ISSN - 2277 - 078X

Journal of Humanities, Social Sciences and Creative Arts

ANALYSIS OF RESOURCE-USE EFFICIENCY IN BENISEED PRODUCTION IN OBI AND DOMA LOCAL GOVERNMENT AREAS OF NASSARAWA STATE, NIGERIA

*[1]O.F. ASHAOLU, [1]S. MOMOH, [1]I.A. AYINDE, AND [2]U.B. UGALAHI

[1]Dept. of Agricultural Economics & Farm Management, University of Agriculture, Abeokuta, Ogun State, Nigeria.

[2]National Cereals Research Institute, Badeggi, Niger State, Nigeria.

***Corresponding author:** oluashaolu2000@gmail.com

ABSTRACT

Beniseed has been recognized as a crop with high economic potential in Nigeria, both as source of raw materials for industries and reliable foreign exchange earner. The study assessed resource-use efficiency in beniseed production in Obi and Doma Local Government Areas of Nassarawa state during 2004/2005 farming season. Data were collected through multi-stage sampling procedure from 200 respondents. Data were analyzed using descriptive statistics and stochastic production frontier analysis. The technical efficiency index estimated for beniseed farmers was 0.59 which indicated inefficiency in current production practices. The efficiency indices for allocative and overall economic efficiencies were estimated to be 0.41 and 0.24 respectively. The findings showed that farm size, tractor service and hired labour significantly influenced technical efficiency ($p < 0.01$). The socio-economic factors associated with higher technical efficiency of the farmers included age, access to credit and fertilizer use ($p < 0.10$); frequency of extension visit ($p < 0.10$) significantly influenced allocative efficiency while overall economic efficiency was significantly ($p < 0.01$) influenced by use of fertilizer, selling price and access to credit ($p < 0.10$). The study concluded that high level of inefficiency exists under the present production practices and therefore recommends that resources such as fertilizer, tractor services and that credit should be made available to farmers for improved beniseed production.

Keywords: Resource-use, efficiency, beniseed, Nassarawa state.

INTRODUCTION

In recent times the major concern of the Federal Government of Nigeria is to be self-sufficient in food production, diversify its economic resources as well as achieve a sustainable economic development. To this effect, efforts are being made to revitalize the agricultural sector. In 2002, a stakeholder's summit aimed at evaluating the agricultural sector was held, at the end of which emphasis was placed on production of beniseed among other crops with high export value.

Beniseed (*Sesamum indicum*) belongs to the division spermatophyte and family *Pedaliaceae*. It is a crop of great antiquity and probably one of the most ancient oilseed crops under cultivation (Weiss, 1983). It is believed to have originated in Africa and is well established in the Savanna regions of the continent. It is essentially a tropical and sub-tropical plant. There are about 19 species of beniseed indigenous to Africa (Uzo, 1998). Beniseed is a rich source of oil (44%) and protein (19-25%). The oil is used for cooking and as raw material for the production of some industrial materials including paints, margarine and varnishes. Its protein content has a high desirable amino-acid profile and is nutritionally as good as soy bean protein (Akintunde and Tunde-Akintunde, 2004). The oil is a rich source of lecithin and essential fatty acid.

Nigeria has a great potential for production of beniseed for both domestic and export markets. An estimated 3.5million hectares of the country's agricultural land is suitable for its production even under low input systems.(Alegbejo *et al.,* 2003) Out of this about 334,685 ha has so far being cultivated (RMRDC, 2004).

Beniseed has over 15% margin in terms of value added compared to other cash crops such as sheanuts and palm-kernels. For instance in the year 2000, a tone of beniseed (raw seed) sold for N72000 while processed oil of the same quantity sold for N350,000.00. Because of its economic importance and various uses, research work on beniseed has come out with varieties which are high yielding. However, yields on farmers' fields in Nigeria are between 500kg -750kg per ha (RMRDC, 2004) which is low compared with yields of 1000kg and above recorded in the United State of America (USA) and other countries.

For sustainable food security, strategies have to be developed to increase food production. One of the ways to achieve this is through efficient use of resources which is defined as the ability to derive maximum output per unit of resources. Farrel (1957) distinguishes between three types of efficiency viz: technical efficiency (TE) allocative or price efficiency (AE) and economic efficiency (EE). Technical efficiency refers to the achievement of the maximum potential output from a given quantity of input, taking into account physical production relationship. Allocative efficiency refers to the allocation of resources taking into account the prices of factors which implies that the marginal product of each input must be equal to its price while economic efficiency is a term applied to the concept of overall efficiency, which includes allocative and technical efficiencies.

Various methods have been used to measure efficiency but the stochastic approach is preferred because it deals with the stochastic noise and degree of inefficiency (Sharma *et al.,* 1999). The measurement of efficiency (technical, allocative and economic) has remained an area of important research in developing countries where resources are meager and the opportunities for developing and adopting new technologies are dwindling (Ali and Chaudhry, 1990). A measure of efficiency which is a factor of productivity also help developing countries determine to what extent it is possible to raise productivity by improving efficiency with existing resources and the available technology. This could help them decide on how to develop a new technology in the short run (Tadesse and Krishnamoorthy, 1997). Therefore, there is need for a study of this nature which will bring about the evolution/development of appropriate strategies towards improving the production system.

The objective of this study therefore is to examine the efficiency (technical, allocative and economic) of utilization of resources in beniseed production and identify socio-economic factors associated with efficiency.

MATERIALS AND METHODS

The study was conducted in Obi and Doma Local Government Areas (LGAs) of Nassarawa state Nigeria, because of their reputation for beniseed production. Nassarawa state has a population of 1,863,275 (2006 census) with estimated farm families of 174,008.(Shaib *et al.,* 1997). The State is divided into thirteen Local government area councils that are grouped into southern and western zones (NCRI, 2001). The southern zone, reputed for beniseed production is made of Awe, Doma, Keana, Lafia, Nassarawa – Eggon and Obi LGAs. This study was based on primary data obtained in a cross section survey of 200 farmers involved in beniseed production in Obi and Doma LGAs of Nassarawa State.

The sampled farmers were drawn in a multi -stage random sampling procedure. In the first stage, two LGAs were randomly selected from the six LGAs in the study area. At the second stage, ten farming communities (villages) noted for beniseed production were purposively chosen from the list of beniseed growing communities in each LGA.

The final stage of the sampling process involved purposive selection of 10 farmers that were involved in beniseed production during 2004/2005 cropping season; from each of the twenty villages. The purposive selection of identified beniseed growing communities and farmers became necessary because not all communities or farmers in the selected study area cultivated beniseed. However, a total of one hundred and ninety five (195) questionnaire administered were found to be adequate for our analysis.

Analysis of data

Efficiency and its determinants were estimated using the Stochastic Production Frontier (SPF) following Battese and Coelli (1992) and Chavas and Roln (2005) in a two stage estimation approach. This method involves the specification of the following *SPF*;

$$lnY_i = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + U_1 - V_1 \quad \ldots\ldots (1)$$

where:

Y_i = beniseed output of the i^th farmer in kg
X_1 = farm size in ha
X_2 = household labour in mandays.
X_3 = hired labour in mandays.
X_4 = quantity of seed planted in kg
X_5 = quantity of fertilizer used in kg
X_6 = cost of other intermediate materials including herbicides, insecticides, etc., in Naira.

β = vector of production function parameters to be estimated.
V_i = random variable which is assumed to be independently and identically distributed *(iid)* $N(0, \sigma_v^2)$ and independent of U_i
Ui = non-negative random variable associated with technical inefficiency in production, and is assumed to be identically and independently distributed half normal *(iid)* $N(\mu, \sigma_u^2)$.

The *SPF* specified in equation 1 was first estimated using the limdep econometric software, as a first stage problem. The process generated the values of inefficiency term U_i, in addition to the parameters of the SPF. The inefficiency term was then used to estimate the technical efficiency index, which also formed the basis for computing the allocative as well as the overall economic efficiency indices.

Computation of production efficiency indices

Having estimated the *SPF* (1) and the one sided error terms (ui) in stage 1, the index of technical, allocative and overall economic efficiency for each farmer were estimated, following Jondrow *et al*. (1982), Battese and Coelli (1992) and Chavas and Roln (2005) as follows:

$TE_i = exp(-u_i)$ ……………..…………(2)

$$AE_i = \frac{\dfrac{P_i \times y_i}{TE_i}}{R^*} \quad \text{………….....….(3)}$$

$EE_i = TE_i \times AE_i$ ……………………...(4)

where:

TE_i = index of technical efficiency of the i^{th} farm.

AE_i = index of allocative efficiency of the i^{th} farm.

EE_i = index of overall economic efficiency of the i^{th} farm.

P_i = average price of beniseed (N/Kg) produced on the i^{th} farm.

y_i = yield of beniseed of the i^{th} farm kg/ha

R^* = highest revenue recorded per hectare on the farms in the sample.

Second stage-production efficiency model

Having estimated the various indices of technical, allocative and overall economic efficiency for each farm, the influence of various socio-economic factors on each of these indicators of production efficiency were examined by specifying and estimating the following second-stage production efficiency equations:

$$EFF_j = \delta_{oj} + \sum_{k=1}^{12} \delta_{kj} Z_{kj} + e_j \quad \text{…………....(5)}$$

where:

EFF_j is the vector of the j^{th} efficiency index *(j=1 for TE, 2 for AE and 3 for EE)*

Z_k *(k=1, 2,……,12)* is the vector of the efficiency changing variables

where

Z_1 = Age (years)

Z_2 = Gender (male =0, female 1)

Z_3 = Educational background (years of formal education)

Z_4 = Farm size in hectare

Z_5 = Dummy variable for source of land, 1 if leased and 0 if otherwise

Z_6 = Dummy variable for cropping pattern; 0 if sole, 1 if mixed

Z_7 = Dummy variable for type of seed planted; 0 if local variety and 1 if improved variety

Z_8 = Dummy variable for mode of land preparation; 1 if tractor was used and 0 if otherwise

Z_9 = Dummy variable on use of fertilizer; 1 if used and 0 if otherwise

Z_{10} = Dummy variable on use of herbicide; 1 if used and 0 if otherwise

Z_{11} = Amount of credits accessed in N

Z_{12} = Frequency of extension visits (No of times during production period).

Equation 5 was estimated by the Tobit regression procedure with the predicted production efficiency indices restricted to lie between 0 and 1. The need for this form of censored regression arises because efficiency estimates can only take on values between zero and one.

RESULTS AND DISCUSSION

General characteristics of farmers

Most of the farmers in the study area (89.2%) are males with average age of 45 years (Table 1).As expected with most economic activities, majority (90.8%) of the farmers were between less than or equal to 60 years with a modal age group of 41–50 years, to which about one-third (30.3%) of the sampled farmers belong. This implies that most of the farmers fall within the active farming age bracket. Majority (74.9%) of the beniseed farmers have farming as their primary occupation, while the remaining 25.1% of the farmers were involved in beniseed production as secondary occupation. Given that most of the beniseed farmers are expectedly involved in its production on full time basis, they are expected to have enough time for tendering their crops which will likely enhance their efficiency.

Education plays a significant role in skill acquisition and knowledge transfer (Ogundele, 2003), and can influence output and production efficiency. The results show that majority (69.8%) of the farm operators had no more than primary school education, with as much as 43.1 per cent of the respondents having had no formal education. This high presence of uneducated farmers in the sample may have implication on the farmers' ability to benefit maximally from extension information due perhaps to their inability to read and interpret or record vital information appropriate for improving farming activities.

The average year of experience in beniseed production was 20½. This suggests that an average farmer involved in beniseed production in the study area has been growing beniseed for over 20 years thus is sufficiently experienced in beniseed farming.

During the 2005/2006 production period, majority (65.1%) of the farmers had no more than two contacts with extension agent while 36.4 per cent had no single contact with extension agents during the production season. Against the background of a relatively low level of formal education among beniseed farmers in the study area, this might have some negative implications on the adoption, management and utilization of improved technology.

Farm size is a parameter which has revealed significant influence on efficiency (Johansson, 2005). Theoretically, where economy of size exists in a production process, cultivation of larger farm size may enable farmers to produce more output at lower average costs, thus enhancing production efficiency. The average farm size was 2.5 hectares; this implies that beniseed cultivation in the study area is predominantly operated as small holding farms.

One major determinant of yield, and thus productivity, in agriculture is the variety of seed planted. While local varieties may be more adapted to a local condition, improved (hybrid) varieties tend to be associated with greater yield and other desirable characteristics like resistance to diseases, none shattering, high oil and protein composition.

Estimates of the stochastic production frontier and the associated technical efficiency indices

Table 2 presents results of estimation of the Stochastic Production Frontier in beniseed production and the associated technical efficiency indices. The MLE estimate of the Stochastic Production Frontier revealed that output is significantly influenced by farm size, seed and hired labour, with one percent increase in land, hired labour and seed result-

Table 1: Distribution of Respondents by their General Characteristics

General characteristics	Frequency	Percentage	Mode / Mean
Age (years)			
Below 31	26	13.3	45
31-40	53	27.2	
41-50	59	30.3	
51-60	39	20.6	
61 and above	18	9.2	
Sex			
Male	174	89.2	Male
Female	21	10.8	
Main occupation			
Farming	146	74.9	
Trading	8	4.1	Farming
Artisans	2	1.0	
Business men	2	1.0	
Civil servants	24	12.3	
Others	13	6.7	
Educational status			
No formal education	84	43.1	No formal education
Primary education	52	26.7	
Secondary education	40	20.7	
Tertiary education	19	9.5	
Farming experience (years)			20.5
Below 10	28	14.4	
11-20	45	23.1	
21-30	63	32.3	
31-40	41	21.0	
Above 40	18	9.2	
Extension contacts (times)			No access
None	71	36.4	
1-2	56	28.7	
3-4	33	16.9	
5-6	25	12.8	
7 or more times	10	5.1	
Farm size (Ha)			
Below 2 ha	62	31.8	2.5
2-4 ha	98	50.3	
4-6 ha	27	13.8	
6 ha and above	8	4.1	

Source: Field Survey, 2006

Table 2: Estimates of Stochastic Production Frontier and Technical Efficiency

Variables	OLS estimates		MLE estimates	
	Parameter	t-value	Parameter	t-value
Stochastic Production Frontier				
Constraint	5.1163	5.65	5.0723	7.18
Farm size	0.5781 ***	6.35	0.5133***	8.29
Hired labour	0.0248	1.27	0.0182**	2.22
Household labour	0.1235 ***	2.79	0.0786	0.92
Fertilizer	0.0194	1.26	0.0168	1.12
Intermediate Material Cost	-0.0359	-0.37	0.0519	0.67
Seed	0.2626**	2.29	0.2703***	3.84
Technical Efficiency Estimates				
Constant			0.6381	9.13
Age			0.0019*	1.88
Gender			-0.0531	-1.29
Education			-0.004	0.17
Farm size			-0.0162***	-2.79
Lease of land (dummy)			-0.0684**	-2.23
Mixed Cropping (dummy)			0.0115	0.29
Improved seed (dummy)			0.0788**	2.22
Tractor use (dummy)			-0.0159	-0.56
Use of fertilizer (dummy)			0.0585**	1.97
Use of herbicide (dummy)			-0.0682*	-1.91
Amount of credits accessed			0.0602**	2.12
Frequency of extension visit			-0.0116	-1.57
Diagnostic statistics				
Lambda			2.4390	5.11
Sigma square			0.8135	16.12
Log likelihood function			-153.85	
Sigma squared (v)			0.09522	
Sigma squared (u)			0.56650	

Note: *= Significant at 10%, **= Significant at 5%, *** = Significant at 1%
Source: Computed from survey data (2006)

ing in 0.51, 0.02 and 0.27% increase in output respectively. Index of technical efficiency of the sampled beniseed farmers ranged from 0.07 to 0.92 with the mean technical efficiency index being 0.59.

Evidence from the technical efficiency estimates shows that increase in age (and therefore, experience) significantly enhances technical efficiency, while increase in farm size as well as use of herbicides significantly lowers technical efficiency. The decline in technical efficiency with respect to herbicides can be attributed to the fact that herbicides naturally affect crops because of its toxic content (phyto-toxicity). This demands that herbicide be used in the right quantity otherwise this can affect the crop stand per hectare resulting to low output while that of farm size could be attributed to diminishing returns to size. Increased access to credits, fertilizer use and planting improved variety of beniseed were revealed to be significantly associated with higher technical efficiency, while farmers that cultivated leased land were found to be significantly less efficient, technically.

Technical efficiency (TE) indices of the sampled farmers varied from 0.10 to 0.94 with mean TE index been 0.65. This implies that beniseed output by an average farmer in the sample can be increased as much as 35% by improving the technical efficiency in resource use by the farmers with no additional cost.

As shown on Table 3, substantial allocative and overall economic inefficiencies exist in the operations of beniseed farmers in the study area. Majority of the farmers had allocative efficiency (53.9 per cent) and overall economic efficiency (90.3%) indices that were less than 0.4. The mean AE was 0.41 while the mean EE was barely 0.24. This suggests that beniseed farmers in the study area have only been realising about one-quarter of the potential profit realisable from beniseed production in the study area. This finding is consistent with evidence in most sub-Saharan African agriculture. Gutierrez (2003), for instance, observed that between 1994 and 1996 farm income realised in one year by an average farmer in low income country (including Nigeria) is barely what their peers in the Netherlands realised in three days between 1994 and 1996.

Table 3: Efficiency (Frequency) Distribution Estimate for Sampled Beniseed Farmers

Level of efficiency	Technical efficiency		Allocative efficiency		Economic efficiency	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
≤ 0.20	6	3.1	2	1.0	80	41.0
0.21 – 0.40	22	11.3	103	52.9	96	49.3
0.41 – 0.60	40	20.5	72	36.9	17	8.7
> 0.60	127	65.1	18	9.2	2	1.0
Total	195	100	195	100	195	100

Source: Derived from Analysis of Survey Data, 2006

Determinants of technical in-efficiency in beniseed production

Evidence from the technical inefficiency equation earlier presented on Table 2 shows that while increase in farm size, use of herbicides as well as tractor services are significantly and positively associated with increase in technical inefficiency, increase in age (and therefore, farming experience) significantly increase technical efficiency. This has to do with experience that the older the farmer the more experienced they become which increase efficiency. The decline in technical efficiency with reference to tractor use however, contradicts a-priori expectation. Meanwhile personal communication with some extension agents in the study area and information obtained from the farmers, suggests that this inefficiency may not be unconnected with delay sometimes experienced while trying to use tractor services of Agro-service centres available in the study area.

Determinants of allocative and economic efficiency in beniseed production

Table 4 presents results of Tobit regression model of the determinants of AE and EE. The use of Tobit procedure was necessitated by the need to restrict efficiency estimates within the range of 0 and 1. Evidence from the Tobit models shows that the influence of use of fertilizer, frequency of extension visit and price at which the farmers were able to sell their beniseed are the variables that positively and significantly enhance allocative efficiency of the beniseed farmers. Female farmers were not allocatively efficient as their male counterpart. Use of fertilizer and price at which farmers sold their produce were significant at 1% while gender of farmer and frequency of extension visit were significant 5%.

Furthermore, from Table 4, use of fertilizer, increased access to credits and ability of the farmers to produce beniseed that commands higher prices (or manage product sales at higher prices) are factors that significantly enhance overall economic efficiency in beniseed production in the study area. This is in line with the work of Bravo-ureta and Evenson, (1994) who found that credit has a positive impact on efficiency in their study of peasant farmers in eastern Paraquay.

The results also show that female farmers achieved significantly lower economic efficiency than their male counterparts. This is contrary to the work of Quisumbing *et al.* (1996) who were able to show in their study on male-female difference in agricultural productivity that female farmers are equally efficient as the male farmers. They suggested that areas where women are inefficient could be due to constraint by cultural factors from having more active roles and low levels of education and technical development. Farmers that cultivated leased land and larger farm sizes were also significantly less efficient than those that had property right on their land and cultivated smaller farm size respectively.

The decline in efficiency on the side of farmers that lease their land could be that the land leased to them may not be productive and they may not be willing to spend their resources to improve on the land since they are not the rightful owners.

The main import of these findings therefore, has been that significant economic inefficiencies (technical and allocative) exist in beniseed production in the study area. These inefficiencies can be significantly reduced if the farmers are granted greater access to credit, more extension contacts, access to better marketing channels (with supportive technologies like storage and processing) and fertilizer use. Use of herbicides significantly lowers technical efficiency (but not allocative or overall economic efficiency), while issues relating to granting property rights to farmers on their farm land should be considered to enhance technical efficiency of beniseed farmers in the study area.

Table 4: Estimates of Tobit Model of Allocative and Overall Economic Efficiency

Variables	Allocative Efficiency		Economic Efficiency	
	Parameter	t-value	Parameter	t-value
Constant	0.1545	3.44	0.1561	3.75
Age	0.0008	1.27	0.0009	1.61
Sex	-0.0723**	-2.39	-0.0552**	-2.28
Education	-0.0011	-0.78	0.004	0.32
Farm size	-0.0046	-0.21	-0.0069 **	-2.02
Leased land	-0.0284	-1.46	-0.0399**	-2.22
Mixed cropping	-0.0285	-1.04	- 0.0097	-0.42
Seed type	0.0215	0.96	-0.0083	-0.39
Tractor	0.0262	1.45	-(0.0004)	-0.08
Fertilizer	0.0858 ***	4.58	0.0591***	3.39
Herbicide use	-0.0208	-0.92	-0.0311	-1.49
Credit	0.0001	0.93	0.0002*	1.87
Extension visit	0.0117*	2.50	0.0032	0.73
Price	0.0018***	17.14	0.0005 ***	4.48
Diagnostic parameters				
Sigma	0.1039		0.096	
Log likelihood function	164.75		179.19	

Source: Computed Survey Data (2006)

Note: *Þ Significant at 10%, **Þ Significant at 5%, *** Þ Significant at 1%

CONCLUSION AND RECOMMENDATIONS

On the basis of the above findings, the study concludes that significant economic inefficiency exist in beniseed production in the study area. These are related to the inadequate access of the farmers to appropriate physical and human capital like fertilizer, credits, extension contact, as well as appropriate marketing channel and associated technologies for harvest, storage and preservation as to enable them to sell their products at reasonably high prices.

The study therefore, recommends that, extension services should be strengthened so that farmers would be made acquainted with the efficient use of the available resources. At least extension agents should visit a farm household twice in a month in order for him to serve as a guide towards adequate management of beniseed farm for better productivity.

More agro-service centres should be established by governments, with enabling environment created for significant private sector participation, so as to give farmers greater access to critical inputs like fertilizer, tractor services, improved seed, the absence of which have been found in this study to hinder efficiency in beniseed production.

Improved beniseed production should be funded and disseminating centres established where farmers can fall back for regular seed supply. The seed should be sold at subsidised rate. This will guarantee availability of products that will attract high market value.

REFERENCES

Akintunde, B.O., Tunde-Akintunde, T. Y. 2004. "Some physical properties of sesame seed". *Journal of Biosystems Engineering,* 88(1): 127-129.

Alegbejo, M.D., Iwo G.A, Abo M.E., Idowu, **A.A.** 2003. "Sesame: Potential industrial and export oilseed crop in Nigeria". *Journal of Sustainable Agriculture,* 23(1): 59-75.

Ali, M., Chaudhry, **M.A.** 1990. "Inter-regional farm efficiency in Pakistan Punjab: A frontier production function study. *Journal of Agricultural Economics,* 4(1): 62-74.

Battese, G.E., Coelli, T. 1992. "Frontier production function and technical efficiency: A survey of empirical applications in agricultural economics". *Agricultural Economics,* 7: 185-208.

Bravo-ureta, B.E., Evenson, **R.E.** 1994. "Efficiency in agricultural production: The case of peasant farmers in eastern Paraguay". *Agricultural Economics,* 10: 27-37.

Chavas, J.P., Roln, M. 2005. "Farm household production efficiency: evidence from Gambia". *American Journal of Agricultural Economics,* 87(1): 160-179.

Farrell, M.J. 1957. "The measurement of production efficiency". *Journal of Royal Statistics Society Series.* A. 120: 253 – 281.

Gutierrez, L. 2003. "Why is agricultural labour productivity higher in some countries than others?"*Agricultural Economic Review,* 3(1): 58 – 78.

Johansson, H. 2005. "Technical, allocative and economic efficiency in Swedish dairy farms: The Data Development Analysis versus the Stochastic Frontier Approach". *Paper presented at 11th international Congress of European Association of Agricultural Economists (EAAE),* Copenhagen, Denmark, August 2005.

Jondrow, J.C, Lovell A.K, Materoy, I.S Schmidt, **P.** 1982. "On the estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model". *Journal of Econometrics,* 19: 233-238.

NCRI, 2001. Report of the Baseline survey on beniseed production processing and utilization in Nassarawa State p. 1-11.

Ogundele, O.O. 2003. Technology Differentials and Resource-use Efficiency in Rice Production in Kaduna State, Nigeria. An unpublished Ph.D. Thesis; Department of Agricultural Economics, University of Ibadan, Nigeria.

Quisumbing, A.R., Brown, L.R., Feldstein, H.S., Haddad, L., Pena, **C.** 1996. *Women: The Key to Food Security,* Food Policy Report, IFFPRI.

RMRDC, 2004. Report on survey of Agro raw materials in Nigeria. Maiden edition p. 1-34.

Shaib, B., Aliyu, A., Bakshi, **J.S.** 1997. "Agricultural Zones. In: National Agricultural Research Strategy Plan. 1996-2010". Inter printers limited, Ibadan. 335pp.

Sharma, K.R., Pingsun, L. H. Zaleski, **M.** 1999. "Technical Allocation and Economic efficiencies in swine production in Hawai. A comparison of parametric and non-parametric approaches". *Agricultural Economics,* 20: 23- 35.

Tadesse, B., Krishnamoorthy, **M.S.** 1997. "Technical efficiency in paddy farms of Tamil Nadu: an analysis base on size and ecological zone". *Agricultural Economics,* 16: 185-192.

Uzo, J.O. 1998 "Beniseed: A neglected oil wealth of Nigeria". In: Pre-conference proceedings. National Workshop on Beniseed L.D. Busari, A.A. Idowu and S. M. Misari (Eds.)."*Beniseed in Nigeria: opportunities for research and marketing*" NCRI Badeggi, Niger State. 3-5, March, 1998, Badeggi in NCRI Badeggi Niger State. Nigeria p. 1 – 17.

Weiss, E.A. 1983. *Sesame in oilseed crops.* Longman group London 282 – 340pp.

(Manuscript received: 16th March, 2010; accepted: 9th July, 2010).