydrate and a good balance of amino acids (RMRDC, 2005). Soya beans oil is 85% unsaturated and cholesterol free when compared with other legumes and other animal sources (IITA, 1998). Health expert posit that Soya beans is medicinal and is extremely useful for treatment of malnutrition, particularly among children, and in the fight against diseases such as heart disease, cancer, diabetes, high blood pressure, stroke, ulcer as well as the loss of body mass among people living with HIV/AIDS (WHF, 2004; Fabiyi, 2006; and Obatolu, 2006 in Agada, 2014). The promotion of Soya beans is valuable in countries such as Nigeria where other sources of high quality protein are too expensive and the purchasing power of a large percentage of the population is low.

Furthermore, Soya beans meal remains a vital and preferred source of protein in compounded feed by the Nigerian livestock, poultry and aquaculture industries. Soya beans also improves soil

fertility by adding nitrogen from the atmosphere (IITA, 2009). And also it is considered sacred for its beneficial effect in crop rotation. This is a major benefit in African farming systems, where soils have become exhausted by the need to produce more food for increasing populations, and where fertilizers are hardly available and/or not affordable for farmers.

OBJECTIVES OF THE STUDY

The main objective of this study is to examine the Economic analysis of Soya beans production in Oyo State.

Specifically, the study will

- examine the profitability level of Soya beans production in the study area.
- measure farm efficiency of individual farm in the industry using stochastic production frontier analysis.
- examine major socio –economic characteristics of the respondent in the study area.

ANALYTICAL FRAMEWORK

The stochastic frontier production function and efficiency studies is employed in this study. In the Stochastic Frontier Analysis (STA), the error term is assumed to have two components parts V and U. The V covers the random effects (random errors) on the production and they are outside the control of the decision unit while the U measures the technical efficiency effects, which are behavior factors that come under the control of the decision unit. They are controllable errors if efficient management is put in place. The stochastic frontier analysis is generally preferred for agricultural research for the following reasons; firstly, the inherent variability of agricultural production due to inter play of weather, soil, pests, diseases and environmental factors. Secondly, many agro-firms are small family owned enterprise where keeping of accurate records is not always a priority hence available data on production are subject to measurement errors. The application of the stochastic frontiers model for efficiency analysis includes the work of Aigner, et al., (1977) in which the model was applied to U.S agricultural data. Battese and Corra (1977) also applied the techniques to the pastoral zone of Eastern Australia.

The stochastic frontier production function model is specified as $Y = f(x_i,\beta) + e$, where Y is output in a specified unit, X denotes the actual input vector, β is the vector of production function parameters and e is the error term that is decomposed into two components, V and U.The technical efficiency of an individual firm is defined in terms of the observed output Y_i to the corresponding frontier output Y_i^*. The Y_i^* is maximum output achievable given the existing technology and assuming 100% efficiency. It is denoted as: $Y_i^* = f(x_{ij},\beta) + v$, that is, $TE = Y_i/ Y_i^*$.

Also the TE can be estimated by using the expectation of U, conditioned on the random variance (V – U) as shown by Battese and Coelli (1998). That is, $TE = f(X_i,\beta) + V\text{-}U/ f(X_i,\beta) + V$ and that $0 \leq TE \leq 1$.

Gross margin. It was used under the assumption that fixed cost component is negligible as in the case with subsistence farming and that the analysis is for short term. It is expressed as:
$GM = \Sigma\ QyPy - \Sigma\ Xi\ Pxi$ …… (i)

Where:
GM = gross margin (₦/ha)
Qy = output of crop (kg)
Py = unit price of the output (₦/100kg)
QyPy = total revenue from the crop (₦/Kg);
X_i = quantity of the ith input used (kg/ha)
Pxi = Price per kg of the ith input (₦/kg);
Xi Pxi = total cost associated with the ith input per hectare;
Σ = summation sign

METHODOLOGY

Study Area

The study was based on farm level data of Soya beans farmers in Saki east local government area of Oyo state. It has an area of 1,569km^2 and a population of 110,223 at the 2006 census. The postal code of the Area is 203. Saki East Local government area has five major communities which are Ago–Amodu, Sepeteri, Ogbooro, Oje–Owode and Agbonle. Its headquarters are in the town of Ago–Amodu, while Sepeteri is the largest community.

Data Collection and Sampling Techniques

The data are mainly from primary sources and were collected from 120 Soya beans farmers selected using multistage sampling techniques. Firstly, four (4) major towns were purposively selected because of their dominance in Soya beans production. Secondly, thirty (30) farmers were randomly selected from each town in the local government, making a total number of 120 respondents. Data were collected with the aid of a structured questionnaire. Parameters as inputs, output and income of farmers during the production season were obtained. Also data on the socio economic variables such as educational level of the farmers, years of farming experience, farm size and age of the farmers were collected to analyze the result.

DATA ANALYSIS

Descriptive statistics (means and percentage), gross margin and the stochastic frontier production function were used to analyze the socio economic characteristics of the Soya beans farmers, Profitability and technical efficiency of Soya beans production in the study area respectively.

The production technology of the Soya beans farmers was expressed following the adoption of Battese & Coelli, (1988) with the explicit Cob Douglas functional form specified as follows:

$$\ln Yi = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + V_i - U_i \ldots\ldots (2)$$

Where; Y = output of Soya beans produced (kg)
X_1 = Farm size (ha),
X_2 = Family labour (man/days),
X_3 = Fertilizer (kg),
X_4 = herbicides (litres),
The inefficiency model U_i is defined by:
$U_i = \sigma_0 + \sigma_1 Z_1 + \sigma_2 Z_2 + \sigma_3 Z_3 + \sigma_4 Z_4$ …….. (3)

Where: Z_1, Z_2, Z_3, Z_4, represent years of formal education, farming experience, extension visits, and age of the farmer respectively. The socio economic variables were included in the model to indicate the possible influence on the technical efficiencies of the farmers. The β's and σ's are scalar parameters to be estimated. The variances of the random error $\sigma^2 v$ and that of the technical inefficiency effect $\sigma^2 u$ and overall variance of the model σ^2 are related, thus, $\sigma^2 = \sigma^2 v + \sigma^2 u$ and the ratio $\gamma = \sigma^2 u / \sigma^2 v$, Gama measures the total variation of output from the frontier which can be attributed to technical inefficiency (Battese and Corra, 1977).

RESULTS AND DISCUSSION

Table 1 revealed that the mean output of the Soya beans harvested by farmers was 1,259.40kg (approximately, 1.2 tones). This indicates that the farmers are small holders and basically subsistence when compare to the world average yield of 3 tonnes per hectare (FAO, 2010). The mean age of the Soya beans farmers is 37 years, this suggest that Soya beans farming is dominated by farmers within the age bracket of working group of the population. The mean years of education (6) shows that on average, the highest level of education attained by most farmers is primary school. Average household size is found to be five (5) per household. This is attributed to the fact that higher household size ensures adequate supply of family labour. Average farm size is 2ha and they received only one visit by extension workers. This point out that farmers operate on a smaller scale and received limited or no technical advice from extension agents. The labour use in Soya beans production recorded an average of 700.00 man-days. This finding revealed that production of Soya beans requires a lot of labour (both hired and family labour) for efficient productivity. This perhaps, could be attributed to the fact that harvesting period is time-bond, to avoid shattering as a result of over maturity. The average cost of chemicals used in Soya beans production was ₦1,785. This shows that Soya beans production requires chemical for viable output.

Table 1: Summary statistics of variables of the stochastic frontier production function for Soya beans production

VARIABLES	MEAN
Output of Soya beans (kg)	1169.45
Age of farmers (years)	38.00
Household size (Number)	5.00
Farm size (ha)	2.00
Education (years)	6.00
Experience (years)	11.20
Extension contact (Number)	1.00
Fertilizer (kg/ha)	400.00
Cost of chemical and other input (naira)	47305.13
Labour (man days)	700.00

Source: Field Survey, 2015.

ESTIMATES OF STOCHASTIC FRONTIER PRODUCTION FUNCTION

For estimating technical efficiency, stochastic production function approach was used. The parameters of the frontier production function were estimated using the maximum likelihood estimation (MLE) and the result are presented in Table 2.

The estimated stochastic frontier function shows that all the coefficients had the expected sign, indicating that an increase in these variables will lead to an increase of the output. It is also evident from the analysis that the estimate of Gama (γ) is large and significantly different from zero, indicating a good fit and the correctness of the specified distributional assumption. Moreover, the estimate of Gama, which is the ratio of the variance output was 0.8756. This means that more than 87% of the variation in output among the Soya beans farmers are due to differences in technical efficiency. The variables farm size had a coefficient of 0.6651 and is statistically significant at 1% level, meaning that at 1% increase in the use of land will increase output by about 6.6%%.

Similarly, the variable family labour, fertilizer and chemicals are statistically significant at 5% level. This observation conformed with a priori expectation and implied that the output of the farmers in the study area would be expected to increase with the increasing use of such production inputs. Amaza *et al*., (2005) and Ebong (2005) also reported a positive and significant relationship between these variables and technical efficiency. The return to scale (RTS) which is the summation of all the estimated elasticities of production was 0.9904 and showed decreasing return to scale. This implies that Soya beans production is in stage 2 of production surface or decreasing return to scale of the production stage. At this stage every additional unit of production input would lead to less than proportionate addition to output, therefore the use of input is needed to increase the output of Soya beans production.

Table 2: Estimates of stochastic frontier production function

VARIABLES	COEFFICIENT	T- RATIO
Constant	3.4626	38.9910***
Farm size	0.6651	3.9822***
Family labour	0.0302	2.2176**
Chemicals	0.0143	2.7852***
Fertilizer	0.0725	2.4682**
Inefficiency model	-4.5448	-2.4522***
Constant		
Age of the farmer	-0.2878	-0.2864
Education	-8.7457	-2.8206***
Farming experience	-1.3427	-2.6208***
Extension visits	-2.0216	-2.4120**
Access to credits	-0.1454	-2.3652**
Gender	-0.1231	-0.7454
Variance Parameters		
Sigma square	6.9513	6.8465***
Gama	0.8756	4.2312***
Log Likelihood function	-147.69	

*** Significance at 5%, *** significant at 1%.**
Source: Field Survey, 2015.

The inefficiency model also revealed that the variable education and farming experience are statistically significant at 1% level, meaning that education of farmers and their experience influence technical efficiency. The implication is that farmers that are experienced, with high level of education and have more extension contact tend to be more efficient in farming and hence increase in the output level. This is consistence with the findings of Amaza and Olayemi (2000). The extension visits and access to credit is significant at 5% level which is also in consistence with the findings of Onyenweaku *et al*., (2005).

Table 3: Elasticity of production and return to scale

VARIABLE	ELASTICITY OF PRODUCTION
Farm size	0.6651
Family Labour	0.0302
Chemicals	0.0143
Fertilizer	0.0725
RTS	0.9904

Source: Field Survey, 2015.

TECHNICAL EFFICIENCY ANALYSIS

The technical efficiency analysis is presented in Table 4. The technical efficiency of the sampled farmers is less than one (i.e 100%) indicating that all the farmers are producing below the maximum efficiency frontier. The farmers' technical efficiency ranged from 0.3318 to 0.9801 with a mean technical efficiency of 0.6649. The distribution of the technical efficiency shows that 54% of the farmer had technical efficiency of 70% above while about 46 % of the farmers had technical efficiency of below 70 %. The distributions of the technical efficiency suggest that in the short run, there is a scope of increasing Soya beans production by about 40%.

Table 4: Frequency distribution of technical efficiency

EFFICIENCY LEVEL	FREQUENCY	PERCENTAGE
0.00 -0.19	3	2.5
0.20 -0.29	5	4.2
0.30 -0.39	6	5.0
0.40 -0.49	11	9.1
0.50 -0.59	17	14.2
0.60 -0.69	24	20.0
0.70 -0.79	41	34.2
0.80 -0.89	10	8.3
0.90 -1.00	3	2.5

Mean * 0.6649, Min * 0.3318, Max * 0.980

Source: Field Survey, 2015.

PROFITABILITY ANALYSIS

Soya beans production was found to be highly profitable in the study area as show by the average gross margin of ₦50, 894.12. The cost elements in the total variable cost (TVC) include labour cost and the cost of agro chemicals, fertilizers, e.t.c which is ₦20, 472.13.

Table 5: Average cost and returns of Soya beans production in the study area.

Variables	Value (₦)
Variable cost	47,305.13
Fixed cost	1,400.00
Total cost of production	48,509.13
Returns	
Total output	1,169.45kg
Price/kg	85.00
Total revenue	99,403.25
Gross margin (TR – TVC)	50,894.12
NFI (GM – TFC)	40,690.12

Source: Field Survey, 2015.

CONCLUSION AND RECOMMENDATION

This study revealed that Soya beans production is a profitable venture. The return to scale indicates decreasing return, this also implies that all inputs were not used within the rational stage of production surface and therefore its production is inefficient in the study area. The technical inefficiency is also found in the production process, as farmers are also technically inefficient. In order to improve the technical efficiency of the farmers, the extension services needed to boost up. Also, provision of affordable credit facilities by government and or other credit institutions is also needed. This will go in no small measure to enhance the productivity and efficiency of Soya beans production in the study area.

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