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Determinant of Beniseed (*Sesamum Indicum* L.) Production among Beniseed Farmers in Mubi Region of Adamawa State, Nigeria

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Abstract: The study examines the determinant of Beniseed (*Sesamum Indicum* L.) Production among Beniseed Farmers in Mubi Region of Adamawa State, Nigeria a multi stage sampling technique was used to select 100 beniseed farmers in the study area. The study used a stochastic frontier production model to estimate the efficiency of the farmers; the empirical result revealed that farm size, seed and herbicide were positive and statistically significant at 1% level and family labour was also was also positive and statistically significant at 5% level in the study. The estimated gamma (ϒ) parameter of 0.799 in the study area indicated the 79% of the total variation in beniseed output is due to the technical inefficiencies in the study. The mean technical efficiency (ϰ) was 0.81 in the region, while Return to Scale (RTS) was 0.94 in the study. It was concluded that there is a positive and significant relationship between farm size, quality of seed used, herbicide used, family labour and beniseed output in the study.

Keywords: Technical efficiency; Beniseed determinant; Production; Stochastic production frontier; Mubi region.

1. Introduction

Beniseed (*Sesamum indicum* L), belongs to the family pedaliacea and is believed to be one of the oldest cultivated plants in the world and oil seed crop grown mainly for its seeds that contain approximately 50% oil and 25% protein [1]. It is generally believed to have originated in Africa, probably West Africa, from where it spread through western Asia to India, China, and Japan and from there to other parts of the world [2]. The main producers of beniseed are India and China, with other big producers in other parts of Asia, Africa, the Americas, and the West Indies [3]. World production of beniseed is estimated between 2 to 5 million tons, but this number fluctuate due to local economic crop production pressures and weather conditions [1].

In Nigeria, beniseed occurrence is fairly widespread, borne out by the fact that there are over twenty different names in different languages for the crop [4]. It is called Ridi (Hausa), Isasa(Igbo), Ocha(Idoma), Ekuku(Yoruba) etc. Main areas of cultivation in Nigeria are found to be between latitudes 6^0 and 10^0 N in the derived guinea and sudan savannah zones including large portions of present day Jigawa, Benue, Kwara, Kogi, Nasarawa, and Niger States [4]. Beniseed is an important export crop in Nigeria, and Nigeria has a substantial role in the global beniseed trade. Food and Agricultural Organization (FAO) [5] reported that annual export of beniseed from Nigeria are valued at about US$20m and Nigeria is the primary supplier of beniseed seed to the world's largest importer, Japan. These features are poorly recognized and it is timely to develop support and action to facilitate the continued expansion of this sector.

Nigeria. It is however, given little attention, there are relatively few companies involved in the trade. As a small holder crop, often intercropped with others, the extent of cultivation is poorly known there is little information on yields or productivity.

Beniseed is considered as the "queen" of vegetable oils due to its numerous economic importance. The importance of the crop lies in its edible leaves and the seed, which is rich in oil, vitamins, proteins, and minerals. The minerals include calcium, iron, and phosphorus while its vitamin constituents include thiamin, riboflavin and niacin [6], as cited by Busari, *et al.* [4]. It also contains a good protein profile (especially methionine) that makes up between 17-19% of its seed while its copius oil constituents (50-52%) is odourless and semi-drying containing fatty stearic and palmatic acids [7].

Although much work has been done in finding the agronomic effect on the crop and crop improvement, little attention has been paid to the economic analysis of beniseed production. According to Busari, *et al.* [4] there are only scanty available data on the cost of beniseed production in any part of the country. It is in view of the prospect which this crop holds for the agro-allied industries in Nigeria that there is a clear need for the conduct of studies on increasing agricultural output and improving nutritional standard.

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The main objective of this research is to analyze the determinant of Beniseed (*Sesamum Indicum L.*) Production Among Beniseed Farmers in Mubi Region Of Adamawa State, Nigeria.
The specific objectives are

- Determine the technical efficiency of Beniseed production in the study area.
- Examine the determinants of beniseed output in the study area.

1.1. Theoretical Framework

Efficiency is the act of achieving good result with little waste of effort. It is the act of harnessing materials and human resources and coordinating these resources to achieve better management goal. Farrell [8] distinguished between technical and allocative efficiency (or price efficiency) as a measure of production efficiency through the use of frontier production and cost function, respectively. He define technical efficiency as the ability of a firm to produce a given level of output with a given minimum quantity of input under certain technology and allocative efficiency is the ability of the firm to choose optimal input level for a given factor prices. In Ferrell's framework, economic efficiency (EE) is an overall performance measure and is equal to the product of Technical Efficiency (TE) and Allocative Efficiency (AE) (that is, EE=TE X AE). Therefore, technical and allocative efficiency are components of economic efficiency

Abdulai and Huffman [9] Economic application of the stochastic frontier model for efficiency analysis include Aigner, *et al.* [10] in which the model was applied to U.S. agricultural data. Battese and Gorra [11] applied the technique to the pastoral zone of eastern Australia. More recently, Ogundari and Ojo [12], Ojo [13], Ajibefun, *et al.* [14], Bravo-Ureta and Pinheiro [15] and Ali and Byerlee [16] offer a comprehensive review of the application of stochastic frontier model in measuring agricultural producers in the developing countries.

Production is defined as the transformation of goods and services into finished products (that is, input – output relationship) and this is applied to every production process, beniseed production inclusive. Olayide and Heady [17] defined production process as one whereby some goods and services called inputs are transformed into other goods and services called output.

2. Material and Methods

2.1. The Study Area

The study was conducted in Mubi region. The region lies between latitude $9^0$30'N and $11^0$45'E and longitude 13^0 and $13^0$45' east of the Greenwich Meridian, comprising of five Local Government areas (L.G.A.) and many villages which are rural in nature It has a land mass of 4,728.77km^2 and a population of 681,353 [18, 19].

2.2. Sampling Procedure

Beniseed farmers are the respondents for the study. 100 beniseed farmers were selected from the region and were used for the study.

A multi-stage sampling technique was employed. The first stage is the purposive selection of three L.G.A. namely Madagali, Michika, and Mubi North because of their involvement in beniseed production. The second stage the three rural areas each from the three L.G.A. namely Shuwa, Mayo-wandu, Kuda from Madagali L.G.A., Dakwa, Kwapalle and Minkisi from Michika l.G.A. and Munchalla, Kirya and Betso from Mubi north. The third stage is the random sampling through random selection of 100 beniseed farmers in the study area.

2.3. Research Instrument

Questionaire and interview schedule were the research instruments used for this study to collect information from the farmers.

2.4. Data Analysis

The stochastic frontier production model was used to determine the relationship between the dependent variable (Beniseed output) and the independent variables as well as to determine the technical efficiency in farmers operation in the study area.

2.5. The Stochastic Frontier Production Function

The use of the stochastic frontier production function has some conceptual advantage in that it allows for the decomposition of the error term into random error and inefficiency effects rather than attributing all errors to random effects [20] as cited by Giroh [21]. The model is specified as:

$$Y_a = f(X_a{:}\beta) + (V.U) \quad [22]\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:
Y_a=Production of the ith farm
X_a=Vector of input quantities of the ith farm
β=Vectors of unknown parameters

V=Assumed account for random factors such as weather, risk and measurement error. It has error mean, constant variance, normally distributed and independent of U i.e. N $(0,\delta^2 V)$. It covers random effects on production outside the control of the decision unit.

U=These are non- negative error term having zero mean, and constant variance i.e. N$(0,\delta^2 U)$ [20]. It measures the technical inefficiency effects that fall within (because of errors could be controlled with effective and adequate managerial control of the farm), the control of the decision unit Ajibefun [23] as cited by Giroh [21].

2.6. The Empirical Stochastic Frontier Production Model

The Cobb-Douglas functional form was used to specify the production technology of the farms. The Stochastic Frontier models are better estimated using either the Cobb-Douglas or Translog functional form. The empirical stochastic frontier model used in determining technical efficiency of beniseed farmers in the study is given:

$$Lny=\beta_0+\beta_1 L_n X_1+\beta_2 L_n X_2+\beta_3 L_n X_3+\beta_4 L_n X_4+\beta_5 L_n X_5+\beta_6 L_n X_6+\beta_7 L_n X_7+V_i-U_{i\ldots\ldots\ldots}(2)$$

Where:
Y=Output of beniseed in Kg
X_1=Size of farm in ha
X_2=Quantity of seed in Kg
X_3=Hired labour (in man days)
X_4=Family labour (in man days)
X_5=Herbicide in litres
X_6=Quantity of fertilizer in kg
V and U as previously defined above.

The technical efficiency of beniseed producer for the ith farmer, defined by the ratio of observed production to the corresponding frontier production associated with no technical inefficiency, is expressed by TE=exp $(-U_i)$ so that

$$0\leq TE\leq 1\ldots\ldots(3)$$

$$\text{Variance parameter are: } \delta^2=\delta^2_v+\delta^2_u \text{ and } \gamma=\delta^2_u/\delta^2\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

So that $0\leq\gamma\leq 1$.

It is assumed that the technical inefficiency effects are independently distributed and Ui arises by truncation (at zero) of the normal distribution with mean, μ_{ij} and variance d^2, where μ_{ij} is defined by:

$$U_{ij}=\delta_0+\delta_1 Z_{1ij}+\delta_2 Z_{2ij}+\delta_3 Z_{3ij}+\delta_4 Z_{4ij}+\delta_5 Z_{5ij}+\delta_6 Z_{6ij}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where:
U_{ij}= Inefficiency effect
Z_1= Family size (total number of persons in household)
Z_2= Farming experience (in years)
Z_3= Literacy level
Z_4= Extension service

$\Delta^2,\delta,\gamma,\beta$s are unknown parameters that was estimated. The Maximum Likelihood Estimate (MLE) for all the parameters of the stochastic frontier production was obtained using the computer programme frontier 4.1 [23, 24].

3. Results and Discussions

3.1. Estimates of Stochastic Frontier Function

3.1.1. Estimated Production Function

The Cobb Douglas production function was adopted for the result compared to the Ordinary Least Square (OLS) functional form because of higher number of significant variables and is also caters for both increasing and decreasing returns to scale unlike the linear functional form which considers only constant return to scale, which rarely exist in agricultural production activities.

The parameter and related statistical test results obtained from the stochastic frontier production function analysis are presented in Table 1. There is positive and significant family labour and beniseed output in the study area. Seed is found to be significant factor influencing changes in beniseed output. This implies seed is a positive factor influencing beniseed output in the study area. In other words, the more the quality (variety) of seeds used in kg the more the output of beniseed produced. There is also a positive relationship between farm size and beniseed output in the study area. Land is therefore a significant factor associated with changes in output because 1% increase in hectare of land used in production ceteris paribus would increase the total output by 0.6%.

The coefficient of herbicide is positive and statistically significant in the study area. This implies that the use of herbicide increases beniseed output and also enables farmers to cultivate large hectare of land with less fatigue and drudgery in the production process.

3.1.2. Source of Inefficiency

The source of inefficiency were examined and estimated (δ) coefficient associated with the inefficiency efficiency effect in Table 1, the inefficiency effects are specified as those relating to family size, experience, literacy and extension contact.

The estimated coefficient for family size is negative and statistically significant at 1%. The negative coefficient indicates that beniseed farmers with more family size tend to be more technically efficient in beniseed production in the study area.

The estimated coefficient for farming experience is also negative and statistically significant at 1%. The negative coefficient indicates that beniseed farmers with more years of farming experience are more technically efficient in beniseed production.

3.2. Return to Scale

The Return To Scale (RTS) was 0.94 in this study indicating increasing return to scale, which implies that beniseed production was in stage 1of the production surface. This indicates that effort should be made to expand the present scope of production to realize the potential in it. More variable inputs should be employed to achieve more output.

3.2.1. The Diagnostic Statistics

The estimated sigma square (δ^2) in the study area (0.413) is statistically different from zero at 1%. This indicates that one sided error term dominates the symmetry error indicating a good fit and correctness of the specified distributional assumptions. Therefore, if ϒ is statistically different from zero implies that traditional average (OLS) function is not adequate representation of the analysis.

3.2.2. The Determinant of Technical Efficiency

The determinants of technical efficiency of the beniseed farmers in the study area include farm size, seed, family labour, and herbicide. The implication is that the variables greatly impact on the technical efficiency of the beniseed farmers in the region, which means that the tendency for beniseed farmers to increase production depends on the amount of farm size, quality of seed, family labour and herbicide available to him. These determinants are significant at various levels in the study; therefore they are significant factors of production in the study area. This implies that the more the land is open for production, the more the quality of seed used and herbicides used the more the beniseed output in the study area.

3.2.3. Gamma (ϒ) Parameter

The estimated gamma (ϒ) parameter of 0.799 in the study indicates that 79% of the total variation in beniseed output is due to the technical inefficiencies in the study area.

Table-1. Maximum likelihood estimates of the parameters of the stochastic frontier production function

Variable	Parameter	Coefficient	t-ratio
Production factors			
Constant	β_0	2.564***	20.14
Farm size (X_1)	β_1	0.606***	9.90
Seed (X_2)	β_2	0.210***	3.32
Hired labour (X_3)	β_3	-0.008	-0.60
Family Labour (X_4)	β_4	0.035**	2.38
Herbicide (X_5)	β_5	0.124***	3.36
Fertile (X_6)	β_6	-0.027	-120
Inefficiency effects			
Constants	δ_o	0.037	0.039
Family size (Z_1)	δ_1	-0.021***	-4.50
Farming experience (Z_2)	δ_2	-0.317***	-3.03
Literacy level (Z_3)	δ_3	-0.032	-1.73
Extension contact (Z_4)	δ_4	-0.112	-0.35
RTS	-	0.94	
Diagnostic Statistics			
Sigma Squared	δ^2	0.413***	6.539
Gamma	ϒ	0.799	2.621
Mean efficiency	ϰ	0.81	
Log likelihood function			

Source: Data analysis 2013, computer printout of frontier 4.1
*** Estimates are significant at1% level
** Estimates are significant at 5% level

3.2.4. Technical Efficiency for the Study

In the study area, the predicted technical efficiencies differs substantially among the beniseed farmers, ranking from 0.70 and 0.99with the mean technical efficiency of estimated 0.81, a frequency distribution of technical efficiencies is presented in Table 2 and Figure 1.

This shows that the highest numbers of farmers have technical efficiency of 0.99, this also indicated that there is a wider distribution of technical efficiencies among the beniseed farmers in the region, which revealed that there is still room for effecting improvements in the technical efficiencies of the farmers in the region (Table 2).

Figure-1. Graph showing decile range of farmers in the study area. Result from data analysis 2013

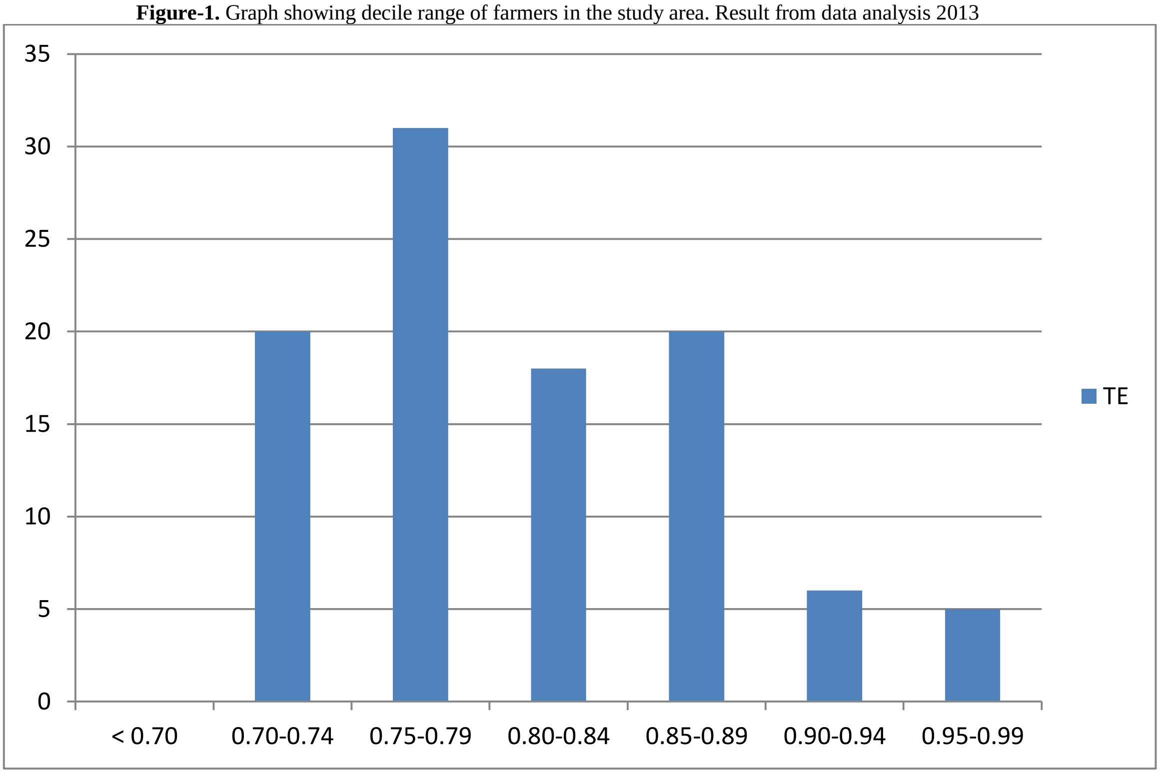

Table-2. The frequency and decile range of farmers' efficiency

Range	Frequency	Percentage
< 0.7	0	0.0
0.70 – 0.74	20	20.0
0.75 – 0.79	31	31.0
0.80 – 0.84	18	18.0
0.85 – 0.89	20	20.0
0.90 – 0.94	6	6.0
0.94 – 0.99	5	5.0
Total	100	100.0

Source: Data analysis, 2013

4. Conclusion

The study examines the determinant of beniseed production among beniseed farmers in mubi region, Adamawa State, Nigeria. A multi stage sampling technique was used to select 100 beniseed farmers in the study area. Data were collected and subjected to inferential statistics (OLS) and the stochastic frontier production model, which was used to determine the relationship between the dependent variable (Beniseed output), the independent variables and the technical inefficiency in farmers operation in the study.

The regression result revealed that farm size, seed and herbicide were positive and statistically significant at 1% level while family labour statistically significant at 5% level in the region. The estimated gamma (Υ) parameter of 0.799 in the study area indicates that 79% of the total variation in beniseed output is due to technical inefficiencies in the study. The mean technical efficiency ($\varkappa$) was 0.81 and the Return To Scale (RTS) was 0.94 in the area.

It can therefore, be concluded that there is a positive and significant relationship between farm size, quality of seed used, herbicide used, family labour and beniseed output in the study area.

4.1. Recommendation

Based on the finding in the study area the following are recommended

- The study indicates that more land can still be open for beniseed production in the study area.
- More efforts should be intensified by the extension agents in educating the farmers on improved farm practices so as to boost their efficiencies in beniseed production.
- Farmers should form themselves into farmer's cooperative societies for easy access to source of credit that will assist them in acquiring farm implements and inputs.

References

[1] Burden, D., 2005. "Agricultural marketing research centre: Sesame profile." Available: http://www.agmrc.org/agmrc/commodity/grainoilseeds/sesame/sesame.

[2] Morris, J. B., 2002. *Food, industrial, nutraceutical, and pharmaceutical uses of sesame genetic resources.Pp. 153-156. In: J. Janick and A. Whipkey (eds).Trends in new crops and new uses*. Alexandria,VA: ASHS Press.

[3] Davidson, A., 1999. *The oxford companion to food*. London: Oxford University Press.

[4] Busari, L. D., Olowe, V. I. O., Yusuf, I. A., and Idowu, A. A., 1998. *Research on sesame agronomy in Nigeria. In:proc of the first national workshop on benised*. Badeggi: NCRI. pp. 75-85.

[5] Food and Agricultural Organization (FAO), 2000. *Food and agricultural organization of the United States*: Year book.

[6] Kinman, M. L. and Martin, J. A., 1954. "Present status of sesame breeding in the United States." *Agron. J.*, vol. 46, pp. 24–27.

[7] Odunfa, A. A. and Oresanya, M. O., 1998. "Domestic Production and utilization of beniseed: Status and Potentials for cottage industries." pp: 112-119. In pre-conference proceedings, 1st National Workshop on beniseed. L.D Busari, A.A. Idowu and S.M. Massari (eds). National Cereals Research Institute, Badeggi, Nigeria. pp: 215.

[8] Farrell, M. J., 1957. "The measurement of production efficiency." *Journal of Royal Statistics Society, Series A*, vol. 120, pp. 253-281.

[9] Abdulai, A. and Huffman, W., 2000. "Structural adjustment and economic efficiency of rice farmers in Northern Ghana." *Econ. Develop. Cultural Change* vol. 48, pp. 504– 520. Available: http//:www.journals.uchicago.edu.

[10] Aigner, D., Lovell, A., and Schmidt, P., 1977. "Formation and estimation of stochastic frontier production function models." *J. Econ.*, vol. 6, pp. 21-37.

[11] Battese, G. E. and Gorra, G. S., 1977. "Estimation of production function model With Application to the pictorial zone of eastern Australia." *Australian J. Agric. Econ.*, vol. 21, pp. 169-179.

[12] Ogundari, K. and Ojo, S. O., 2005. "The determinants of technical efficiency in mixed crop food production in Nigeria." *Journal of Social Sciences*, vol. 13, pp. 131-136. Available: www.ajol.info/viewarticle.phpjid-38094.

[13] Ojo, S. O., 2004. "Improving labour productivity and technical efficiency in food crop production. A panacea for Poverty Reduction in Nigeria." *J. Food Agric. Environ.*, vol. 2, pp. 227-231.

[14] Ajibefun, I. A., Battese, G. E., and Daramola, A. G., 2002. "Determinant of technical efficiency in smallholders corps farming in Oyo state Nigeria. Application of frontier production function." *Q. J. Int. Agric.*, vol. 41, pp. 226-240.

[15] Bravo-Ureta, B. and Pinheiro, A., 1993. "Efficiency analysis of developing country agriculture. A review of the frontier function literature." *Agric. Resource Econ. Rev.*, vol. 22, pp. 88-101. Available: www.ideas.repec.org/a/ags/arejl/31643.

[16] Ali, M. and Byerlee, D., 1991. "Economic efficiency of small-scale farmers in a changing world. A survey of recent evidence." *J. Develop. Stud.*, vol. 4, pp. 1-27. Available: www.interscience.wiley.com/journal.

[17] Olayide, S. O. and Heady, E. O., 1982. *Introduction to agricultural production economics*. Nigeria: University of Ibadan press.

[18] Adebayo, A. A., 2004. *Mubi region, Geographical synthesis*. Yola, Adamawa State: Paraclete Publishers. pp. 17-43.

[19] National Population Commission (NPC), 2007. *Federal Republic of Nigeria Official Gazette* vol. 94. Lagos-Nigeria.

[20] Xu, X. and Jeffrey, S. R., 1998. "Efficiency and technical progress in traditional and modern agriculture, evidence from rice production in China." *Agricultural Economics*, vol. 18, pp. 157-165.

[21] Giroh, Y. G., 2010. "Efficiency of latex production in planted Rubber Agroforest of Edo and Delta States, Nigeria". A Ph.D Research proposal, Department of Agricultural economics and extension, Federal University of Technology, Yola, Nigeria.

[22] Battese, G. E., Malik, S. J., and Brocas, S., 1993. "Production functions for wheat farmers in selected districts of Pakistan. An application of a stochastic frontier production with time varying inefficient effects." *The Pakistani Devet. Review*, vol. 32, pp. 233-268.

[23] Ajibefun, I. A., 1998. "Investigation of technical inefficiency of production of farms under the national direction of employment in Ondo State." *Applied Tropical Agriculture*, vol. 3, pp. 15-28.

[24] Coelli, T., 1994. "A guide to frontier version 4.1; A Computer program for stochastic frontier production and cost function estimation." Mineo, Department of Agricultural Econometrics, University of New England, Armidale.