PRODUCTIVITY ANALYSIS OF SESAME (*Sesamum indicum* L.) PRODUCTION UNDER ORGANIC AND INORGANIC FERTILIZERS APPLICATIONS IN DOMA LOCAL GOVERNMENT AREA, NASARAWA STATE, NIGERIA.

[ANÁLISIS DE LA PRODUCTIVIDAD DE LA PRODUCCIÓN DE AJONJOLI (*Sesamum indicum* L.) CON LA APLICACIÓN DE FERTILIZANTES ORGÁNICOS E INORGÁNICOS EN DOMA, NASARAWA, NIGERIA]

H. S. Umar[1]; C. U. Okoye[2] and A. O. Agwale[3]

1Department of Agricultural Economics and Extension, Nasarawa State University, Keffi (Lafia Campus), Nigeria. Email: umarhsuleiman@ yahoo.com
2Deparment of Agricultural Economics, University of Nigeria, Nsukka, Nigeria Email:cuzomaokoye@yahoo.com
3Department of Agricultural Extension and Management, College of Agriculture, Lafia, Nasarawa State, Nigeria.
**Corresponding author*

SUMMARY

The study assessed productivity levels of sesame farms under organic and inorganic fertilizers applications in Doma Local Government Area of Nasarawa State. Multi-stage random sampling was used in selecting 96 sesame farmers; made up of 48 organic and 48 inorganic fertilizers users. Data were collected through structured questionnaire and analyzed using Total Factor Productivity Analysis, OLS Regression Analysis and Gross Margin Analysis. Results show that sesame farmers who applied inorganic fertilizer earned higher returns (41%) over farmers under organic fertilizer. The productivity level of sesame farms under inorganic fertilizer application was higher (27%) over sesame farm under organic fertilizer. Farm size, labour, education and farming experience as well as inorganic fertilizer were factors influencing productivity level of the two enterprises. Poor road network, poor access to credit facility, poor extension service and high cost of inorganic fertilizer were major constraints to sesame production. In order to reduce the gap of income earn and productivity level between the two enterprises, organic fertilizer users should be encouraged to apply, and educated on, the recommended quantity of organic fertilizer require per hectare through effective extension service.

Key words: Productivity level; higher returns.

RESUMEN

Se evaluó los niveles de productividad del ajonjolí en fincas que aplican fertilizantes orgánicos o inorgánicos, en Doma, Nasarawa, Nigeria. Se uso un muestro de multi-etapas para seleccionar 96 productores de ajonjolí, 48 con uso de fertilizantes orgánicos y 48 con fertilizantes inorgánicos. Se empleo cuestionarios estructurados y análisis de productividad, análisis de regresión y de margen bruto. Los productores que aplicaron fertilizantes inorgánicos tuvieron mayores retornos (41%) y mayor productividad (21%). El tamaño de la finca, mano de obra, nivel educativo y experiencia del productor junto con el empleo de fertilización inorgánica fueron los principales factores que influyeron sobre la productividad. Las principales limitantes para la producción de ajonjolí fueron la baja disponibilidad de caminos, bajo acceso a crédito y programas de extensión y el alto costo de los fertilizantes. Para reducir la brecha entre ambos sistemas de producción se recomienda capacitar a los productores que emplean fertilización orgánica sobre los niveles adecuados de éste tipo de fertilizantes en la producción de ajonjolí mediante un servicio efectivo de extensión.

Palabras clave: Nivel de productividad; tasa de retorno.

INTRODUCTION

In Nigeria, sesame is cultivated on over 80,000 ha across most of the Northern States for food and oil. Benue and Nasarawa States are the highest sesame producers in Nigeria with an annual outputs of not less than an average of 40,000MT each per annum (Raw Materials Research and Development Council, 2004). As a raw export commodity, sesame seed from Nigeria is enjoying a rising profile on the world market where overall global demand has risen to 3.3 million tons.

Sesame is one of the major cash crops grown in Nasarawa State. It is a very popular crop among the rural farmers because of the good local and international markets for its seed and oil. There are already buyers from China and other parts of the Asian countries that patronize the product (Nasarawa State Government, 2008). Doma Local Government Area is the major producer of sesame in Nasarawa state.

The number of constraints has adversely affected the performance of the agricultural sector. Most importantly, the agricultural raw materials production has been faced with the problems of persistent short supply if available, and high cost of inputs, as well as, the insufficient purchasing power of small scale producers, and low international demand for primary commodity export due to poor quality. The Raw Materials Research and Development Council (RMRDC) (2004), identified shortages of fertilizers, agro-chemicals, improved seeds, lack of access to agricultural loan and tractors for cultivation as major problems hindering sesame production in the country. Food production, farm incomes and food prices are vulnerable to inadequacy in supply and high cost of chemical fertilizers in Nigeria (Rahman et al; 2001). According to Eboh, et al (2006), despite application of subsidy by federal government of Nigeria, nominal prices of chemical fertilizer (for 50kg bag) rose from ₦50 in 1990 to ₦875 in 1996, ₦1200 in 1997, ₦1500 in1999 and ₦1800 in 2000 with considerable price variability within states. In 2009, average price for 50kg bag of chemical fertilizer was ₦3500. Adediran et al; (1999), observed that crop production has suffered a serious set back due to a general shortage and unaffordable cost of chemical fertilizers. Much attention is therefore directed towards the search for alternative fertilizer source to boost crop production.

Where chemical fertilizers like NPK (that is a mixture of Nitrogen, Phosphorus and Potassium fertilizer) and Urea are available, excessive usage increases pollution, decreases soil productivity and leads to nutrient imbalance (Duhoon et al; 2004). Thus, sustainable agricultural production is not guaranteed while reline on chemical fertilizers like NPK and Urea fertilizers.

Organic fertilizer like animal manure is cheaper and affordable by average Nigerian farmers. Application of poultry manure and other farm wastes have been found to increase the carbon content, water holding capacity, aggregation of the soil and a decrease in the bulk density (Echezona and Nganwuchu, 2006). This can helps in checking or reducing the effect of water and wind induced erosion. The result of study on comparative effectiveness of organic based fertilizer (OBF) with mineral fertilizer on crop yield indicated high effectiveness of OBF on crop performance and is well comparable with the chemical fertilizers (Adediran et al, 1999). Rahman et al (2001), observed that gross margin per hectare of maize production using inorganic fertilizer (NPK) was 17% higher than maize produced using organic fertilizer (manure).

Therefore, the study is aimed at finding answers to the following research questions:-i what is the extent of difference in the amount of returns between sesame farmers under organic and inorganic fertilizers application? ii is there difference between productivity of sesame farms under organic and inorganic fertilizers application? iii what factors determine productivity in these farms? iv what are those constraints limiting sesame production.

METHODOLOGY

Description of the study area

Doma Local Government area of Nasarawa State is situated in the North Central (middle belt of savanna ecological zone) of Nigeria. The study area lies between latitude 08^0.33N and longitude 08^0.32E and approximately 181.53m above sea level. The mean temperature range between 22.7^0C- 36.8^0C with average annual rainfall of 1288mm. The soil texture is predominantly sandy-loam. The area has a population of about 139,607 inhabitants. The major occupation of the population is predominately farming. The major crops grown in large quantities are Cassava, Yam, Sesame, Rice, Maize, Millet, Groundnut, and Cowpea. While tree crops include Mango, Cashew, Citrus and Guava are common. The following are the districts that make up Doma Local Government Area, namely; Alagye, Akwashi, Akpata, Madaki, Doka, Akpanaja, Galadima Sabongari, Sarkin dawalai, Rukubi madauci, and Tsarkin madauci.

Sampling techniques

A multi-stage sampling procedure was employed for the study as used by Umar and Okoye (2010). The first stage of sampling involved random selection of Six (6) out of ten districts in the local government area. In the second stage, two (2) villages were randomly selected from the six (6) selected districts to give the total number of twelve (12) villages for the study. Thirdly, four (4) organic (fertilizer applied) farmers and four (4) inorganic or chemical (fertilizer applied) farmers involved in Sesame production was purposively selected from each of the twelve (12) selected villages to give forty eight (48) farmers using organic and forty eight (48) farmers using inorganic or chemical fertilizer. Purposive selection was done to enable identification and classification of Sesame farmers into two groups- those that applied only organic fertilizers and those who applied only inorganic fertilizers. Organic fertilizer applied farmers refer those sesame farmers that applied only organic manure (animal manure) in the production of sesame. While inorganic applied farmers are sesame farmers that applied NPK (mixture) and/or urea fertilizers in the production of sesame in the study area.

Method of data collection

Data were collected from primary sources. Primary data for 2008/09 cropping season were collected using structured questionnaire as used by Rahman and Umar (2009). Data were collected on production inputs like fertilizers: organic (animal manure) and inorganic (NPK and Urea), pesticides, seed, labour (mainly human and few of mechanical for tillage), farm size as well as output of the farmers. Data were also collected on educational status, access to credit and farming experience from both categories of farmers.

Method of data analysis

The Gross Margin analysis, Total Factor Productivity analysis and Ordinary Least Square (OLS) regression method were employed for analyses of data for the study. The gross margin analysis method was employed to determine the overall gross margin per hectare as the farmers used simple traditional farm implements (hoe and cutlass) for cultivation of difference crops on scattered and fragmented small size farm lands. Total factor productivity analysis was used to estimates the productivity levels of both farms (that is farms under organic fertilizer and those under inorganic fertilizer). Ordinary lead square regression was employed for the analysis of effects of various factors on productivity level.

Model specification

TFP was estimated using the Key and Mcbride (2003) and Fakayode et al. (2008), approach as follows:

$$TFP = \frac{Y}{TVC} \qquad 1$$

Where Y = quantity of output (kg)
TVC = total variable cost (N)

$$TFP = \frac{Y}{\Sigma P_i x_i} \qquad 2$$

Where p_i = unit price of ith variable input.
x_i = quantity of ith variable input. This methodology ignores the role of total fixed cost (TFC) as it does not affect both the profit maximization and the resource use efficiency conditions. Total fixed cost is constant as it is fixed.

From cost theory:

$$AVC = \frac{TVC}{Y} \qquad 3$$

Where AVC = average variable cost in naira (N)
Therefore,

$$TFP = \frac{Y}{TVC} = \frac{1}{AVC} \qquad 4$$

As such, TFP is the inverse of the AVC.
The partial productivity estimate are the marginal products (MP) given as MP = ΔTFP/Δ X (input) ----5

Determinants of Agricultural productivity

Hussain and Perera (2004), classified the determinants of agricultural productivity as follows: i Land and water related factors (such as farm water course, location, quality of land, sources of water, quality and quantity of water and timing of water application, etc); ii climatic factors (i.e. rainfall, temperature, sunshine, frost, etc); iii Agronomic factors such as quality, quantity and timing of input application (i.e. seeds, fertilizers, herbicides, labour, etc); iv Socio-economic factors (such as farmers health, education, experience in farming, farm size, tenancy terms, land fragmentation and availability of credit); v Farm management factor (i.e. adoption of modern production technologies, farm planning and management practices, etc. According to Fakayode et al, (2008), other factors responsible for agricultural productivity change include technology, labour employment, education and training of farm operators, agro-environmental conditions, security of land ownership rights and fund. Some of these factors are interrelated and the effects of some of them may be much greater than those of others and there may be locational variations in the degree of their effects on productivity. Some of these factors may be under the direct control of all the farmers. Others may be controlled by groups of other farmers, managers at the system level and policy-makers at higher levels. Yet some of these are beyond human control.

Based on the views of Hussein and Perera (2004) and Fakayode et al ,(2008), the following factors were hypothesized as the determinants of TFP on sesame farms: Farm size in hectare (X_1), Seeds in kilogram (X_2), Labour in man-hour (X_3), Educational status in year (X_4), Fertilizers (chemical or organic) in kilogram (X_5), Pesticides in litre (X_6), Seed varieties (1= dummy for improved varieties, 0 = dummy for local varieties)(X_7 access to credit (1=dummy for access, 0 = dummy for non-access to credit) (X_8) and Farming experience in year (X_9).

To examine the influence of these factors on TFP, the linear function of the determinants is specified as follows:

$$TFP = b_0 + b_1X_1 + b_2x_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + U$$

Where: TFP= Total Factor Productivity; b_0= Constant; b_1-b_9 = Regression Coefficients
U= Error

All the hypothesized factors were therefore incorporated into the regression equation. The data gathered on these factors were fitted by OLS method using diverse econometric specifications, namely; Cobb-Douglas, semi-log and linear. The best fit equation was chosen as lead equation based on coefficient of determination (R^2), Standard error, Signs of coefficient and T-value.

The Gross Margin Analysis: GM = GR-TVC
Where; GM = gross margin (₦ /ha); GR = gross revenue (₦ /ha)
TVC = Total Variable cost (₦ /ha).This involved the cost of fertilizer (organic or inorganic) (Kg), Seeds (Kg), Labour (man hours) and Pesticides (litre).

Note: $= ₦150 at the time of data collection for this article.

RESULTS AND DISCUSSION

The gross margin analysis of Sesame farmers

The gross return was computed for every farmer by multiplying Gross yield by unit price. The unit price varied widely from ₦100 to ₦300 on the average. The unit price was at lowest amount (₦100) during harvesting period (around January, 2009) and rose steadily to its peak (₦300) (around August, September, 2009) at planting season. The average gross returns per hectare realized by both organic and inorganic (fertilizers applied) farmers were ₦59640 and

₦89433 respectively (Table 1). The total variable cost was computed by adding all the variable costs (that is costs of seed, fertilizer, pesticides and labour) incurred in production of sesame by every farmer. Table1 shows that average total variable cost per hectare incurred by both organic and inorganic (fertilizers applied) farmers were ₦22825 and ₦27682 respectively. The gross margin was computed by subtracting the total variable cost from gross return for every farmer. Table1 shows that average gross margin per hectare realized by both organic and inorganic (fertilizers applied) farmers were ₦36815 and ₦61751 respectively. The average rate of returns from both farms were

₦2.6 and ₦3.2. That is for every naira investment, ₦1.6 and ₦2.2 profit are made by organic and inorganic (fertilizers applied) farmers. The difference in gross margin by the two enterprises was significant at 5% level of probability.

Total factor productivity TFP estimates

The table 2 indicates that farms under inorganic fertilizer have higher average TFP value (1.8) than farms under organic fertilizer (1.2). That is on average basis, farms under inorganic fertilizer were more productive than farms under organic fertilizer. The difference in productivity levels between the two enterprises (0.5) is statistically significant at 5% level of probability.

OLS regression estimates for determinants of TFP in inorganic (NPK or Urea) fertilized Sesame farms

The linear function of OLS Regression has the best fit to data for determinants of TFP in Inorganic fertilized farms. Table4 shows that variable coefficients for farm size, seeds, fertilizer, labour, educational status, seed varieties, access to credit and farming experience have the expected positive a prior signs. Farm size, inorganic fertilizer, labour, educational status and farming experience were significant at 1%, 5% and 10% level probability and implied that they were factors influencing productivity level of inorganic fertilized farms. The R^2 value was 0.703 implying that TFP determinants included in regression model accounted for 70 percent variation in the productivity level of sesame farms under inorganic fertilizer. The F-ratio was 5.45 and significant at 5% level of probability implying that the joint effects of variables included in the model were significant.

OLS regression estimate For determinants of TFP in organic fertilized farms

The lead equation for the organic fertilized farms TFP determinant model was double log function. Table 3 shows that variable co-efficient for farm size, seeds, labour, pesticides, educational status, access to credit and farming experiences have the expected positive aprori signs. The farm size, educational status, farming experience and labour were significant at 1% and 10% level of probability and therefore influenced the productivity level of sesame farms under organic fertilizer. The R^2 value was 0.698 implying that the TFP Determinants included in regression model accounted for about 69.8 percent variation in the productivity level of organic fertilized farms. The F ratio was 4.070 and significant at 5 percent level of probability implying that the joint effects of the hypothesized determinants in regression model were significant for productivity level of organic fertilized sesame farms.

Table 1: Gross margin analysis of Sesame farmers

		Organic (fertilizer applied) Sesame Farmers			**Inorganic (fertilizer applied) Sesame Farmers**		
	Variables	**Av. Qty/ha**	**Av. Unit price**	**Value (₦/ha)**	**Av. Qty/ha**	**AV. Unit price**	**Value (₦/ha)**
1.	**Gross Returns:** Average yield (kg)	284	210	59640	523	171	89433
2.	**Inputs:**						
	Seed (kg)	10.5	308	3235	15.4	211	3249
	Fertilizer (kg)	316	2.3	712	51	43	2193
	Pesticides (Lt)	1	1047	1047	1.1	1164	1280
	Labour (man hour)	251	71	17821	154	136	20944
3.	**Total variable cost/ha**			22825			27682
4.	**Gross margin/ha**			36815			61751

Source: Field Survey, (2009)
₦150=$

Table 2. Percentage distribution of total factor productivity indices for organic and inorganic (fertilizers applied) sesame farmers.

TFP Indices	**Organic farms**		**Inorg. Farms**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**
0.1 – 2.03	43	89	37	77
2.04 – 3.97	03	6.2	08	17
3.98 –5.91	0	0	02	4.2
5.92 – 7.85	02	4.1	01	2
Total	48	100	48	100
Mean	1.2		1.8	
Maximum	6.9		7.8	
Minimum	0.3		0.1	
Standard deviation	1.3		1.9	
Coefficient of variation	108		106	

Source: Data Analysis, (2009)

Table 3. OLS regression result for organic fertilized farms (Double log function)

Variable	Beta Coefficient	Standard	T-Value	F-ratio	Error
Constant	0.392	0.540	-0.727	NS	4.07**
Farm Size X_1	3.83	0.237	16.164	***	
Seed X_2	0.01174	0.149	0.076	NS	
Organic manure X_3	-0.0095	0.057	-0.107	NS	
Labour X_4	5.079	0.167	2.343	*	
Pesticide X_5	0.09327	0.165	0.567	NS	
Education X_6	6.782	2.151	3.152	***	
Seed Variety X_7	-0.987	0.906	-1.090	NS	
Access to Credit X_8	0.03129	0.902	0.035	NS	
Farming experience X_9	5.702	1.160	4.91	***	

Source: Data Analysis (2009)
R^2 = 0.698; NS= Not Significant; ***= Significant at 1% level of probability
*= Significant at 10% level of probability; ****=** Significant at 5% level of probability

Table 4. OLS Regression result for inorganic fertilized sesame farms (Linear Function)

Variable	Beta Coefficient	Standard Error	T-Value	F-value
Constant	-0.889	0.505	-1.761*	5.45**
Farm SizeX_1	8.796	3.062	2.872*	
Seed X_2	0.005669	0.005	1.118^{NS}	
Fertilizer X_3	12.57	5.002	2.512*	
Labour X_4	0.001390	0.001	2.399**	
Pesticide X_5	-0.01039	0.022	-0.482^{NS}	
EducationX_6	6.307	1.033	6.105***	
Seed Varieties X_7	0.583	0.353	1.650^{NS}	
Access to Credit X_8	0.938	0.567	1.652^{NS}	
Farming experienceX_9	9.048	2.016	4.488***	

R^2 =0.703; Ns=Not Significant;*= Significant at 10% level of probability
***= Significant at 1% level of probability;**= Significant at 5% level of probability
Source: Data analysis, (2009)

Partial factor productivity estimates for Sesame farms

The partial factor productivity estimates for individual inputs used in production of sesame are shown in Table 5. The individual estimates for farm size, seed and fertilizer were higher in farms under inorganic fertilizer applications. While individual productivity for pesticides and labour were higher in farms under organic fertilizer application. The inorganic fertilizer was the most productive while seed was the least productive (Table 5).

Table 5. Partial Factor Productivity Estimates for Sesame Farms Under Organic and Inorganic Fertilizers Applications.

Variables	**Organic Fertilized**	**Inorganic Fertilized**
Farm size (X_1)	1.8	8.8*
Seed (X_2)	0.001	0.006*
Labour (X_4)	0.02*	0.001
Fertilizer (X_3)	- 0.000 04	12.6*
Pesticide X_5	0.1*	- 0.01

Source: Data analysis, (2009). *Indicates the highest partial factor productivity estimate for each factor or variable across the two enterprises.

Constraints to Sesame Production by Sesame Farmers Under Organic and Inorganic Fertilizers Applications

Table 6 shows that poor road network, poor access to credit facility, high cost of inorganic fertilizer, poor extension service, high cost of transportation and low market price for sesame grain were the major constraints to an increased sesame production in the area.

Table 6. Constraints to Sesame production

Constraints	**Frequency***	**Rank**
Poor road network	73	1st
Poor access to credit	65	2nd
High cost of Inorganic fertilizer	51	3rd
Poor extension services	47	4th
High cost of transport	43	5th
Low market price	42	6th

Source: Field survey, (2009). * = Multiple choices allowed.

CONCLUSION

The result indicated that inorganic fertilizer applied farmers were earning higher returns(₦61751) as result of producing greater average output of sesame per hectare than organic fertilizer applied farmers (₦36815). The reason for higher returns to inorganic applied farmers was because of higher output per hectare which is 523 Kg as against 284 Kg for organic applied farms, even though the unit cost of inorganic fertilizer (NPK/Urea) was ₦43/Kg as against ₦2.3/Kg for organic fertilizer (animal manure). The difference in returns between the two enterprises was significant at 5% level of Probability. The productivity level of inorganic fertilized farms (1.8) was higher than organic fertilized farms (1.2). The difference in productivity level between the two technologies was significant at 5% level of Probability. Farm size, labour, education and farming experience as well as inorganic fertilizer were factors influencing productivity levels of the two enterprises in the area. This is so because increase in farm size, education and farming experience would increase the productivity level of sesame farms, as they contribute little or no cost to the total production cost. Increase in farmer's educational status and farming experience will definitely enhance his management skill and hence his productivity. Labour and inorganic fertilizer have higher marginal physical product (Table 5), therefore influenced the productivity level of the sesame farms.

RECOMMENDATIONS

The difference in gross margin emanating from higher average output per hectare between two enterprises can be bridged if farmers using organic fertilizer are educated on the recommended quantity of organic fertilizer to be applied per hectare which is 4000kg as against the presence average quantity of 316kg per hectare through an effective extension service. Labour saving technology should be made available in the area to reduce dependence manure labour.

REFERENCES

Adediran, J.A., M.O. Akande., L.B. Taiwo and R.A. Solubo (1999). "Comparative Effectiveness of Organic Based Fertilizer with mineral fertilizer on crop yield". In: proceedings of 25th annual conference of soil science society of Nigeria. Benin'99.pp 91.

Duhoon, S.S., A. Jyotishi., M.R. Deshmukh and N.B. Singh (2004). "Optimization of Sesame (Sesamun indicum L) production through bio natural inputs". In: Proceedings of the 4th International Crop Science Congress Brisbane, Australia, 26 Sept – 1 Oct. http://www.cropscience.au/ics2004.Retrieved 22/02/09

Echezona, B.C. and O.G. Nganwuchu (2006). "Poultry manure application and varietal Effects of Chilly-pepper (Capsicum species) on Insect Pests and Diseases in a Humid-Tropical Environment". Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension. 5: 49-50.

Eboh, R.C., C. U. Oliver and A.C. Ebele (2006). Do Government Fertilizer Subsidies Benefit Rural Poor Farmers in Nigeria? Making Sence Out of Existing Data. A paper presented during the 5th poverty and Economic Policy (PEP) Research Network General Meeting. Addis Ababa, Ethiopia. June 18-22.

Fakayode, S.B., R.D. Babatunde and R. Ajao (2008). "Productivity Analysis of Cassava-Based Production Systems in the Guinea Savannah: Case Study of Kwara State, Nigeria". American-Eurasian Journal of Scientific Research. 3: 33-39.

Hussain, I. and I.R. Perera (2004). Improving Agricultural Productivity through integrated service provision with public, private-sector partnership working paper 66. Columbia. Srilanka: International water management institute. In: productivity analysis of cassava-based production systems in the Guinea Savannah: Case Study of Kwara State, Nigeria. Fakayode, S.B., Babatunde, R.O. and Ajao R. (Eds). American-Eurasian Journal of Scientific-Research. 3: 33-39.

Key, N. and W. Mcbride (2003). "Production Contracts and Productivity in the US Hog Sector". American Journal of Agricultural Economics. 85: 121-133.

Kuepper, G. and L. Gegner (2004). Fundamental of Sustainable Agriculture: Organic crop production overview. http://www.attrg.ncat.org/attra-pub/organiccrop.html. Retrieved on 03/09/08.

Nasarawa State Government (2008). *Precious Nasarawa Nigeria Investor's Haven*. An information brochure on the investment and tourism potentials of Nasarawa State. A publication of the Nasarawa State Government. pp. 1-22.

Rahman, S.A., J.F. Alamu and M.I Haruna (2001). "Comparative Economic Analysis of Maize production under organic and inorganic fertilizers: A case study of Daudawa village in Katsina State, Nigeria". Nigerian Journal of Bio-Sciences. 1: 64-65.

Raw materials Research and Development Council (2004). *Report on Survey of Agro-Raw materials in Nigeria: Beniseed.* Publisher Raw materials Research and Development council Garki-Abuja. 1st Edt. Pp. 1-87.

Rahman, S. A. and Umar, H. S. (2009). Measurement of Technical Efficiency and its Determinants in Crop Production in Lafia Local Government Area of Nasarawa State, Nigeria**.** *Agro-Science:* Journal of Tropical Agriculture, Food, Environment and Extension**.** 8: 90-96.

Umar, H. S. and Okoye, C. U. (2010). Productivity Analysis of Organic and Conventional Sesame Production Systems in Nasarawa State, Nigeria. International Journal of Agricultural and Rural Development. 1:160-166.

Submitted January 30, 2010 – Accepted May 03, 2010
Revised received October 25, 2010