



EFFECT OF RICE PRODUCTION ON AGRICULTURAL GROWTH IN NIGERIA (1981-2020): EVIDENCE FROM VECTOR ERROR CORRECTION MODEL

Abah, D., Ochoche, C. O. and Teran, A. D.

Department of Agricultural Economics,
Federal University of Agriculture, Makurdi, PMB 2373, Makurdi, Nigeria.
Corresponding Authors' E-mail: dangod23@yahoo.com **Tel.:** 08038823544

ABSTRACT

The study assessed the effect of rice production on agricultural growth in Nigeria (1981-2020). Time series data obtained from archives of Food and Agriculture Organization (FAO) and Central Bank of Nigeria (CBN) for a period of 39 years were used in the study. The data collected were analyzed using both descriptive and inferential statistics such as trend graphs, growth model and vector error correction model [VECM]. The result of the study revealed that the trend of rice production has fluctuated considerably over the years but has experienced a downward trend in the last few years while the trend of agricultural output in Nigeria has been experiencing an appreciable level of increase over the years. The growth rate and direction of rice production was 4.2% with a stagnated process while agricultural output was 4.4% with an accelerated growth process respectively during the period of study. The result of VECM indicated that in a long run, the coefficient of rice production with a coefficient of 18.942 was positive and statistically significant at $P \leq 0.01$. The result showed that the coefficient of determination (R^2) is 0.46. The result also showed that the F-statistics (8.112) was positive and significant at $P \leq 0.01$ indicating the overall significance of the model. The study therefore, recommended that conscious effort must be made to increase rice production level geometrically so as to maintain pace with the rapid population growth if food security is to be ensured in Nigeria.

Keywords: Co-integration, Output, Rice, Trend, VECM.

INTRODUCTION

Agriculture as the main stay of Nigerian economy, provides primary means of employment for Nigeria and accounts for more than one third of total gross domestic product (GDP) as reported by Kolawole and Ojo, 2007 with more than 70% of the working adult populations employed in the agricultural sector directly or indirectly. The agricultural sector comprises crop production, fishery, livestock and forestry. Crop production is the dominant activity accounting for 35.64% from 2000-2007, relative to livestock (2.83%) and 0.59% for forestry (Balami *et al.*, 2011).

Cereals are a major contributor to agriculture and food security in Nigeria; consisting of about 55 - 60% of subsistent farmers output, and provide incomes as well as form the basis of many a households' diets both in the rural and urban areas (Balami *et al.*, 2011). Today, cereal grains are the single most important source of calories to a majority of the world population. Isah *et al.* (2015) posited that developing countries depend more on cereal grains for their nutritional needs than the developed world. Close to 60% of calories in developing countries are derived directly from cereals, with values exceeding 80% in the poorest countries.

The major cereal crops in Nigeria are rice, maize, sorghum, wheat, pearl millet, sugar cane and fonio millet with rice ranking as the sixth major crop in terms of the land area while sorghum account for 50% of the total cereal production and occupies about 45% of the total



land area devoted to cereal production in Nigeria (National Agricultural Extension Research and Liaison [NEARLS], 1996).

Rice (*Oryza Sativa*) is a staple food in many countries of Africa and other parts of the world. It is also the most important staple food for about half of human race. Rice is one of the widely produced and consumed cereal crops in Nigeria, with per capita consumption of between 3.5 kg and more than 14 kg per year per household (FAO, 2002). Nigeria is currently the largest rice producing country in Africa. This is as the result of conscientious efforts by the current administration to place more emphasis on agrarian production. With the available literature, annual rice production in Nigeria has increased from 5.5 million tons in 2015 to 5.8 million tons in 2017 (Udemezue, 2018).

Nigeria has made significant strides towards increasing their rice production by encouraging the adoption of new and improved varieties but mostly through area expansion and intensification. Initiatives currently underway in Nigeria is contributing to what is likely to become a trend of increasing rice production. Rice is cultivated virtually in all the agro-ecological zones in Nigeria. Despite this, the area cultivated and devoted to rice still appears small. In early 2000, about 25 million hectares of land cultivated to various food crops, about 6.37% was cultivated to rice (Onu *et al.*, 2015).

Rice is important in Nigeria for several reasons; it is a major contributor to internal and sub-regional trade. West African Rice Development Association (WARDA) and Imolehin and Wada put potential areas for rice production as 4.6 - 4.9 million ha and 1.7 million ha, respectively, (Imolehin and Wada 2000 as cited in Udemezue, 2018). The increase in production is due to an increase in land under rice cultivation and not increase in yield. The difference between potential and actual yields is also very high. A yield of 4.4 -7.2 t/ha has been recorded on research farm. However, average rice yields are consistently low and stand at around 1.5t/ha (Singh *et al.*, 1997). Production increase in rice has been unable to match the consumption increase in the same commodity (Okoruwa *et al.*, 2006), and domestic production capacity is below the national requirements for rice (Rahji and Adewumi, 2008).

The Food and Agriculture Organization (FAO) asserts that the level of Nigeria's self-sufficiency in cereals has been falling resulting in rapid growth in the amounts of cereals imports, especially rice imports, which increased 130% in 2001 over the previous five year average (FAO, 2001). Despite the various policies measures, domestic rice production has not yet increased enough to meet the increase demand, even during the rice import ban period, Nigeria was still importing several hundred thousand tons of rice per year through illegal trade (Udemezue, 2018). Nigeria cereal crops production is potentially competitive in the domestic market if the crops industry would enhance the overall economic development through the income and employment effects in the rural and urban economics.

Several studies have carried out on cereal crops in general and rice in particular in Nigeria such as Maikasuwa (2013) who assessed factors affecting cereal crops in Nigeria; Tahir (2014) who focused on trend analysis of productivity of some selected cereal crops in Nigeria amongst others. However, there is perhaps little or no known study on the trend analysis of rice production and its corresponding impact on agricultural output in Nigeria hence, the need for this study to fill this research gap.

MATERIALS AND METHODS

The study was carried out in Nigeria. Nigeria has a total geographical area of 923, 768 square kilometers constituting land area of 910768 square kilometers and water area of 13000 square kilometers, respectively. It is one of the eight most populous countries in the world with a population of about 140 million (NPC, 2006). With a population growth rate of 2.6%, Nigeria



has a projected population of about 206 million in 2020. Nigeria is located between 4°16 and 13°53 north latitude and between 2°40 and 14°41 east longitude (Central Intelligence Agency [CIA] Fact Book, 2009). Nigeria has a highly diversified agro-ecological climatic condition and hence, agriculture constitutes one of the most important sectors of the Nigeria economy. The climate varies with Equatorial in South, Tropical in Centre and in the North. There are two seasons – the wet season (April-October) and the dry season (November-March). The type of vegetation is grassland savannah in the North and forest in the south. This vegetation has made agriculture the major employer of labour in the country.

Methods of Data Collection

The study relied basically on secondary data. Annual time series data spanning from 1981 to 2018 were sourced from Central Bank of Nigeria (CBN) and Food and Agriculture Organization (FAO) database. Specifically, data on agricultural output were collected from the statistics of Central Bank of Nigeria (CBN) while data on rice production were collected from the archives of the Food and Agriculture Organization (FAO).

Analytical Techniques

The data collected were analyzed using both descriptive statistics (mean, maximum and minimum with graphs) and inferential statistics (Growth model, vector error correction model [VECM] after testing for unit root and co-integration among the variables) and t-test.

Vector Error Correction Model (VECM) was used to model causal influence between non stationary I (1) variables with evidence of long run relationship. The vector error correction model is useful for the evaluation of a short term adjustment which adjusts towards the long run equilibrium in each time period. If the variables are found to be co-integrated, a vector error correction model (VECM) is estimated because a co integrating relationship deals only with long-run relationship without considering the short-run dynamics. The advantage of this procedure lies in the fact that both long run and short run influences of the endogenous variables in the model can be determined with the mechanism that keeps the variable in equilibrium evaluated. For instance, if we hypothesized that variable rice production and agricultural growth are jointly determined (i.e. endogenous to a system). The relationship between these variables can be described by VAR such that:

$$\Delta \ln Ag_t = \varphi_1 + \sum_{i=1}^p \alpha_{1i} \Delta \ln Ag_{t-i} + \sum_{i=1}^p \beta_{1i} \Delta \ln Rp_{t-i} + \sigma_1 ECT_{t-i} + \xi_{1t} \quad \dots(1)$$

$$\Delta \ln Rp_t = \varphi_2 + \sum_{i=1}^p \alpha_{2i} \Delta \ln Ag_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta \ln Rp_{t-i} + \sigma_2 ECT_{t-i} + \xi_{2t} \quad \dots(2)$$

where;

φ and σ are mx1 vector of parameters; α, β are mx1 and m x p vectors of parameters, respectively; p is the optimal lag order that minimizes Information criteria; m is the number of endogenous variables under investigation (rice production and agricultural growth); ξ_{jt} is an mx1 vector of random variables assumed to be normally distributed white noise process.

Suppose we hypothesized further that the series under investigation have unit roots and possibly co-integrated, the Granger representation theorem asserts that vector error correction model (VECM) or restricted VAR of the form:

$$Ag_t = \gamma_1 + \lambda_j (Ag_{t-1} - \alpha_1 Rp_{t-1}) + \sum_{i=1}^{p-1} \alpha_{1i} \Delta Ag_{t-i+1} + \sum_{i=1}^{p-1} \beta_{1i} \Delta Rp_{t-i+1} + \varepsilon_{1t} \quad \dots(3)$$

$$Rp_t = \gamma_2 + \lambda_j (Ag_{t-1} - \alpha_1 Rp_{t-1}) + \sum_{i=1}^{p-1} \alpha_{2i} \Delta Ag_{t-i+1} + \sum_{i=1}^{p-1} \beta_{2i} \Delta Rp_{t-i+1} + \varepsilon_{2t} \quad \dots(4)$$

Equations 4 produce consistent estimates of the system parameters. The parameter λ_j in equation 3 and 4 measures the speed of adjustment of short run disequilibrium to long run equilibrium position; while the parameter α and β measure the short run temporary influence of the past values of rice production on agricultural growth and past values of agricultural

growth on rice production, respectively, such that if the coefficient in equation (3) and (4) are respectively such that;

$$a_{11} = a_{12} = a_{13} \dots a_{1p-1} = 0$$

$$\beta_{11} = \beta_{12} = \beta_{13} \dots \beta_{1p-1} = 0$$

RESULTS AND DISCUSSION

Trends of Rice Production in Nigeria (1981-2020)

Figure 1 presents the trend of rice production in Nigeria. The result shows that the trend of rice production in Nigeria ranges between 1241000 tons and 11346076 tons with a mean of 3698054 during the period under study. This can be attributed to the fact that rice production has received tremendous support over the years in Nigeria through various government programmes and projects. Specifically, from 1981 to 1986, rice production was fairly constant until it increased sharply till 1990. Between 1990 and 1991 there was a decline in rice production but increased yet again from 1991 to 1993. From 1993 to 1995 rice production experienced another decline but increased continuously till 2000. Between 2000 and 2015, there was a serious fluctuation in rice production intermittently increasing and decreasing at intervals. From 2015 to 2017 there was a sharp increase in rice production but experienced another decrease in recent years till 2020. This could be due to the impact of Covid-19 that hampered most production activities in the world. This is consistent with the findings of Abah *et al.* (2021) who observed that the cereals production has shown increasing trend in Nigeria over the years but has experienced downward trend lately.

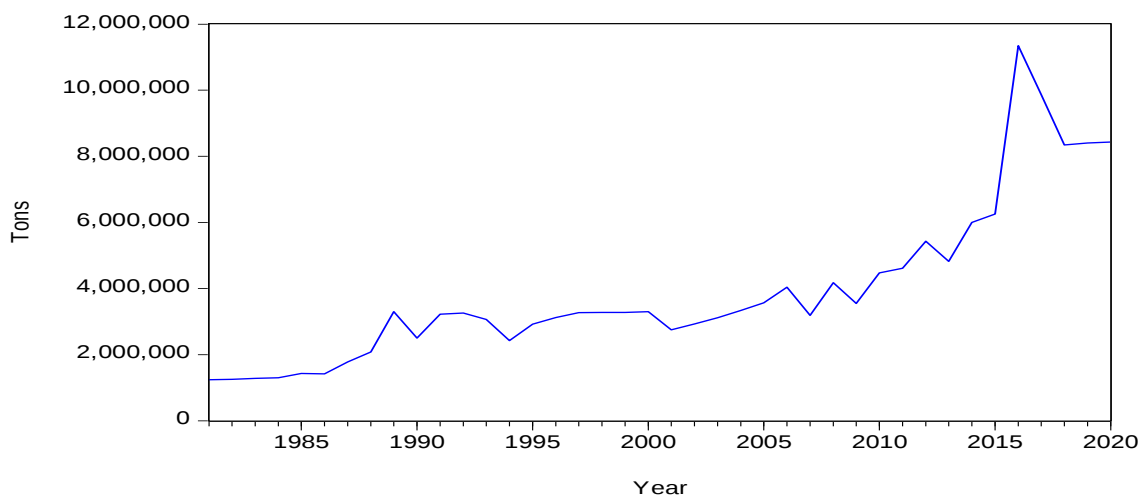


Figure 1: Trends of Rice Production (1981-2020)

Source: Data analysis (2021)

Trends of Agricultural Output in Nigeria (1981-2020)

Figure 2 presents the trend of agricultural output in Nigeria. The result shows that the trend of agricultural output in Nigeria ranges between ₦2303510 to ₦17544147 with a mean of ₦7671357 during the period under study. This can be attributed to political instability, lack of focused and visionary leadership, economic mismanagement and corruption (Adekanye, 1993). Specifically, from 1981 to 1982 agricultural output was fairly constant but decreased from 1982 to 1984. Between 1984 and 1990 agricultural output increased at a steady rate but became constant from 1990 to 1991. Agricultural output continued to increase from 1991 to 1998 and became constant yet again from 1998 to 1999. From 1999 to 2001 there was a slight



increase in agricultural output but from 2001 to 2015 there was a rapid increase in agricultural output. However, agricultural output declined from 2015 to 2016 but has continued to increase till 2018 while a slight downward trend was noticed most probably due the effect of Covid-19 pandemic on the economy. Abah and Ochoche (2021) observed a similar trend in agricultural output in Nigeria between 1981 and 2018.

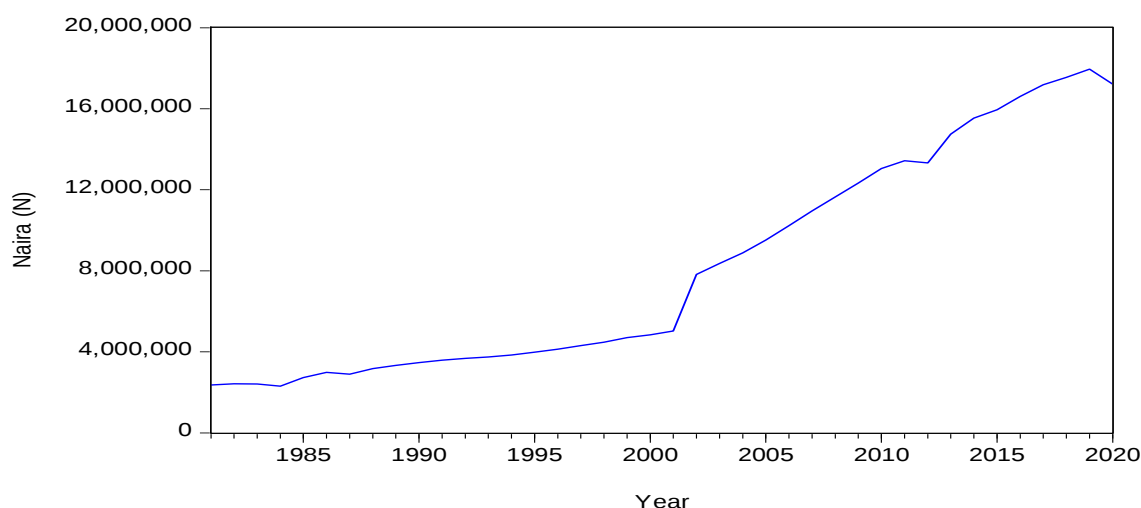


Figure 2: Trends of agricultural output in Nigeria (1981-2020)

Source: Data analysis (2021).

Growth Rates and Direction of Rice Production in Nigeria (1981-2020)

The result of the growth trend of rice production is shown in Table 1. The trend equation revealed that the growth rate of rice production was positive which implies a positive growth rate. The coefficient for estimating the growth (0.042) was positive and significant at 1%. The instantaneous growth rate (growth at a point) of rice production is 4.2% while the compound growth rate is 5.01%. The direction of growth of rice production shows that there was a stagnated growth process in rice production over the years. This implies that rice production had not improved appreciably over the years. This could be attributed to the fact that rice importation is a phenomenon that has plagued indigenous rice production in Nigeria, a case the Nigeria government has been tackling through various measures including the ban on importation of rice. This is in line with the study of Abah and Ochoche (2021) who observed a stagnated growth process in wheat production in Nigeria. The coefficient of multiple determination (R^2) value of 0.84 shows that 84% of the variations in the trend of rice production are explained by time.

Table 1: Trend Analysis of Rice Production

Variables	Coefficient	t-statistics
Constant	14.164	136.12
@ trend	0.0421	3.25***
@ trend ²	0.0007	0.22
R^2	0.84	
F-statistics	91.15	

***significant at 1%

Source: Data analysis (2021).



Growth Rates and Direction of Agricultural Output in Nigeria

The result of the growth trend of agricultural output in Nigeria is shown in Table 2. The trend equation revealed that the growth rate of agricultural output in Nigeria was positive which implies a positive growth rate. The coefficient for estimating the growth (0.044) was positive and significant at 1%. The instantaneous growth rate (growth at a point) of agricultural output is 4.4% while the compound growth rate is 5.06%. The direction of growth of agricultural output in Nigeria shows that there was an accelerated growth process in agricultural output. The coefficient of multiple determination (R^2) shows that 97% of the variations in the trend of agricultural output in Nigeria are explained by time. This is similar to the findings of Soyibo and Olayiwola (2000) who observed that agricultural output in Nigeria has been good relative to annual GDP growth rate.

Table 2: Trend Analysis of Agricultural Output

Variables	Coefficient	t-statistics
Constant	14.59709	265.3317
@ trend	0.043810	6.368046***
@ trend ²	0.000469	2.611086***
R^2	0.970363	
F-statistics	606.7469	

***significant at 1%

Source: Data analysis (2021).

Table 3: Growth Rates and Direction of Rice Production and Agricultural Output

Variables	Growth rate	Direction of growth
Agricultural Output	4.4%	Acceleration
Rice	4.2%	Stagnation

Source: Data analysis (2021).

Unit Root test

The Augmented Dickey Fuller (ADF) test for unit root was employed to test whether or not a variable is stationary and also determine the order of integration of the variable. The result indicated that the variables were not integrated of order zero and this implies that the variables were not stationary at level form. However, the variables were found to be integrated (Table 4) of order one and became stationary on first differencing. This indicates that the variable exhibit random walk (unit roots) or the future values of these variables do not converge from their past values or their mean are unpredictable.

Table 4: Result of Augmented Dickey-Fuller (ADF) Test

Variable	Level				First difference				Inference
	ADF	1%	5%	10%	ADF	5%	1%	10%	
Agricultural Output	-0.814	-3.736	-	-	-	-	-	-	I (1)
			2.994	2.638	3.814***	3.743	2.951	2.614	
Rice Production	-2.679	-3.736	-	-	-	-	-	-	I (1)
			2.994	2.638	4.773***	3.743	2.951	2.614	

***significant at 1%

Source: Data analysis (2021).

Result of Co-integration Rank Test for the Long Run Relationship among the Variables

According to Engle and Granger (1987), regressing a non-stationary series on another non-stationary series yields spurious regression, but if the linear combination of the series is stationary, we could say the variables are cointegrated and the regression is no longer spurious. Variables are said to be cointegrated if they have long run association. Since our variables are non-stationary, it becomes imperative to test whether or not the variables are cointegrated. To do this, the study adopted the Johansen Co-integration Trace test; the result is presented in Table 5. Further investigation into the series properties of the variables through the use of Johansen co-integration mechanism indicates that co-integration exists among the variables. The result shows that the computed trace statistic (23.773) is greater than the critical value (22.683) at 5% level of significance therefore, co-integration exists among the variables. On this basis, the null hypothesis of none of the hypothesized number of equation(s) is rejected.

Table 5: Johansen co-integration Test for unrestricted co-integration Rank Test (Trace)

Hypothesized No. of CE(S)	Eigen value	Trace Statistics	0.05 critical value	Prob**
None*	0.763	23.773	22.683	0.0118
At most 1	0.243	8.293	10.423	0.4323

*denotes rejection of the hypothesis at the 0.05 level of significance; **MacKinnon-Haug-Michelis (1999) p-values

Source: Data analysis (2021).

Effect of Rice Production on Agricultural Growth in Nigeria

Consequent upon the existence of one co-integrating equation among the variable, implying long run relationship exist among the variables, the Vector Error Correction Model (VECM) was estimated. The result of VECM as shown in Table 5 indicates that in a long run, the coefficient of rice production is rightly signed as expected and statistically significant at 1% probability level. Thus, this implies that a unit increase in rice production will increase agricultural growth by 18.942 units. This shows that rice is a very important crop in Nigeria therefore; its production will inevitably bring about a significant increase in agricultural growth in Nigeria in the long run. This agrees with the studies of 1996 by West African Rice Development Association (WARDA) and Imolehin and Wada (2000) who variously affirmed the importance and contribution of rice production to agricultural growth in Nigeria as it is an important staple food for about half of human race. Similarly, Abah *et al.* (2021) also re-echoed the overwhelming importance of cereal production in agricultural output in Nigeria.

The result of the short run Vector Error Correction Term [VECM (-1)] is positive (0.004) as expected, indicating a slow speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where 0.004 of the disequilibrium is removed immediately in each period). The result shows that the speed of adjustment where rice production will equilibrate agricultural growth in Nigeria is at 0.4% in the short run and statistically significant at 10% probability level.

Furthermore, in the short run, rice production in the first lagged period will increase agricultural growth by 0.343 units *ceteris paribus*. This shows that rice production has a significant effect on agricultural growth both in the short run and long run. The coefficient of multiple determination (R^2) is 46%. This implies that the independent variable is found to explain 46% of the movement of the dependent variable. The remaining 54% can be attributed to the influence of other variables not included in the model.



Table 5: The Vector Error Correction Model of Long and Short-Run Relationship between Rice Production and Agricultural Growth in Nigeria

Long run estimates		
Regressors	CointEq1	
Agricultural growth	1.000000	
Rice production	18.942 (8.292***)	
Constant	-281.998	
Short-run estimates:		
Error correction model	Agricultural growth model	Rice production model
CointEq1	0.004 (1.669*)	0.003 (-1.717*)
Agricultural growth-1	0.363 (2.188**)	-0.186 (-1.135)
Rice production-1	0.343 (2.686**)	0.149 (1.183)
Constant	0.252 (2.683**)	0.019 (2.159)**
R ²	0.459	
Adjusted R ²	0.406	
F-statistics	8.112	
Likelihood	-501.871	
Akaike Information Criteria	27.885	
Schwarz Criteria	28.495	

Figures in parentheses are t-values, *significant at 10% ** significant at 5%

Source: Data analysis (2021).

CONCLUSION AND RECOMMENDATIONS

The study assessed the effect of rice production on agricultural output in Nigeria (1981-2021). The study revealed that, rice production has a positive and significant relationship with agricultural output in Nigeria both in the short run and in the long run. This implies that the more rice is been produced in Nigeria, the more the improvements in the performance of agricultural growth in Nigeria. Also, the trend of rice production and agricultural output in Nigeria has been experiencing an appreciable level of increase over the years. The study therefore, recommended that:

1. Conscious effort must be made to increase rice production level geometrically so as to maintain pace with the rapid population growth if food security is to be ensured in Nigeria.
2. Government should encourage the use of modern mechanized farm tools, and subsidize the prices of agro-chemical and fertilizer for farmers in order to improve rice production in the country and to encourage soil conservation methods.
3. Policies and laws enacted to restrict rice importation should be sustained while policies aimed at increasing local production of rice should be encouraged and pursued with all vigour so as to boost agricultural output in Nigeria.

REFERENCES

- Abah, D. and Ochoche, O. C. (2021). Trend Analysis of Wheat Production in Nigeria (1981-2018): Impact on Agricultural Output. *International Journal of Advances in Engineering and Management (IJAEM)*, 3(3): 871-878.
- Abah, D., Ochoche, C. O. and Hundu, I. S. (2021). Contribution of cereal crops production to agricultural output in Nigeria (1981-2020): An econometrics analysis. *International Journal of Agricultural Economics, Management and Development (IJAEMD)*, 9(1): 14-27.



- Adekanye, D. O. (1993). Public Enterprises Reforms in West Africa: Issues and Research Agenda". *Res. Dev.*, 11(1&2): 13-24.
- Balami, D. H., Ogboru, I. and Talba, D. M. (2011). *The Cereal Economy in Nigeria and the Sub- Regional Dimension. SSSG Series 1 (29)*. Benue State University. Destiny Ventures. Makurdi.
- Central Intelligence Agency [CIA] (2009). *The World Fact Book*. Available online at <http://www.cia.gov/library/publications/the-world-factbook/goes/ni.html>.
- Food and Agricultural Organization [FAO] (2001). *The state of food insecurity in the world, 2000*.
- Food and Agricultural Organization [FAO] (2002). *FAO Rice Conference 2002*. Accessed Online at www.fao.org
- Imolehin, E. D. and Wada, A. C. (2000). *Meeting Rice Production and Consumption Demand of Nigeria with Improved Technologies*. International Rice Commission Newsletters: Vol. 49 FAO Rome
- Isah, M. A., Samuel, E., Makama, S.A. and Kiresur, V. R. (2015). Trend of Area, Production and Productivity of major cereals: India and Nigeria Scenario. *Research Journal of Agriculture and Forestry Sciences*, 3(2): 10-15.
- Kolawale, O. and Ojo, S. O. (2007). Economic efficiency of small scale food Crop production in Nigeria. *Journal for Social Sciences*, 14(2): 123-130.
- MaiKasuwam, M. A. (2013). Trend Analysis of Area and Productivity of Sorghum in Sokoto State, Nigeria, 1993-2012. *European Scientific J. June*, 2013 Edition, 9(16):69-75.
- NEARLS (1996). *Prospects and problems of the 1996 Cropping season*. Research Report of the National Agricultural Extension Research and Liaison Services (NEARLS) and Agricultural planning Monitoring and Evaluation Unit (APMEU). A.B.U. Zaria.
- NPC (2006). *National Population Commission Census*. National Economic Census Board, 2006, Abuja, Nigeria.
- Okoruwa, V. O., Ogundele, O. O. and Oyewusi, S. O. (2006). *Efficiency and Productivity of Farmers in Nigeria: A Study of Rice Farmers in North Central Nigeria*. Poster Paper Prepared for Presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia; August 12-18, 2006.
- Onu, D. O., Obike, K. C., Ebe, F. E. and Okpara, B. O. (2015). Empirical assessment of the trend in rice production and imports in Nigeria (1980 – 2013). *International Research Journal of Agricultural Science and Soil Science*, 5(6): 150-158.
- Rahji, M. and Adewumi, M. O. (2008). Market Supply Response and Demand for Local Rice in Nigeria: Implications for Self Sufficiency, *Central European Agriculture Journal*, 9(3): 567-574.
- Singh, B. N., Fagade, S., Ukwungwu, M. N., Williams, C. and Jagtap, S. S. (1997). Rice Growing Environments and Biophysical Constraints in different Agroecological Zones of Nigeria. *Metropolitan Journal*, 2: 35-44.
- Soyibo, A. and Olayiwola, K. (2000). *'Interest rate Policy and the Promotion of Savings Investment and Resource Mobilisation in Nigeria'*. Research Report 24, Development Policy Centre, Ibadan.
- Tahir, H. M. (2014). Trend Analysis of Productivity of Some Selected Cereal Crops in Nigeria: 1983-2008. *Research on Humanities and Social Sciences*, 4(8):110-116.
- Udemezue, J. C. (2018). Analysis of Rice Production and Consumption Trends in Nigeria, *Journal of Plant Sciences and Crop Protection*, 1(3): 305-316.
- West African Rice Development Association [WARDA] (1996). *Rice Trends in Sub-Saharan African*. 2nd (edn). WARDA, Bouake.