



**IMPACT OF FOREIGN AGRICULTURAL AID ON CROP PRODUCTION OUTPUT IN
NIGERIA**

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ABSTRACT

The study analyzed the effect of Agricultural Aid on Crop output in Nigeria using time series data from 1991-2018. The level of stability of crop output, official development assistance to agriculture, loans from commercial banks, fertilizer consumption and climate change, Vector auto-regression analysis, Granger causality relationship and variance decomposition analysis were analyzed. Data generated were analyzed using a modified time series regression analysis and Augmented Dickey Fuller test. The unit root test revealed that there was unit root which means that at levels the variables were not stationary but stationary at the first difference. About 96.6% of the variation in crop output is explained by official development assistance, total domestic loans by commercial banks to agriculture, fertilizer consumption and carbon emission. The result reveals that official development assistance to Nigerian agriculture had a positive relationship with crop output, but there is an inverse relationship between total domestic commercial loans to agriculture and crop output. Granger causality test indicated a unidirectional causality between commercial loans and climate change and the result further indicated a bi-directional relationship between ODAA and CC (climate change) to crop output in the country. The variance decomposition analysis result in the long run suggest that innovation to crop output steadily reduces to 47%, while shock to agricultural ODA (24%), loans (2%), fertilizer consumption (14%), and climate change (13%) can cause fluctuation in crop output. This implies that agricultural ODA, fertilizer consumption and climate change are the major determinants of crop output in Nigeria. It was recommended that donor agencies should increase agricultural aid for agricultural production. Nigerian government should implement policies that ensure proper use of aid to agriculture.

Keywords: Agricultural, Aid, Foreign, Nigeria and Production

INTRODUCTION

Official Development Assistance (ODA), commonly known as foreign aid is a flow of financial resources from developed countries to developing countries on development grounds (Moreira, 2005; Leeson, 2008). It is an international transfer of public funds in the form of loans or grants either directly from one government to another (bilateral) or indirectly through multilateral assistance agency such as International Monetary Fund and World Bank (Radelet, 2006; UNCTAD, 2006; OECD, 2009).

Similarly, Development Assistance Committee (DAC) defines ODA as grants or loans to developing countries and multilateral agencies active in development that are undertaken by the official sector at concessional terms, with the promotion of economic development and welfare as the main objective. Technical cooperation is also included in aid. Grants, loans, and credits to be used in military purposes are excluded (OECD, 2009). Official development assistance (ODA) or foreign aid has been an important economic growth factor throughout history (Yiew and Lau, 2018). According to Niyonkuru (2016), ODA provides assistance to countries' development. These aids may include social infrastructure and economic infrastructure, services' aid and



production sector's aid. Social infrastructure in this case includes education, water supply and sanitation, all with the aim to improve human development and eventually contribute to long-term sustainable economic growth (Addison and Tarp, 2015). Besides, economic infrastructure aid does improve energy, transport and communications systems in the recipient countries. On the other hand, production sector's aid is aimed for agriculture, forestry and fishing, industry, mining and construction, trade and tourism. It may also attract FDI flows which further contribute positively to the growth.

Foreign aid to developing countries like Nigeria (under \$5 billion in 1960 to \$50 billion in 2000 and to over \$128 billion in 2008) (OECD, 2009) from time to time, there are controversies about aid effectiveness which go back to decades. There are two in general but contending schools of thought with regard to the effectiveness of aid in spurring economic growth in the third world (Gebhard *et al.*, 2008). Research results on the macroeconomic impacts of foreign aid in developing countries are ambiguous. Some studies concluded that this relationship was negative; others concluded it was positive, and others found no relationship at all. Several studies have noted that foreign aid has a positive effect on the economic growth of poor countries (Chenery and Strout, 1966; Burnside and Dollar, 2000; Lohani, 2004). Odusanya *et al.* (2011) carried out studies on the impact of foreign aid and public expenditure on economic growth in Nigeria. Their result reveals that foreign aid and public expenditure impact positively on the economic growth with foreign aid indicating a very significant impact on growth. They conclude that foreign aid can have positive effect on economic growth, through public expenditure if properly channeled to the productive sectors of the economy. They used static framework in carrying out their studies. Their conclusions may be incorrect because the economic agents associated with aid administration are dynamic. Also, they did not disaggregate the GDP into different sector levels for the sectorial level study they have conducted.

Few studies have attempted to determine the effect of foreign aid on agriculture in Nigeria (Verter, 2017). Even though there are many studies about the effect of foreign aid on economic growth, in general, research on the effect of aid on agriculture, especially in Nigeria is still scanty. Against this background, this study is an attempt to determine the effect of agricultural foreign aid on crop production in Nigeria. The objective of the study is to analyze the effect of foreign agricultural aid on agricultural production in Nigeria from 1991 – 2018.

MATERIALS AND METHODS

The Study Area

The study area is the Federal Republic of Nigeria. And it is situated at the western coast of Africa. The Federal Republic of Nigeria, with an area of 923,769 square kilometers (made up of 909,890 square kilometers of land area and 13,879 square kilometers of water area), is situated between 4° and 14° North Latitude and Longitude 3° and 14° East of the Greenwich meridian. The country is bordered on the west by the Republics of Benin and Niger; on the east by the Republic of Cameroon; on the north by Niger and Chad Republics and on the south by the Gulf of Guinea. Nigeria has a land mass of 910,768sq km while water occupies 1,300sq km.

The data used for this study are mainly secondary in nature. Time series data for the period between 1991 and 2018 were obtained from Food and Agriculture Organization of the United Nations (FAO), and Central Bank of Nigeria statistical bulletins. The data for the study were analyzed using Augmented Dickey Fuller Test. Dickey-Fuller add lagged dependent variables to the test equation to remove distortions to the level of statistical significance thereby lowering the power of the test to detect a unit root when one is present.

Analytical Technique

To determine the effect of foreign aid on agricultural (crop) production in Nigeria, multiple regression model was used which was specified as follows:

$$NAP = \beta_0 + \beta_1 ODA + \beta_2 TDCLA + \beta_3 FER + \beta_4 CC + \varepsilon \quad \dots(1)$$

Where:

NAP = the net agricultural (crop) production. Agriculture and crop production are used interchangeably in this present study.

ODA = the official development assistance (actual disbursement flows, US\$) to support agricultural production to address food security issues, farmers' income and the general wellbeing of producers in Nigeria.

TDCLA = growth rate of total domestic commercial loans to agriculture (%) given to farmers by Commercial Banks in Nigeria;

FER = fertilizer consumption (tonnes);

CC = climate change (CO₂ emissions) on agricultural soils, measured in gigagrams;

$\beta_1 \dots \beta_4$ = coefficients of each variable in the model; and ε represents the error term.

Four functional forms of multiple regression that were tried to select the best fit based on statistical, economic and econometric criteria. The functional forms are: linear function, exponential function, semi-log function and double log function.

$$\text{Linear function: } Y = \beta_0 + \beta_1 T_{it} + \beta_2 R_t + \beta_3 AP_t + \beta_4 S_t + \beta_5 nCO_{2t} + \varepsilon_t \quad \dots(2)$$

$$\text{Semi-log: } \ln Y = \beta_0 + \beta_1 T_{it} + \beta_2 R_t + \beta_3 AP_t + \beta_4 S_t + \beta_5 nCO_{2t} + \varepsilon_t \quad \dots(3)$$

$$\text{Exponential: } Y = \ln \beta_0 + \ln \beta_1 T_{it} + \ln \beta_2 R_t + \ln \beta_3 AP_t + \ln \beta_4 S_t + \ln \beta_5 nCO_{2t} + \varepsilon_t \quad \dots(4)$$

$$\text{Double-log: } \ln Y = \ln \beta_0 + \ln \beta_1 T_{it} + \ln \beta_2 R_t + \ln \beta_3 AP_t + \ln \beta_4 S_t + \ln \beta_5 nCO_{2t} + \varepsilon_t \quad \dots(5)$$

Unit root test

To avoid reporting spurious regression findings, the study examined each series of the variables for evidence of non-stationarity in order to confirm that co-integration approach is the appropriate tool (Bonsu *et al.*, 2011). The null hypothesis is normally stated as the presence of a unit root and the alternative hypothesis is stationarity. The ADF equation estimated by OLS is rooted in a model with a constant as follows:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum Y \Delta Y_{tj} + e_t; \quad \dots(6)$$

Where, Y_t = series tested

ΔY_t = first difference of Y_t

δ = test difference coefficient

j = lag length chosen for ADF

e_t = white noise

t = time or trend variable

The significance of δ was tested against null hypothesis (H_0), $\delta=0$ and alternative hypothesis, $\delta<0$. If we do not reject the null hypothesis, the series is non-stationary. Hence the hypothesis of non-stationarity cannot be rejected, each of the variables was differenced until they became stationary (that is significant at 5% level). At this point, the existence of a unit root was rejected.

RESULTS AND DISCUSSION

Unit root test was carried out for the ODA, TDCLA, FER and CC. The result in Table 1 revealed that at level, all the variables with p-values of 0.6837, 0.4950, 0.4950 and 0.5877 were not significant at 5% respectively because the p-values are more than 5%. The null hypothesis was therefore accepted because the four variables were not stable. To make them stable or stationary,

their first difference was taken and the p-values for their coefficients were significant at 5% meaning that the null hypothesis for the four variables were rejected meaning there was no unit root.

Table: 1 Unit root test Results

Variable s	Levels		Trend and intercept		First Diff	intercept		Trend and intercept		Order of integration
	ADF	p-values	ADF	p-values		ADF	p-values	ADF	p-values	
ODAA	-0.953	0.7549	-1.785	0.6837		-6.805	0.0000	-6.978	0.0000	I(1)
TDCLA	-1.631	0.4531	-2.153	0.4950		-6.806	0.0000	-6.841	0.0000	I(1)
FER	-2.481	0.1308	-2.308	0.4951		-6.334	0.0000	-7.185	0.0000	I(1)
CC	-0.839	0.3425	-1.976	0.5877		-6.237	0.0000	-6.287	0.0000	I(1)

Source: Field Survey (2022)

The effect of Foreign aid on Crop output in Nigeria.

The result in Table: 2 shows that, the coefficient of multiple determinations is 0.9600 indicating that about 96% of the variation in crop output is explained by official development assistance, total domestic loans by commercial banks to agriculture, fertilizer consumption and carbon emission. The result reveals that official development assistance to Nigerian agriculture had a positive relationship with crop output at 1% level of significance and the result corresponds to the work by Verter (2017). But there is an inverse relationship between total domestic commercial loans to agriculture and crop output and the result disagrees with the work of Verter (2017). However, this could be attributed to the bottlenecks involved in accessing loans in Nigeria, also high interest rates discourage farmers from getting loans for agricultural production (Verter and Bečvářová, 2015). Fertilizer consumption is not significant but has an inverse relationship with crop output, meaning that 1% increase in fertilizer application will result in the decrease in the output of crops by 0.11%. This result does not correspond to Ammani *et al.* (2010), who also find out that fertilizer can increase agricultural production. Carbon dioxide emissions has a negative relationship with crop output at 1% level of significance and 1% decrease in carbon dioxide emissions will bring about 91.42% decrease in the output of crops in Nigeria, this result also agrees with the work of Seguin and de Cortazar (2005), that increase in Carbon dioxide emissions will bring reduction in agricultural production.

Table: 2 Determinants of crop output in Nigeria from 1991-2018

Variables	Linear	Semi-Log	Double-Log	Exponential
Cons	101758.9***	13.01857***	-29606.27***	0.686137***
ODAA	13.71099***	0.000522***	106638.7***	0.406476***
TDCLA	-37774.55***	-1.514668***	-741169.8***	-0.284600***
FER	0.002366	-3.77E-07	488.9079	-0.001101
CC	-19.26178***	-0.000991***	-17903.73***	-0.914174***
R ²	0.966051	0.964971	0.957443	0.963041
Adj R ²	0.960146	0.958879	0.950042	0.960001
F-statistics	163.6200	158.3998	129.3637	149.8292
Prob (F-stat)	0.000000	0.000000	0.000000	0.000000
DW	1.877274	1.797384	1.788822	1.834505

Source: Field Survey (2022) ***, **, * = significant at 1%, 5% and 10% level respectively

The results in Table 4 shows that there is a positive relationship between the average annual ODAA and crop production in the current year and the second year, confirming that increase in official Developing Assistance is essential in enhancing agricultural production. This finding is expected and is in agreement with the findings of Izuogu and Atasi (2015) that donors have contributed substantial finance to support Nigeria's efforts aimed at improving agricultural production, food security, and exports. Furthermore, a 1% increase in annual average ODAA also increases agricultural production by 23% and 28% in the current and second years respectively, based on the coefficients of the ODAA. The TDCLA has a negative relationship with agricultural production in the second year. This finding shows that an increase in TDCLA decreases agricultural production by 24.9%. This result agrees with the findings of Alabi (2014) who report that, the financial institutions in Nigeria, always demand high-interest rates and collateral security, which screen out most of the smallholder rural farmers. Carbon dioxide emissions has negative significant relationship with agricultural production in the first year. A 1% increase in carbon dioxide emissions will decrease agricultural production by 67% based on the coefficient of CC and the result agree with the study conducted by van Leeuwen and Darriet (2016) show that climate change shocks might substantially reduce yields and total output from rain-fed agriculture in some countries.

Table 4: VAR model results

Variables	NAP	ODAA	TDCLA	FER	CC
NAP (-1)	-0.176503 (0.39108) [0.39108]	-0.134466 (0.06181) [-2.17552]**	-4.90E-05 (2.5E-05) [-1.93567]	-3.440681 (6.08452) [-0.56548]	0.003556 (0.00660) [0.53840]
NAP (-2)	0.307237 (0.33012) [0.93067]	-0.136491 (0.05217) [-2.61605]**	-5.43E-05 (2.1E-05) [-2.53674]**	10.13994 (5.13612) [1.97424]**	0.015328 (0.00557) [2.74939]**
ODAA (-1)	10.16986 (5.10557) [1.99191]**	2.308963 (0.80692) [2.86147]**	0.000700 (0.00033) [2.11466]**	85.64695 (79.4333) [1.07822]	0.042825 (0.08622) [0.49669]
ODAA (-2)	3.257938 (7.08238) [0.46001]	2.826285 (1.11934) [2.52495]**	0.001061 (0.00046) [2.31144]**	-106.2610 (110.189) [-0.96435]	-0.239759 (0.11960) [-2.00461]**
TDCLA (-1)	-25251.61 (14798.1) [-1.70641]	-5862.733 (2338.78) [-2.50675]**	-1.724563 (0.95883) [-1.79862]	-251206.3 (230231.) [-1.09111]	-32.29233 (249.903) [-0.12922]
TDCLA (-2)	-8180.224 (18026.8) [-0.45378]	-6253.116 (2849.06) [-2.19480]**	-2.492257 (1.16803) [-2.13373]**	325163.8 (280463.) [1.15938]	564.0762 (304.427) [1.85291]
FER (-1)	-0.021517 (0.01494) [-1.44069]	0.001723 (0.00236) [0.72978]	9.94E-07 (9.7E-07) [1.02710]	0.454062 (0.23237) [1.95406]	-0.000137 (0.00025) [-0.54456]
FER (-2)	-0.004236 (0.01934) [-0.21909]	0.001050 (0.00306) [0.34366]	3.72E-08 (1.3E-06) [0.02973]	0.202212 (0.30083)2 [0.67217]	-4.06E-06 (0.00033) [-0.01244]
CC (-1)	6.323442 (12.5428) [0.50415]	-0.153972 (1.98234) [-0.07767]	9.30E-06 (0.00081) [0.01144]	-23.93907 (195.143) [-0.12267]	0.670389 (0.21182) [3.16495]**
CC (-2)	7.847086 (13.9199) [0.56373]	5.752086 (2.19999) [2.61460]**	0.002018 (0.00090) [2.23791]**	-88.49665 (216.568) [-0.40863]	-0.093549 (0.23507) [-0.39796]

Source: Field Survey (2022) **Notes:** ** and * indicate 5% and 10% significant levels
Standard error in () t-statistics in []

Variance Decomposition Analysis Results (VDA)

The Variance Decomposition Analysis (VDA) tells us how much of a change in a variable is due to its own shock and how much is due to shocks of other variables. Usually, for the initial period, it is due to own shock, however, as the lagged variables' effect starts manifesting, the percentage of effect of other shocks increases over time. VDA results for the variables over a 10-year horizon are presented in Table 5-8. In this study, short run means in the fifth period or year, while long run means in the tenth period or year. The results show that in the short run, the impulse to crop output accounts 57% variation in the fluctuations to its own shock. Similarly, innovation to agricultural ODAA (19%), domestic loans (2%), fertilizer consumption (16%), and climate change (4%) can cause the fluctuation in crop output in the short run (Atayi *et al.*, 2020). In the long run, the results further suggest that innovation to crop output steadily reduces to 47%, while shock to agricultural ODAA (24%), loans (2%), fertilizer consumption (14%), and climate change (13%) can cause fluctuation in crop output. This implies that agricultural ODAA, fertilizer consumption and climate change are the major determinants of crop output in Nigeria.

Table 5: Variance Decomposition of NAP Period

Period	SE	NAP	ODAA	TDLA	FER	CC
1	1603.37	100.0000	0.000000	0.000000	0.000000	0.000000
2	1933.651	75.76774	10.83784	3.316618	9.515970	0.561828
3	2285.781	72.04174	10.68221	2.923495	13.00743	1.345119
4	2491.786	60.64089	17.69460	2.743695	15.80402	3.116798
5	2558.934	57.16490	19.33092	2.643276	16.29020	4.570709
6	2696.178	52.72314	21.94700	2.495309	16.03965	6.794904
7	2745.847	50.98431	22.67901	2.407054	15.63728	8.292348
8	2792.625	49.30171	23.49546	2.341816	15.16457	9.696438
9	2832.854	48.37504	23.85785	2.769380	14.76519	10.72498
10	2879.413	47.51884	24.24683	2.204268	14.40554	11.62452

Source: Field Survey (2022)

Variance Decomposition of ODAA Period

The results in Table 6 show that in the short run, the impulse to agricultural ODAA accounts 52% variation in the fluctuations to its own shock. Similarly, innovation to crop output (11%), commercial loans (8%), fertilizer consumption (20%) and climate change (9%) can cause fluctuation in crop output in the short run. In the long run, the results further suggest that innovation to sluggishly reduce to 43%, while shock to crop output (12%), commercial loans (6%), fertilizer consumption (28%) and climate change (11%) can cause fluctuation in agricultural ODAA. This VDA result suggests that even though agricultural production explains the variation in ODAA, it is still minimal as ODAA substantially accounts for its own shock in the long run (Verter, 2017).

Table 6: Variance Decomposition of ODAA Period

Period	SE	NAP	ODAA	TDCLA	FER	CC
1	253.4065	12.14475	87.85525	0.000000	0.000000	0.000000
2	286.8133	9.762049	77.91578	10.01654	2.290497	0.015140
3	351.6821	6.500117	72.11927	11.60809	1.734778	8.037742
4	379.8460	8.652468	64.74974	9.951901	8.700269	7.945620
5	425.6046	11.23194	52.90244	8.296978	20.49446	7.074178
6	452.1188	9.954820	48.55617	7.691390	26.62043	7.177192
7	471.7185	10.91293	45.65110	7.338053	28.66269	7.435228
8	486.1945	10.97194	44.42363	6.912248	30.18244	7.509740
9	500.6560	11.51724	43.82417	6.618644	30.46107	7.578872
10	519.4187	12.94394	43.67094	6.593860	28.80126	7.990004

Source: Field Survey (2022)

Variance Decomposition of TDCLA Period

The results in Table 7 shows that in the short run, the impulse to commercial loans account 8% variation in the fluctuations to its own shock. Similarly, innovation to crop output (27%), agricultural ODAA (36%) (Ngobeni and Chiedza, 2022), fertilizer consumption (21%) and climate change (8%) can cause fluctuation in commercial loans in the short run. In the long run, the results further suggest that innovation to commercial loans steadily reduces to 7%, while shock to crop output (25%), agricultural ODAA (33%), fertilizer consumption (27%) and climate change (8%) can cause fluctuation in commercial loans.

Table 7: Variance Decomposition of TDCLA Period

Period	SE	NAP	ODAA	TDCLA	FER	CC
1	0.103889	43.31092	54.50808	2.180991	0.000000	0.000000
2	0.115096	38.40078	50.28105	7.029312	4.288516	0.000343
3	0.134215	28.25085	50.60551	10.65645	3.326058	7.161133
4	0.142056	27.50108	46.06410	9.669196	9.619308	7.146324
5	0.159552	27.63398	36.90344	8.556769	21.00934	5.896465
6	0.167245	25.16702	34.30570	8.103811	26.62201	5.801469
7	0.173015	25.80912	32.68262	7.947874	27.58964	5.970751
8	0.176554	25.47905	32.19469	7.632793	28.73301	5.960459
9	0.180067	25.18619	32.30773	7.388961	29.15167	5.965441
10	0.185284	25.67880	32.77146	7.443561	27.83001	6.276169

Source: Field Survey (2022)

Variance Decomposition of FERTILIZER Period

Also, the results in Table 8 show that innovation to fertilizer consumption reduces to 63%, while crop output (15%), agricultural ODAA (14%), commercial loans (4%), and climate change (4%) can cause fluctuation in fertilizer consumption in the long- run. This implies that finance (ODAA, loans and climate change) are the major determinant that drives fertilizer application in Nigeria. In Nigeria, a substantial number of smallholder farmers do not have access to finance needed for fertilizer purchase and application in their farms. The VDA results indicate that impulse to climate change reduces to 29%, while crop output (16%), agricultural ODAA (13%), commercial loans (1%), and fertilizer consumption (41%) can cause fluctuation in climate change in the long- run (Edeh *et al.*, 2020). By and large, fertilizer and agricultural ODAA appear to have an effect on crop output.

Table 8: Variance Decomposition of FERTILIZER Period

Period	SE	NAP	ODAA	TDCLA	FER	CC
1	24945.51	0.775969	5.925008	0.000133	93.29889	0.000000
2	28164.36	3.810828	5.049661	1.993977	89.10758	0.037955
3	31938.34	9.016063	6.075267	2.249875	81.42845	1.230343
4	33049.16	8.482673	6.253936	2.154300	81.33951	1.769577
5	35077.31	15.50524	6.264150	3.873288	72.76120	1.596119
6	36121.85	16.56597	8.560768	4.597619	68.61608	1.659565
7	36504.70	16.35243	9.877347	4.557590	67.53673	1.675912
8	37130.03	15.84374	11.77788	4.591008	65.85363	1.933743
9	37741.97	15.50451	13.06660	14.03625	64.20540	2.434361
10	38246.48	15.12597	4.789137	4.721187	63.16541	2.951183

Source: Field Survey (2022)

Diagnostic Test

A serial autocorrelation test was conducted using the residual portmanteau test as shown in Table 9, all probability values are greater than 0.05 level of significance. Therefore, we conclude that there is no autocorrelation problem in the estimated VAR model.

Table 9: Residual portmanteau test for autocorrelations

Lags	Q-Stat	Prob.	Adj. Q-Stat	Prob.	Df
1	12.35015	NA*	NA*	NA*	
2	34.75004	NA*	36.37309	NA*	NA*
3	65.32416	0.5352	69.64493	0.3886	67
4	94.87790	0.7036	102.7809	0.4876	103

Source: Field Survey (2022) *The test is valid only for lags larger than the VAR lag order'

Df is degrees of freedom for (approximate) chi-square distribution

VAR Residual Serial Correlation LM Test

A serial correlation test was also conducted employing the LM test. Table 10 shows that the probability values were all greater than 0.05 (5%). This implies that there is no serial correlation in the model.

Table 10: VAR Residual Serial Correlation LM Test

Lags	LM-Stat	Prob
1	42.87106	0.2002
2	45.27238	0.1383
3	42.49442	0.2115
4	35.77350	0.4793

Source: Field Survey (2022)

VAR Residual heteroscedasticity test

The heteroscedasticity test was conducted using the Breusch–Pagan–Godfrey test. Table 1 shows that the probability value of 0.2139 and probability of chi-square value of 528.9084 are greater than 0.05 (5%). This shows that the model is homoscedasticity. Hence, the diagnostic test revealed that the VAR model used for the study is a good fit and is reliable. The results showed the appropriateness of VAR to model the effects of agricultural climatic aid on agricultural production in Nigeria.

Table 11 VAR Residual heteroscedasticity test

Chi-square	df	Prob
528.9084	504	0.2139

Source: Field Survey (2022)

CONCLUSION AND RECOMMENDATIONS

The result shows that there is a positive relationship between the average annual ODAA and crop production in the current year and the second year and that a 1% increase in annual average ODAA also increases agricultural production by 23% and 28% in the current and second years respectively. Carbon dioxide emissions has negative significant relationship with agricultural production in the first year. A 1% increase in carbon dioxide emissions will decrease agricultural production by 67% based on the coefficient of CC. The following recommendations are hereby made:



- i. Donor agencies according to the findings of the study should increase agricultural aid for agricultural production. Nigerian government should implement policies that ensure proper use of aid to agriculture.
- ii. Interest charged on agricultural loans should be reduced to a single digit so as to aid agricultural production.
- iii. The government of Nigeria and donors should ensure that carbon dioxide emissions are reduced so that agricultural production will be increased.

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