

DETERMINANTS OF ALLOCATIVE EFFICIENCY OF SMALLHOLDER CASSAVA FARMERS IN IMO STATE, SOUTH EAST NIGERIA

Ibeagwa, O.B¹.; Eririogu H., Chikezie C¹.; Ukoha I.I¹.; Osuji M.N.¹, Uhuegbulem I.J.¹ and Barnabas B. C..

¹Department of Agricultural Economics, Federal University of Technology, Owerri, Nigeria

Corresponding email okwyibeagwa2@gmail.com

ABSTRACT

The study analyzed the determinants of allocative efficiency of smallholder cassava farmers in Ohaji-Egbema Local Government Area of Imo State, Nigeria. The specific objectives were to determine the costs and returns from cassava production, estimate the allocative efficiencies of smallholder cassava and estimate the determinants of allocative efficiency of smallholder farmers in the study area. Primary data used were collected by means of a set of structured questionnaire administered to 60 respondents who were selected using dual stage random sampling. Data analysis was done using simple descriptive statistics and other appropriate statistical and econometric tools. The results showed that there were equal number of males and females among the farmers with majority of them being young and energetic, having some level of formal education and fairly large household sizes. The farmers made and aggregate return of N21979156 from their farms; average allocative efficiency was 56% while the maximum and minimum allocative efficiencies was 92% and 48% respectively. Allocative efficiency was positively influenced by household size, educational level, farm size and experience and negatively influenced by fixed cost of production. The study recommended the development of a more proactive extension service to meet the need of the entire farming household. It advocated that measures be taken by the government to reduce the rent charge on land and interest charged on loans obtained by the farmers.

Key words: Allocative efficiency, Smallholder farmers, Cassava, Ohaji-Egbema.

INTRODUCTION

The race to achieving self-sufficiency in food production for many developing Africa countries is based on increased production of root and tuber crops arising from enhanced productivity of small holder farmers. The argument that the continent has potentials in terms of large arable land to be able to feed itself is true only to the extent that appropriate technologies are used to ensure that the large area of arable land produces optimally. Also, it is imperative to ensure that the right combination of crop mix that will yield the desired level of output is cultivated. In this regard, roots and tuber crops come in as willing allies to the aim of most countries to achieve self-sufficiency in food production. According to the Food and Agriculture Organization (FAO) (2004), root and tuber crops provide a substantial part of the world's food supply, and are also an important source of animal feed and industrial products with approximately 45% of the total quantity produced being consumed as food, with the remainder used as animal feed or for industrial processing for products such as starch, distilled spirits, and a range of minor products. The production of roots and tuber crops in Africa large in quantities should therefore be viewed from the perspective of a veritable weapon against hunger and an important component of the food security strategy of African nations.

Roots and tuber crops comprise of crop covering several genera. They include commodities like cassava (*Manihotesculenta*), potato (*Solanumtuberosum*), sweet potato (*Ipomoea batatas*), yam (*Dioscorea spp.*), edible aroids (*Colocasiaesculenta* and *Xanthosoma spp.*), and Andean root and tuber crops (several genera). They are staple food crops, being the source of daily carbohydrates intake for the large populace of the world. Kana et al (2012) posited that root and tuber crops occupy a remarkable position in food security due to their high calorific value and carbohydrate content. The root crops typified by cassava are the most important of the arable crops grown in the southern agro-ecological zones of Nigeria. Cassava supplies the bulk of energy intake in southern Nigeria and can be processed into many different forms (Abolaji et al., 2012)

Nigeria cassava production is by far the largest in the world, a third more than production in Brazil and almost double the production of Indonesia and Thailand, its cassava transformation is the most advanced in Africa (International Fund for Agricultural Development, IFAD 2004). The Food and Agricultural Organization of the United Nations (FAO) estimated cassava production in Nigeria to be approximately 42 million tons in 2006 (FAO, 2007). Farmers produce cassava as source of family food and income in Nigeria. The International Institute for

Tropical Agriculture (IITA) (2004) corroborated this ranking by noting that Benue and Kogi states are the largest producing zones in the North-central zones producing 0.72 tons per capita per person in 2002, followed by Southern-east (0.56), South-south (0.47), South-west (0.34), North-west (0.10) and North-east (0.01). Natural per capita production of cassava is 0.32 tons per person.

According to Kawano (2003) cassava fits well into the farming systems of the smallholder farmers in Nigeria because it is available all year round, thus providing household food security. It is the mostly widely cultivated in the country and the crop plays a vital role in the food security of the rural economy because of its capacity to yield under marginal soil conditions and its tolerance of drought (Ezedinma et al, 2006). According to Hahn (1988) the crops efficient production of cheap food, year round availability energy reported that It is important not just as a food crop but even more so as a source of income for producing households. According to Abolaji et al (2012) rising consumer demand for cassava from both rural and urban households have encouraged farmers to bring more land under the cultivation.

The attention given to the production of the crop in Nigeria by governments at various levels will not yield the desired result if the perceived inefficiency in resource use of the farmers is not addressed. This fact is buttressed by studies conducted by other researchers including Ohajianya (2006), Onyenweaku and Nwaru (2005) and Oguoma and Ohajianya (2007) all of which suggest that existing operation level of resources use technicality and allocative efficiency cannot match the opportunities afforded in the international market for cassava production; they cannot as well cope with the expanded domestic demand for the crop as a food sample unless the allocation and management of resources use efficiency among operators are identified for proper action by the government. According to Anyaegbunam et al. (2010), the requirements of consistent supply of large volume of fresh roots by cassava – based industries cannot be supported by the current subsistence production systems. Nwaiwu et al (2010) also rated the performance smallholder cassava farmers in Nigeria unsatisfactory based on the slow rate of growth or even stagnation in the wake of rapid population growth. The challenges faced by the smallholder cassava are therefore multifaceted and they range from population pressure, environmental degradation, natural disaster and social conflicts. Their low productivity may also be due to inadequate allocation of inputs, lack of improved technology and inefficiency in the use of productive resources. Olayide and Heady (1982) attributed the issue of low agricultural productivity to inability of farmers to make use of available resources efficiently. Efficiency is an important factor of

productivity growth. According to Kabwe (2012) efficiency could be considered as productivity at optimal values and can be investigated in three ways; technical, allocative and economic efficiencies. Fletschner *et al.*, (2002) and Ajibefun (2008) defined price or allocative efficiency as ratio between minimum cost required to produce a certain level of output and the unit's production costs if it were technically efficient. Heady (1982) stated that optimum productivity of resource implies an efficient utilization of resource in the production process. That is, attainment of a production goal without waste. The objective of this study is therefore to determine the costs and returns from cassava production, determine the allocative efficiencies of smallholder cassava and estimate the determinants of allocative efficiency of smallholder farmers in the study area.

METHODOLOGY

The study area of this research was Ohaji/Egbema Local Government Area of Imo State. It is situated at the outskirts of Owerri Capital Territory at a boundary between Imo state and River state with her headquarters in Mmahu in Egbema. Dual stage random sampling technique was used to select the communities and respondents used for the study. First, 6 communities were selected from the 18 communities in the Local Government Area. Second, 10 respondents comprising of 5 males and 5 females were randomly selected from each community giving a total of 30 males and 30 females and 60 respondents in all for the study.

The cost and returns from cassava production is achieved using the net return model

Net profit = Total Revenue (TR) – Total Cost (TC)

Gross Margin (GM) = Total Revenue – Total Variable Cost (TVC)

The allocative efficiencies of the respondents were analysed using the allocative efficiency model as used by Onubuoguet *al* (2012). The model is specified thus:

$$MVP_{xi} = P_{xi} \text{ or}$$

$$P_y f_i = P_{xi}$$

Where

$f_i = \partial Y / \partial X =$ marginal physical product (mpp) of the i th input

$P_{xi} = (i = 1, 2, \dots, 6) =$ unit price of the i th input

$P_y =$ Unit output price

$MVP_{xi} = (i = 1, 2, \dots, 6) =$ marginal value product of the i th input

The factors influencing allocative efficiency of the respondents were estimated using the ordinary least squares multiple regression model. The implicit form of the model is specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9) + e$$

Where

$Y =$ allocative efficiency of respondents

X_1 = gender (male =1, female =0)
 X_2 = educational level of respondents (Number of years spent in school)
 X_3 = farming experience (years)
 X_4 = access to credit (Dummy variable; access =1, no access = 0)
 X_5 = Contact with extension agents
 X_6 = membership of association
 X_7 = Household size (Number of persons in the household)

X_8 = fixed inputs cost (rent, interest, annual depreciation)
 X_9 = nonfarm income (Naira)
 e = stochastic error term

3.0 RESULTS AND DISCUSSION

The results of the analysis carried out in the study are presented and discussed in this section.

3.1 Socioeconomic characteristics of respondents

The socioeconomics characteristics of respondents are discussed in this section

Table 3.1: socioeconomic characteristics of respondents

Socioeconomic variable	Frequency	Percentage
Age		
20-30	17	28.33
31-40	20	33.33
41-50	12	20
51-60	7	11.67
61-70	0	-
71-80	4	6.67
Total	60	100
Mean	39.53	
Educational Level		
1-6	24	40.00
7-12	27	45.00
13-18	9	15.00
Total	60	100
Mean	8	
Farming experience		
1-10	30	50
11-20	13	21.67
21-30	10	16.67
31-40	5	8.33
41-50	2	3.33
Mean	14.83	
Total	60	100
Sex		
Male	30	50.00
Female	30	50.00
Total	60	100
Farm Size in Hectare		
0.1-0.19	17	28.33
0.2-0.29	19	31.67
0.3-0.39	8	13.33
0.4-0.49	6	10
0.5-0.59	7	11.67
0.60-0.69	2	3.33
0.7-0.79	1	1.67
Total	60	100
Mean	0.31	
Household size		
1-2	8	13.33
3-4	11	18.33
5-6	20	33.33
7-8	12	20
9-10	5	8.33
11-12	4	6.67

Total	60	100
Mean	5.73	

Source: field survey, 2014.

The table shows that majority of the farmers (about 62 percent) were at most 40 years old. The mean age was also about 40 years. This result indicates that farmers in the area young and still within their active and productive age and should have some formal education which will make the adoption of new technologies and modern agricultural practices easier for them and hence enable them increase their efficiency and productivity on their farms. This result is consistent with Bravo-Ureta and Pinheiro (1997) who reported that younger farmers are likely to be more educated than older ones and therefore more successful in information gathering and understanding new practices which will invariably increase their efficiency. This finding is not in agreement with generally held view that an aging population of farmers is responsible for the decline in agricultural production in the country.

The mean years of education for the farmers was 8 years with the overwhelming majority (about 85 percent) having just up to 12 years of formal education. This result is a true reflection of the situation in most rural farming communities where the rate of school dropout is quite high. This low educational level may inhibit the ability of the farmers to adopt technologies and other important practices that could enhance their efficiency. These farmers will therefore continue to be trapped in the rut of low productivity leading to low output which leads also to low income and poor welfare.

About half of the farmers had farming experience of not more than 10 years while the mean years of farming experience was 15 years. These farmers

cannot be considered as novices or inexperienced rather they may be considered knowledgeable enough in the art of farming albeit with old practices that are not efficient.

There were equal numbers of male and female respondents. This result indicates that cassava is no longer considered a woman's crop. Men too are now fully involved in the production of the crop. The relatively high involvement of males may also be an indication of the transition of the crop from being a staple subsistence to a cash crop.

The mean farm size of the farmers was 0.31 with a majority of the farmers (about 62 percent) having not up to 0.3 hectares. This is an indication of a severe case of the fragmentation of farm land and may be related to the land tenure system prevalent in the area. These small farm holdings will only lend themselves to subsistence farming with very little left to sell. The small farm holdings hardly provide a good basis to evaluate the efficiencies of these farmers.

The mean household size of the farmers was about 6 persons. Most of the households (about 64 percent) had household sizes of not more than 6 persons. The moderately household size could be beneficial to these farmers not only in terms of reduced household burden but much more in having family members who can provide labour on the farm.

3.2 Cost and Returns

The result of the analysis of cost and returns from cassava production is presented in this section.

Table 3.2: Summary Statistic of Cost Analysis of Cassava Farmers

Variable	Value
Fixed cost	
Rent on land	369400
Depreciation of hoe	47670
Depreciation of cutlass	89720
Depreciation of shovel	27037
Depreciation of wheel barrow	116160
Depreciation on basket	59330
Depreciation on rake	28551
Depreciation on cost of other implement	31908
Total fixed cost	779039
Variable cost	
Cost of labour	465900
Cost of fertilizer	40200
Cost of stem	1503550
Total variable cost	2009650
Total cost = TVC+ TFC	2788689

Source: Field survey, 2014

Table 3.3 Statistic of Returns Analysis of Cassava Farmers

Items	Value (N)
Revenue from sale of bundle of cassava stem	513000
Consumption from cassava	1682345
Revenue from sale of cassava	22572600
Total revenue	24767875
Gross margin (TR – TVC)	22758275
Net return (GM – TFC)	21979156

Sources: Field survey, 2014

The costs and returns analysis of the farmers shows that they made an aggregate net return of ₦21979156 from cassava farming. The fixed costs and variable costs are about 4 and 9 percent of the net return with the average net return per farmer being ₦366,319.27. The high cost of production, especially the variable cost component may be attributed to scarcity of labour which therefore makes the cost of getting labour for the farm quite exorbitant. The almost non-existence of feeder roads linking the communities to the main roads make it difficult for the farmers to access improved inputs like fertilizer and other

agrochemicals that help improve output. This moderate net return from cassava is however an indication that the enterprise could as a matter of fact be a major income earner for these smallholder farmers if they are given necessary incentives and support to boost production and increase output and yield.

3.3 Allocative Efficiency of the farmers

Table 3.4 presents the resulted for the estimated allocated efficiencies of the cassava farmers.

Table 3.4: estimated allocative efficiencies of the farmers

Allocative efficiency	frequency	percentage
≤ 50	10	16.67
51 – 60	8	13.33
61 – 70	27	45
71 – 80	7	11.67
81 – 90	6	10
91 – 100	2	3.33
Total	60	100
Mean efficiency	56	
Maximum efficiency	92	
Minimum efficiency	48	

Source: Field survey, 2014.

The result shows that the farmers had a mean allocative efficiency of 56 percent. Majority (about 75 percent) of the respondents had allocative efficiencies of not more than 70 percent. This result implies that the farmers were allocatively inefficient in the use of resources on the farm. The result may also be an indication of waste or decreasing return to scale as it pertains to resource use by the farmers.

3.4 Determinants of Allocative Efficiency of cassava Farmers

The Ordinary Least Squares Multiple regression technique was used to estimate the determinants of allocative efficiency of the cassava farmers in the study area. The result is presented in Table 3.5.

Table 3.5: Determinants of allocative efficiency of cassava farmers in the study area.

Variable	Linear	Exponential®	Semi-log	Double-log
Age	0.003879 (2.107116)**	0.010167 (1.385348)	0.221337 (3.000919)***	0.736941 (2.30063)**
Matstat	0.077983 (1.356115)	0.47232 (2.060327)**	0.084126 (1.455008)	0.463012 (1.84392)*
Household size	0.037434 (3.373356)***	0.15057 (3.403539)***	0.173644 (4.005273)***	0.665055 (3.532177)***
Education	0.018865 (2.852438)**	0.105501 (4.00152)***	0.16329 (2.810791)**	0.844524 (3.347295)***
Experience	0.004471 (1.525634)	0.034477 (2.951118)**	0.069056 (1.6935)	0.368157 (2.078873)**
Cooperative	-0.02268	-0.28141	-0.02035	-0.29758

	(-0.42282)	(-1.31598)	(-0.38179)	(-1.28575)
Farm size	0.035589 (2.131591)**	0.198803 (2.986826)**	0.056461 (1.44466)	0.36686 (2.161399)**
Fixed Cost	-2.8E-06 (-3.82463)***	-1.5E-05 (-5.24178)***	-0.05508 (-3.05644)***	-0.2246 (-1.28575)
Major occupation	0.081643 (1.53566)	0.128297 (0.605335)	0.075011 (1.402088)	0.119944 (0.516231)
Constant	0.170489 (1.483766)	-2.25942 (-4.93249)***	0.009356 (0.029923)	-2.33165 (-1.71701)*
R ²	0.614246	0.649536	0.606795	0.576036
Adjusted R ²	0.546171	0.58769	0.537406	0.501219
F- Statistic	9.02317***	10.50238***	8.744806***	7.699259***

Note: Asterisk ***, ** and * represent 1%, 5% and 10% significance level respectively. ® means lead equation.

The exponential functional form was chosen as the lead equation because it gave the best fit having the highest value of coefficient of multiple determination (R²), highest number of significant variable, relative model of F- value and in conformity with a priori expectations. The coefficients of marital status, household size, education, farm size and farming experience were significant and positively related to allocative efficiency of the farmers while the coefficient of cost of fixed inputs was significant and negatively related to allocative efficiency.

The positive significant relationship between marital status and allocative efficiency of the farmers may be attributed to the assistance in terms of informed advice and technology dissemination these married farmers receive from their spouses and other experienced household members on the farms. The typical married farmer in the area is usually one with a fairly large household size with most of the household members offering their services as labourers on the farm. This coupled with the small and highly fragmented farm sizes make it easier to achieve a higher level efficiency of resources used on the farm since there are more hands to do the work.

The household size of the farmers positively influenced their allocative efficiency on the cassava farms. This is expected since it is the household which provides the most labour for farmers especially smallholders. With an average household size of about 6 persons it is obvious that these farmers have fairly large households which could be advantageous in contributing labour for farm activities by ensuring that marginal value product exceeds wage rate on the farms and thereby increasing allocative efficiency. This result differs from that of Bravo-Ureta and Pinheiro (1997) and Asogwa et al (2011) who reported negative significant relationship between household size and farmers' allocative efficiency.

The positive relationship between education and allocative efficiency is in agreement with a priori expectation. Formal education according to Onyebinama (2000) exposes the farmer to better and more ingenious ways of managing resources. It also

prepares him and makes it easier for the farmer to adopt techniques and technologies that could enhance his efficiency and hence his productivity and output. The educated respondents are therefore better positioned to manage their and allocate resources efficiently. Kabwe (2012) agrees with this position and posits that allocative efficiency would increase with increase in years of schooling of the farmers because more educated farmers are able to perceive, interpret and respond to new information and adopt improved technologies such as fertilizers, pesticides and planting materials much faster than their counterparts. This result is consistent with Bravo-Ureta and Pinheiro (1997) who also found a positive significant relationship between education and allocative efficiency. Armagan (2008) and Kabwe (2012) also reported a positive albeit, non-significant relationship between education and allocative efficiency. Asogwa et al. (2011) however differ in their finding, they reported negative significant relationship between formal education and allocative efficiency.

Farm size was positively related to allocative efficiency of the cassava farmers. This direct relationship may be as a result of ability of the farmers to manage their resources, in this case, land, to obtain maximum output. It may also be as a result of the farmers' ability to utilize the experience they have gathered over time to in allocating resources in such a way that waste is avoided and completely eradicated from the farms. This result is consistent with Ajibefun and Abdulkadri (2004) who reported that farmers with less intensive use resources including land are more efficient in the use of these resources than do farmers with more intensive use of the resources. Bravo-Ureta and Pinheiro (1997) and Laha and Kuri (2011) also reported positive significant relationship between farm size and allocative efficiency for farmers. Nwachukwu and Onyenweaku (2009), Okoye et al. (2006) and Kabwe (2012) however differ, reporting negative relationship between farm size and allocative efficiency.

The coefficient of farming experience positively influenced the allocative efficiency of the farmers. This again is in agreement with a priori expectations

and may be due to the smallholder farmer's ability to recollect and put into practical use the wealth of experience they have gathered over time working and living in the same environment. Nwaru (2004) agrees with this position, adding that the number of years a farmer has spent in the farming business may give an indication of practical knowledge he has acquired on how he could overcome certain inherent farm production challenges. Iheke (2010) also noted that farmers rely a lot on their farming experience for increased efficiency and productivity. This finding is consistent with Nwachukwu and Onyenweaku (2009) and Laha and Kuri (2011) who also reported significant positive relationship between farming experience and allocative efficiency. Asogwa et al (2011) however differ in their findings. They reported negative significant relationship between farming experience and allocative efficiency. The coefficient of cost of fixed inputs was inversely related to the allocative efficiency of the farmers. This implies that the higher the fixed cost component of the farm's cost structure, the lower the allocative efficiency. This result may be an indication that the farmers have not been able to manage properly and probably cut down on the rent and or the interests they pay for their land and credit gotten. It is also possible that the farmers possess farm machinery which is operating inefficiently thereby increasing its annual depreciation.

RECOMMENDATION

The following research recommendations are based on the findings of this study.

1. Programmes, policies and activities aimed at improving and enhancing the efficiency and productivity of the entire farming household should be considered and given some emphasis by government and private stakeholders through the development of more proactive extension services.
2. Better access to functional education for these farmers will go a long way in increasing their efficiency and hence increase agricultural productivity in the country.
3. Government should embark on deliberate policies aimed at reducing the cost of production especially at it relates to rent paid on land and interests charge on loan to smallholder farmers in the country. In this context, the farm settlement scheme of the 1960s and early 1970s should be revived to provide land for farmers.

REFERENCES

Abolaji D.D., Ali G.A., Oladele O.A. and Williams O.S. (2012). "Innovative Approaches to Industrial Utilisation of Cassava in a

Developing Economy" in; *Creating Systems of Innovation in Africa; Country Case Studies*. DALRO Publishing South Africa.

- Ajibefun, I.A., and A.O. Abdulkadri (2004). Impact of size of farm operation on resource use efficiency in small scale farming: Evidence from southwestern Nigeria. *Journal of Food Agriculture and Environment* 2(1): 259-264
- Ajibefun, I. A. 2008. An Evaluation of Parametric and Non-parametric Methods of Technical Efficiency Measurement: Application to Small Scale Crop Production in Nigeria. *J. Agric. Soc.*, 4: 95-100
- Anyaeibunam, H.N., B.C. Okoye, G.N. Asumugha, M.C. Ogbona, T.U. Madu, N. Nwakor and M.E. Ejechi (2010), Labour productivity among small- holder cassava farmers in South East agro ecological zone, Nigeria *African Journal of Agricultural Research* 5(21) 2882-2885.
- Armagan (2008). Determining the factors affecting efficiency scores in Agriculture. *International Journal of Agricultural Research* 3(4): 325-330
- Asogwa, B.C., J.C. Umeh and S.T. Penda (2011). Analysis of Economic Efficiency of Nigerian Small Scale Farmers: A Parametric Frontier Approach. *Journal of Economics* 2(2): 89-98.
- Bravo-Ureta, B.E. and A.E. Pinheiro (1997) Technical, Economic, and Allocative Efficiency in Peasant Farming: Evidence from the Dominican Republic/ *The Developing Economies* XXXV-1 48 -67.
- Ezedinma CI, Okafor C, Asumugha GN, Nweke F (2006). Trends in farm labour Productivity and implications for cassava industrialization in Nigeria. *Proceeding of the 40th Annual conference of the Agricultural society of Nigeria held at NRCRI Umudike, Abia State. Oct. 16th – 20th, p. 109-115.*
- FAO (2004). "Trends in Cassava Production." Web page, [accessed 2004b].
- Fletschner, D. K. and L. Zepeda (2002). Efficiency of Small landholders in Eastern Paraguay. *Journal of Agricultural and Resource Economics* 27(2):554 – 572.

- Heady, E.O. (1982). *Economics of Agricultural Production and Resource Use*. Englewood Cliffs, NJ Prentice Hall, USA. 9
- IFAD (2004). *The Global Cassava Development Strategy: A cassava industrial revolution in Nigeria The potential for a new industrial crop*. Philips, T.P; Taylor, D.S; Sani, L. and Akoroda M. O.(eds). International Fund for Agricultural Development Food and Agriculture Organization of the United Nations: Rome. I
- Iheke R.O. (2010). "Migrant Remittances, Resource Use Efficiency and Welfare among Rural Smallholder Arable Crop Farm Households in South Eastern Nigeria". A PhD Dissertation Research; Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Nigeria.
- IITA (2004). *Nigerian's Cassava Industry: Statistical Handbook*.
- Kabwe, S. (2012). *Factors Affecting Efficiency of Smallholder Cotton Producers in Zambia*. A Published Dissertation for the Award of Master of Science Degree in Agricultural Economics, University of Zambia. P. iv.
- Kana, J.R., Defang, F.H., Mafouo, G.H., Ngouana, T.R, Moube, M.N., Ninjo, J. and Tegua A. (2012). Effect of Cassava Meal Supplemented with a combination of palm oil and Cocoa husk Alternative energy source on broiler growth. *ArchivaZootechnica* 15 (4): 17-25.
- Kawano, K. (2003). Thirty Years of Cassava Breeding for Productivity – Biological and Social Factors for Success. *Crop Science* (43):1325-1335.
- Laha, A. and P.K. Kuri (2011). Measurement of Allocative Efficiency in Agriculture and its Determinants: Evidence from Rural West Bengal, India. *International Journal of Agricultural Research*, 6: 377-388.
- Nwachukwu, I.N. and C.E. Onyenweaku (2009). Allocative efficiency among Fadama fluted pumpkin farmers in Imo State, Nigeria. *Int. J. Agric. Rural Dev.*, 11: 129-136.
- Nwaiwu I., M. Odii, D. Ohajianya, C. Eze, N. Oguoma, C. Ibekwe, A. Henri-Ukoha, F. Kadiri, C. Amaechi and J. Oguh (2010). *Comparative Analysis Of The Productivity Of Sustainable Cassava Farming Under External And Internal Input Use In Imo State Nigeria*.
- Nwaru, J.C. (2004). "Rural Credit Markets and Resource Use in Arable Crop Production in Imo State of Nigeria". Ph.D dissertation, Michael Okpara University of Agriculture, Umudike.
- Oguoma, N.N.O. and D.O. Ohajianya, (2007). Potentials in Financing Heliculture Under the Agricultural Credit guarantee scheme in Imo and Rivers, States: A comparative analysis. *Int. J. Agric. Rural Dev.*, 9: 48-54.
- Ohajianya (2006). Resource use Efficiency of land Owners and Tenants in Food Crop Production in Imo State Nigeria. *Journal of Sustainable Tropical Agricultural Research* Vol.17, PP.26-30.
- Okoye, B.C., C.E. Onyenweaku, and A.E. Agwu. (2006). *Technical Efficiency of Smallholder Cocoyam Farmers: Implications for Agricultural Extension Policy*. Anambra State, Nigeria
- Olayide, S.O. and Heady, E. (1982). *Introduction to Agricultural Production Economics*. Ibadan University Press, Ibadan, Nigeria
- Onyebinama, U.A.U. (2000). "Economic Incentives and Strategies for Commercialization Of Agriculture in Nigeria". *African Journal of Business and Economic Research* 1(2): 182-184.
- Onyenweaku, C. E. and J. C. Nwaru (2005) "Application of the Stochastic Frontier Production Function to the Measurement of Technical Efficiency in food production in Imo State, Nigeria" *Nigeria Agricultural Journal*.