Profitability and efficiency of Cajanus Cajan production in Benue State: Implication for food security

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ABSTRACT

Pigeon pea, an under-utilized leguminous crop often referred to as 'complete food' not only has the capacity of fighting hunger and malnutrition but also improves the soil conditions with minimal effect to the environment. The study assessed the Net returns and economic efficiency of the Pigeon pea farmers in Benue State. Primary data were collected from 81 pigeon pea (*cajanus cajan*) farmers using structured questionnaire and oral interview. Multi-stage sampling technique was adopted. This involves purposive selection of three communities in Benue State (Odoba, Pila and Shaminja Descriptive statistics, gross margin analysis and Stochastic Frontier Model were used to analyse the data. The study found mean gross margin per hectare of pigeon pea as ₦18,958.83. Also, the result of the profitability test showed a positive net returns on investment (t=2.23; P ≤0.05). Furthermore, the mean technical efficiency estimates of pigeon pea farmers was 72%. Similarly, an average farmer spent about 9% above the minimum frontier cost in producing a unit output. Thus, there is a scope for increasing the technical and allocative efficiency of pigeon pea farmers through better use of resources, given the current level of technology. Policy makers should focused on Pigeon pea production among other crops for increased food production and food security.

KEYWORDS:

Pigeon pea, technical efficiency, allocative efficiency, gross margin

I. INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millspaugh], a deep rooted and drought-tolerate leguminous food crop belongs to the genus *Cajanus,*subtribe *Cajaninae,* tribe Phaseoleae, and family abaceae. *Cajanus* is derived from a Malay word 'katschang' or 'katjang' meaning pod or bean. Pigeonpea is one of the oldest food crops and ranks fifth in importance among edible legumes of the world (Salunkhe *et al*., 1986). The current global estimate of its annual productivity is valued at more than US $1700 million (FAOSTAT, 2005). Van der Maesen (1980), opined that India is the primary center of pigeonpea origin as it accounts for about 80% of the total world production (3.5m ha) and Africa was the secondary center of origin.

On the African continent, Kenya, Malawi, Uganda, Mozambique, and Tanzania grow considerable quantities of pigeonpea which represents about 4% of the world's population (FAOSTAT, 2005). The Caribbean islands and some South American countries also have a considerable area devoted to growing pigeonpea (about 2% of the total world population, Sharma *et al.,* 1981). It is cultivated in more than 25 tropical and sub-tropical countries either as sole crop or intermixed with some cereals and other legumes (Reddy *et al.,* 1993).

Pigeonpea is a multipurpose leguminous crop used for food, feed, and fuel. Nutritionally pigeon pea contains high level of protein and the important amino acids: Methoinine, lysine and tryptophan. In combination with cereals, it makes a well balanced human food. It therefore has the capacity to improve the diet of most smallholder communities. It can be eaten as vegetable (immature pods or green pea) or as dried grain (cooked and eaten as dhal, dry split cotyledons). In Ethiopia, not only the pods but the young shoots and leaves are cooked and eaten. In some places, such as the Dominican Republic and Hawaii, pigeon peas are grown for canning and consumption. Pigeon peas are also made as a stew, with plantain balls. In Thailand, pigeon peas are grown as a host for scale insects which produce lac. Pigeon pea, an under-utilized leguminous crop often referred to as 'complete food' not only has the capacity of fighting hunger and malnutrition but also improves the soil conditions with minimal effect to the environment.

Apart from its nutritional roles, pigeonpea produces more nitrogen from plant biomass per unit area of land than many other legumes although it usually produces fewer nodules than legumes (Onim, 1987). It can fix about 70 kg N/ha per season by symbiosis until the mid-pod-fill stage.The residual effect on a following cereal crop can be as much as 40 kg N/ha (Nene, 1987). It can also be used as a green manure crop. The leaves, husks and bye-products of split and shrivelled seed provide livestock feed.

Furthermore, all parts of the crop ranging from the roots, leaves (fresh or dry), stem to seed is used in treating one form of ailment to the other. The crop has been found to cure diseases like sores, bladderstones, jaundice, genital and other skin irritations, bronchitis, coughs, pneumonia, toothache, mouthwash, sore gums and dysentery. Chinese shops sell dried roots as an alexeritic, anthelminthic, expectorant, sedative, and vulnerary. Fresh seeds are said to help incontinence of urine in males, while immature fruits are believed to be of use in liver and kidney ailments (Duke, 1981).

The branches and stems can be used for baskets and firewood. It is often grown as a shade crop, cover crop or windbreak. It can be processed and exported to foreign countries, thereby bringing in the much needed foreign exchange earnings.The crop has local, regional and international markets and contributes to poverty reduction. Thus, pigeonpea has a potential to reduce hunger and malnutrition while maintaining sustainable productivity of smallholder cropping systems.

Despite relative progress in agriculture recently , Nigeria is still faced with dire situations of hunger and undernutrition. Massive disruptions to food systems caused by narrowed focused on stable food rather than a comphrehensive approach could result to the displace-ment of crops like cajanus cajan (an all important crop) with severe effect on poverty and hunger. Pigeon pea is widely consume across the globe but knowledge about the profitability of this crop and the potential possibility of generating export revenue for the national economy appears to be very low. For instance demand for canned and frozen pigeon pea in the US is also increasing. Profit spurs investment…… According to World bank (2008) Labour intensive nontraditional exports can also have substantial local poverty-reducing effects by generating employment as in Kenya and Senegal. Surveys conducted by Egbe and Kalu (2006) indicated that pigeon pea is widely cultivated in Nigeria and it appears that the intensity of pigeon pea cultivation is influenced by the culture and food habits of the people. Pigeon pea consumption appears to have outpaced production, hence the increasing demand for it. If resources are inefficiently combined either technically or economically in the production of Pegoen pea, it may result in low productivity and revenue with its attendant consequence on profit level. Pigeon pea plays an important role in developing new strategic approaches to ensure food security and sustainable increase in agricultural productivity. However, little or no systematic study, as revealed by a search through the literature, has been carried out on the profitability and economic efficiency of this important crop (pigeon pea production) in Benue State. The dearth of empirical information on the production of this important food legume crop portends danger of under nutrition which is closely related to poverty hence the need for this study.

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Thus, the specific objectives of the study are:

i. assess the profitability of pigeon pea production in the study area;

ii. determine the level of technical and allocative efficiencies of pigeonpea farmers in the study area and;

iii. ascertain the major determinants of technical and allocative efficiencies of pigeon pea production in the study area.

II. THEORY OF PROFIT

According to economic theory finding the maximum profit that a firm can make is a two-stage process. The first stage is to find the profit maximising output. To do this the *MC* and *MR* curves are used. The second stage is to find out just how much profit is at this output. To do this the *AR* and *AC* curves are utilized.Total profit ($T\Pi$) is found by subtracting *TC* from *TR*. Where $T\Pi$ is negative, the firm is making a loss. profit-maximising rule stipulates that if profits are to be maximised, *MR must equal MC*. This means that by producing more units there will be a bigger addition to revenue (*MR*) than to cost (*MC*). Total profit will *increase. As long as MR exceeds MC, profit can be increased by increasing production*. At a level where, *MC* exceeds *MR*. All levels of output above thus add more to cost than to revenue but Profit-maximising rule Profit is maximised where marginal revenue equals marginal cost.

According to Slowman (2009), the rule for profit maximisation is that firms should produce where *MC* = *MR*. This can be derived algebraically as follows. Profit is defined as

$$T\pi = TR - TC \;\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \mathbf{(1)}$$

Profit is maximised at the point where an additional unit of output will add no more to profit – that is, where

$$\frac{\Delta T\pi}{\Delta Q} = M\pi = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(2)}$$

or, from (1), where

$$\frac{\Delta TR}{\Delta Q} = \frac{\Delta TC}{\Delta Q} = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(3)}$$

Or

$$\frac{\Delta TR}{\Delta Q} = \frac{\Delta TC}{\Delta Q} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{(4)}$$

i.e. where *MR* = *MC*.

Profits are maximised at the highest point of the *T*Π curve. At the top of any curve (or bottom for that matter), its slope is zero.Thus Δ*T*Π/*Q* =*M*Π = 0. Under perfect competition, the firm is one among a large number of producers. It cannot influence the market price of the product. It is the price-taker and quantity-adjuster. It can only decide about the output to be sold at the market price. Therefore, under conditions of perfect competition, the MR curve of a firm coincides with its AR curve.

III. METHODOLOGY

Benue State is the study area. It is in the middle belt zone of Nigeria; located between latitude 8^0-10^0N and between longitudes 6^0-8^0E. It has a total landmass of about 33,955 km^2 with 23 Local Government Areas. The State is politically and agriculturally divided into three zones: A, B, & C with a population of 4,219,244 people, and 413,159 farm families (BNARDA, 2005; NPC 2006). The State derives its name from the River Benue; the second largest river in Nigeria. Benue State slogan is "food basket of the nation" which is due to the natural endowment of the State with rich fertile soils and favourable climatic conditions suitable for agricultural production. Thus, majority of the people in the State depend on agriculture as means of livelihood.

Multi-stage sampling technique was adopted in selecting respondents. First, a purposive selection of three communities in the two Local Government Areas (Ogbadigbo and Makurdi) where 'legume technology' campaign was carried out was made. A uniform percentage (39.2%) of farmers was selected in each of the three earlier selected communities, which gave a total of 81 respondents.Data was collected by the use of a well-structured questionnaire, oral interviews and direct observations. It was supplemented with secondary data from farmers' records.Gross margin and stochastic frontier model were used to analyse the data. The parameters of the stochastic frontier model were obtained by the maximum likelihood estimation method using the computer programme, FRONTIER version 4.1 (Coelli, 1994).

Model specification

Technical efficiency

Technical efficiency model is embedded in equations linking pigeon pea outputs to resources inputs on one hand and pigeon pea output to inefficiency model on the other hand. Inefficiency effects is linked with the age of farmers, educational level, farming experience, annual income, household size, extension contact and variety of crop planted.

However, it was assumed that the age of farmers, educational level, farming experience, income household size, extension contact and variety of crop planted have influence on the inefficiency effects of resource-use of farmers in the study area. The transcendental logarithmic (Translog) functional form of the stochastic frontier was found most suitable and is stated as follows:

$$\text{Ln}Y_i = \beta_0 + \beta_1 LnX_{1i} + \beta_2 LnX_{2i} + \beta_3 LnX_{3i} + \beta_4 LnX_{4i} + \beta_5 LnX_{5i} + \beta_6 (LnX_1)^2 + \beta_7 (LnX_2)^2 + \beta_8 (LnX_3)^2 + \beta_9 (LnX_4)^2 + \beta_{10} (LnX_5)^2 + \beta_{11} LnX_1X_2X_3X_4X_5 + V_i - U_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where

Ln –denotes natural logarithm to base e

Y_i– represents output of the ith farmer (in kg).

β_i – represents the unknown parameters associated with the explanatory variables in the production function (1=0, 1, 2, 3, 4, 5)

X_{1i} = farm size – total amount of land under pigeon pea cultivation.

X_{2i} = quantity of seed of pigeon pea planted (kg/ha).

X_{3i} = total amount of inorganic fertilizer used for production (in kg/ha).

X_{4i} = total agro-chemicals in litres

X_{5i} = amount of hired labour in mandays

V_i- random errors that are assumed to be independently and identically distributed of the U_i.

U_i –non-negative random variables associated with technical inefficiency of production which are assumed to be independently distributed, such that U_i is obtained by truncation (at zero) of the normal distribution with variance σ^2 and mean U_i where the mean is defined by:

$$U_i = \sigma_0 + \sigma_1 Z_{1i} + \sigma_2 Z_{2i} + \sigma_3 Z_{3i} + \sigma_4 Z_{4i} + \sigma_5 Z_{5i} + \sigma_6 Z_{6i} + \sigma_7 Z_{7i} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where

σ is a (7× 1) vector of unknown parameters to be estimated.

Z_1 is age of farmers.

Z_2 is educational level of farmers.

Z_3 is farming experience

Z_4 is annual farm income of farmers in Naira

Z_5 is extension contact

Z_6 is household size

Z_7 is variety of food legume crop

IV. RESULTS AND DISCUSSION

The costs and returns in Pigeon pea production in the study area is presented in table 1. The result revealed that amongest the costs involved in pigeon pea production, the cost of hired labour accounted for 61.23% of the total variable costs. This implies that the crop is highly labour-intensive. Apart from the high cost incurred on labour, an important variable that reduces the gross margin of pigeon pea as revealed by the study was cost of seed. It constitute about 31.10% of the total variable cost. However, the mean costs of fertilizer and agrochemicals were minimal suggesting the low use of the variables in the production of the crop in the study area.

Table 1: Descriptive Statistics of Costs and Returns and Profitability test in Pigeon pea Cultivation

Statistics	Revenue (₦/Ha)	Total Variable Cost (₦/Ha)	Cost of Seed (₦/Ha)	Cost of Labour (₦/Ha)	Cost of Ferilizer (₦/Ha)	Cost of Agrochemical (₦/Ha)	Gross Margin (₦/Ha)	Profitability test
Mean	24230.9	12830.8	4118.9	7856.4	669.8	185.8	11400.1	2.23*
Mode	20000	10000	5000	5000	0	0	3000	
Std. Dev	18464.27	7071.24	2450.18	4831.58	1970.02	675.52	14976.15	
Variance	3.409E8	5.000E7	6.003E6	2.334E7	3.881E6	456327.16	2.243E8	
Minimum	2000	975	225	750	0	0	-7500	
Maximum	120000	32000	11000	22000	9000	3000	96000	

Source: Analysis of field data, 2015.

Furthermore, the mean total variable cost per hectare was found to be more than half (53%)of the total revenue per hectare. The result also revealed that the mean total revenue ranged from ₦2,000 to ₦120,000, with a mean of ₦24,230.9. In addition, the mean gross margin per hectare was found as ₦11,400 which translates to ₦950 per month. This amount is below the National poverty line of $350 per annum (₦52,500 at exchange rate of ₦150 to $1 during the time of the study). It is on this ground that the production of this crop is considered unprofitable. However, bearing in mind that most farmers do not plant this crop as a sole crop, (it is normally planted alongside with other crops in mixed cropping) the overall profitability will be higher than the figure above. Moreover, the result of the profitability test revealed that pigeon pea production in the area is profitable since mean total revenue per hectare is significantly higher ($t=2.23$; $P \leq 0.05$) than the mean total variable cost per hectare. This result implies that the difference between mean total revenue and mean total variable cost per hectare is not by chance. Thus, pigeon pea is profitable in the study area. This implies that not only will pigeon pea farmers in the study area be encouraged to remain in the enterprise but will expand their production of the crop. This is in line with the assertion made by Gilbert (1999), that apart from soil fertility benefit, there must be other corollary benefits perceived by farmers before they adopt and sustain legume production.

Stochastic Production Frontier model for pigeon pea

Table 2 presents the result of the stochastic production frontier model for pigeon pea in the study area.The performance of the model in terms of sigma squared and gamma was large and significantly different from zero at 1%. The gamma value was found as 0.99. This implies that 99% of the variations in the output of pigeon pea are accounted for by the differences in the technical efficiency of farmers. This implies the correctness of the model and that the conventional ordinary least square method is not an adequate representation of the model. Transcendental logarithmic (Translog) was used instead of Cobb-Douglas based on the joint significance of the additional coefficients in the translog model using wald test.

Table 2: Maximum Likelihood Estimates for the Paramaters in Stochastic Production Frontier Model Pigeon Pea Farmers in Benue State

Variables	Parameter	Coefficient	T-ratio
Stochastic production frontier			
Constant	β_0	8.42	10.41**
Ln Farm size (β_1)	β_1	0.19	6.25**
Ln Seed rate (β_2)	β_2	-0.96	-5.69**
Ln Qty of fert (β_3)	β_3	-0.0091	-5.04**
Ln Qty of Agroch (β_4)	β_4	0.58	35.44**
LnHired labour(β_5)	β_5	-0.787	-5.29**
Ln Farm size^2(β_6)	β_6	-0.027	-0.69
Ln Seed rate^2 (β_7)	β_7	0.123	5.82*8
Ln Qty of fert^2 (β_8)	β_8	0.153	146.98**
Ln Qty of Agroch^2(β_9)	β_9	0.228	42.59**
LnHired labour ^{2}(β_{10})	β_{10}	0.050	5.70**
LnPdt of Bs(β_{11})	β_{11}	0.000086	7.437**
Inefficiency model			
Constant	δ_0	-16.25	-10.10**
Age	δ_1	1.975	4.86**
Educational level	δ_2	0.3014	2.54*
Farming Experience	δ_3	0.158	0.86
Annual income	δ_4	0.492	4.97**
Extension contact	δ_5	-0.501	-3.65**
Household size	δ_6	4.766	16.102**
Variety	δ_7	-3.127	-10.205**
Variance Parameter			
Sigma Square	δ^2	0.75	17.77**
Gamma	Γ	0.999	563411.52**
Log likelihood function		3.138	
LR test		57.14	

*****t-ratio is significant at 1% level *t-ratio is significant at 5% level***

The result revealed that farm size, hired labour, quantity of seed,quantity of fertilizer and quantity of agrochemicals exert significant influence on the production of pigeon pea in the study area. This implies that they are the major determinants in technical efficiency of pigeon pea production in Benue State. In other words, they play significant role in the production of the crop. This implies that farm size, quantity of seed, quantity of inorganic fertilizer, quantity of agrochemical and hired labour are important for achieving effective utilization of inputs in pigeon pea production in Benue State.

While quantity of seed exerts high influence (-0.714) on the technical efficiency of pigeon pea production, the influence of farm size was found to be minimal (0.136). Similar to quantity of seed's high influence on the output of pigeon pea in the study area is hired labour. The elasticity of pigeon pea production with respect to hired labour was found as -0.687. This implies that for every one unit increase in labour, there is a corresponding 69 unit increase in pigeon pea output. The significant quantity of seed and hired labour agrees with the findings of Okoh (2009) that seed rate and hired labour are the significant determinants of technical efficiency in fadama tomato production in Benue State.

The result of the inefficiency model (table 3) revealed that technical efficiency of pigeon pea farmers ranged from 0.9998 to 0.1385.

Table 3: Distribution of Respondents by Technical Efficiency Estimates of Pigeon pea Enterprise

Efficiency Range	Frequency	Percentage
0.1 < 0.4	8	9.9
0.4 < 0.6	18	22.2
0.6 < 0.8	15	18.5
0.8 < 1.00	40	49.4
Total	81	100.0

Mean efficiency = 0.7225, Minimum efficiency = 0.1385, Maximum efficiency = 0.9998
Source: Analysis of field data, 2015

The result also shows that majority (49.4%) of the farmers operated between 8.0 to 1.0. However, the mean technical efficiency found by the study was 0.7225. This implies that technical efficiency of pigeon pea could be increased by about 28% through better use of available resources, given the current state of technology. Furthermore, the result also revealed that age (1.975), educational level (0.3014), annual income (0.492), extension contact (-0.501), household size (4.766) and variety (-3.127) are significant. This implies that the more pigeon pea farmers had contact with extension agents and the more they use improved variety of pigeon pea, the more technically efficient they become. In contrast, increase in age, educational level, annual income and household size decreases the technical efficiency of pigeon pea farmers.This result also supports Okoh's findings (2009), that farmers that use improved variety of tomato are more technical efficient in fadama tomato production in Benue State.

Stochastic frontier Cost Function for Pigeon pea farmers in Benue State

Table 4 summarized the result of the stochastic frontier cost function for pigeon pea farmers in the study area.The performance of the model in terms of the magnitude and significance of sigma squared (δ^2) was good. The significance of sigma squared (δ^2) shows the correctness of estimated cost frontier models and that the conventional ordinary least square (OLS) is not an adequate representation of data in all the models.The gamma value of 0.99 implies that 99% variations in the cost involved in pigeon pea production is accounted for by the allocative efficiency of pigeon pea farmers.

The result further revealed the variations in output significantly influenced (-0.208) the cost of production of pigeon pea in the study area.The negative elasticity of cost with respect to output indicates that as output increases, the cost of production decreases. Another factor that exerts significant influence on the cost of production of pigeon pea as found by the study was labour cost. The elasticity of cost with respect to cost of labour was found as high as 0.74. This result supports the earlier findings from this study that labour play a major and critical role in pigeon pea production. Similar to the significant influence of cost of labour, the cost of seed exerts a positive significant influence on the cost of production of pigeon pea.

Table 4: Maximum Likelihood Estimates for the Paramaters in Stochastic Frontier Cost Function Model for Pigeon pea Farmers in Benue State

Variables	Parameter	Coefficient	T-ratio
Stochastic Cost frontier			
Constant	β_0	2.03	10.46**
Ln Output	β_1	-0.25	-9.57**
Ln Labour cost	β_2	0.75	8.49**
LnCost of seed	β_3	0.29	3.78**
LnCost of fert	β_4	0.031	7.76**
LnCost of agroch	β_5	0.115	11.63**
Ln Output^2	β_6	0.021	10.13**
Ln Labour cost^2	β_7	-0.0055	-1.01
Ln Cost of seed^2	β_8	0.0029	0.58
LnCost of fert ^{2}	β_9	0.0014	1.4
LnCost ofAgroch^2	β_{10}	-0.027	-9.36**
Ln Pdt of the Bs	β_{11}	0.000008	5.7**
Inefficiency model			
Constant	δ_0	-3.16	-6.06**
Age	δ_1	0.038	0.28
Educational level	δ_2	0.35	8.67**
Farming Experience	δ_3	-0.044	-0.80
Annual income	δ_4	0.26	11.04**
Extension contact	δ_5	-0.14	-3.3**
Household size	δ_6	0.60	11.92**
Variety	δ_7	-0.92	-11.52**
Variance Parameter			
Sigma Square	δ^2	0.024	17.97**
Gamma	Γ	0.99	17895553**
Log likelihood fn		171.14	
LR test		147.36	

****t-ratio is significant at 1% level *t-ratio is significant at 5% level**
Source: Analysis of Field data, 2015

Its influence on the cost of production was found as 0.284 The significant influence of seed cost and labour cost is in line with the findings of Okoh (2009), who similarly found seed and labour cost as determinant of allocative efficiency in the Fadama production of tomato in Benue State of Nigeria. Though, cost of fertilizer and cost of agrochemicals have significant influence (0.028 and 0.061 respectively) on the cost of production of pigeon pea, the low elasticity of their influence shows the minimal role it plays in influencing the cost of production in the study area. This can be attributed to the increased awareness campaign in the study area that legume cultivation requires less inorganic fertilizer application.

Analysis of inefficiency, presented in table 5 shows that the allocative efficiency of pigeon pea farmers ranged from 1.000 to 3.55 with a mean of 1.099. This result implies that an average pigeon pea farmer spent about 10% above the minimum cost of producing a unit output.

Table 5: Percentage Distribution of Respondents by Allocative Efficiency Estimates of Pigeon Pea Enterprise

Efficiency Range	Frequency	Percentage
1.00 < 2.0	78	96.3
2.0 < 3.0	2	2.5
3.0 < 4.0	1	1.2
Total	81	100.0

Mean efficiency = 1.0998, Minimum efficiency = 1.0000, Maximum efficiency = 3.5508
Source: Analysis of Field data, 2015

The result also indicates that 96.3% of the sampled farmers operated at allocative efficiency range of 1.0 and 2.0. This result shows that even though pigeon pea farmers are allocatively efficient, there is still scope for increasing the allocative efficiency of pigeon pea in the study area.

Furthermore, the result of inefficiency model (lower section of table 4) revealed that educational level, annual farm income and household size exert a positive influence on the allocative efficiency of pigeon pea farmers. This implies that increase in educational level, annual farm income and household size decreases the allocative efficiency of pigeon pea farmers. This can be explained by the fact that when farmers' income level has increased, there is a tendency that funds may be disbursed arbitrarily thus reducing the allocative efficiency. Also, farmers that have large household size may not be efficient in allocating resources in the farm.

On the other hand, extension contact and variety of seed had negative influence on allocative inefficiency of pigeon pea farmers. This implies that as these variables increase, the allocative efficiency of pigeon pea farmers also increases. In other words, as farmers contact with extension increases, allocative efficiency of farmers also increases. Similarly, the use of improved variety also increases allocative efficiency of pigeon pea farmers. The significant role of improved seed varieties agrees with the findings of Tchale *et al.,* (2008) that farmers that grow hybrid maize are about 5% more efficient than those that grow local maize varieties.

V. CONCLUSION AND RECOMMENDATION

The study highlighted the importance of pigeon pea as 'complete food' that can be eaten at different maturity levels of the plant, as medicinal herb and also as a legume crop capable of restoring soil fertility.The study found that pigeon pea is under-utilized and has not been fully researched. The result of profitability test shows that the cultivation of pigeon pea in the study area is profitable although highly labour-intensive. Farm size, seed rate, quantity of fertilizer and hired labour were found as the major determinants in technical efficiency of pigeon pea production in the study area. The mean technical efficiency of 0.704 implies that the technical efficiency of pigeon pea farmers could be increased by about 30% through better use of available resources, given the current state of technology. On the other hand, an average pigeon pea spent about 9% above the minimum cost frontier of producing a unit output.

The study concludes that farm mechanisation should be encouraged and facilitated to forestall labour shortage in pigeon pea production. Access to land should also be facilitated. There is a scope for increasing the economic efficiencies of pigeon pea through better use of resources given the current state of technology.Goverment should make available improved varieties of pigeon pea seeds to farmers at subsidized rate. Development is a holis-tic one that calls for multisectoral and multilevel collaboration. Governments must now follow through with politi-cal will and commitment to action that is both strong and sustained. Recognizing that the root causes of food insecurity are complex and inex-tricably linked with poverty, inequality and violence.

REFERENCES

[1]. **BNARDA (1997)** Benue Agricultural and Rural Development Authority. Crop production Manual for Benue State, 7-14.

[2]. **Coelli, T.J (1994).** A guide to Frontier version 4.1. A Computer Programme for Stochastic Frontier Production and Cost Function Estimation. Department of Econometric, University of New England, Armidale.NSW2351 Australi.

[3]. **Duke, J.A. (1981).** Handbook of legumes of world economic importance. Plenum Press. NewYork.

[4]. **Egbe, O. M. and Kalu, B. A. (2006).** Farming systems study: Participatory Rural Appraisal of pigeon pea cropping systems in Southern Guinea Savanna of Nigeria. Abia State University Environmental Review (ASUER) 5(1):37 – 47.

[5]. **FAOSTAT (2005).** Food and Agriculture Organization of the United Nations, 2005. [Online] Available at: http:/faostat.fao.org/database; verified 14th July, 2006.

[6]. **Gilbert, R.A.(1999).**Best-bet green manures for smallholder maize-based cropping systems of Malawi. In: Ritchie, J.M (ed) (2000).Intergrated Crop Management Research in Malawi: Devel technologies with farmers. Proceedings of the Final Workshop of the Farming Systems Intergrated Pest Management Project, Club Makokola, Mangochi, Malawi, 29 November-3 December.Chatham, UK: Natural Resources Institute, pp.239-245.

[7]. **National Population Commission (NPC) (2006).** National Population Census, Federal Republic of Nigeria official gazette, 94 (4) Lagos Nigeria.

[8]. **Nene, Y.L. (1987).** Overview of pulses research at ICRISAT In: Adaptation of chickpea and pigeonpea to abiotic stresses. ICRISAT, Patancheru, India p. 7-12.

[9]. **Okoh, C.O. (2009)**.Resource use efficiency in tomato production in the Fadama: Implications for poverty reduction in Benue State, Nigeria, an unpublished M.Sc thesis in the Department of Agricultural Economics, University of Agriculture, Makurdi, Benue State, Nigeria.

[10]. **Onim, J.F.M. (1987).** Multiple uses of pigeonpea, p. 115-120. In: Research on grain legumes in Eastern and Central Africa. International Livestock Centre for Africa (ILCA), Addis Ababa, Ethiopia.

[11]. **Reddy, M.V., Raju, T.N., Sharma, S.B., Nene, Y.L. and McDonald, D. (1993).** Handbook of pigeonpea diseases. ICRISAT Infomation Bulletin No. 42 pp1-3.

[12]. **Salunkhe, D.K., J.K. Chavan, and S.S. Kadam. (1986).** Pigeonpea as important food source. CRC Critical Review in Food Sci. and Nutrition 23(2):103-141.

[13]. **Tchale, H., Kumwenda, I., Wobst, P. and Mduma, J. (2008).** Technical efficiency of small holder farmers in Malawi in the post-reform era: Journal of African Economies, 13 (1):102-113.

[14]. **Vander Maesen, L. J. G (1980).** India is the native home of the pigeonpea. Pages 257- 262 in Libergratulatorius in honorem H.C.D. de Wit. Land bouwhogeschool (Arends, J.C., Boel G., deGroot, C.T., and Leeuwenberg, A.J. M., eds.).Miscellaneous Paper no.19.Wageningen Netherlands: H.Veen man and B.V. Zonen.

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