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Effects of Sesame production on economic growth in Nigeria (1981 to 2021)

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ABSTRACT

This study assessed the effects of Sesame production on economic growth in Nigeria. Time series data from the Central Bank of Nigeria Statistical Bulletin (CBN Statistics) and Food and Agriculture Organization Statistics (FAOSTAT) spanning from 1981 to 2021 were used. After conducting the Augmented Dickey Fuller (ADF) and Phillips Perron unit root tests, the variables were all found to be stationary at first difference for Phillips Perron test and a mixture of level and first difference for ADF test. Ordinary Least Squares regression model results revealed that there was a significant positive relationship ($p < 0.01$) between sesame output and Real GDP over the period under study. Consequently, the exchange rate had an inverse significant relationship with real GDP at ($p<0.05$). Furthermore, there was a significant positive relationship between agricultural GDP and sesame output in Nigeria. The study concludes that growth of the sesame industry in Nigeria will boost economic growth and contribute to the growth of the agricultural sector contribution to the Nigerian GDP. Policies necessary to improve the production of sesame are therefore recommended as a way to improve economic growth in the country.

Keywords: Sesame yield; agricultural GDP; OLS regression model

INTRODUCTION

Sesame, also known as Benniseed is an important oil seed crop grown around the world and well sought after in the international market today. It was introduced to Nigeria just after the Second World War though regarded as an oil crop of lesser importance compared to oil palm, cotton, groundnut and cocoa in the 1970s. Sesame is widely grown in Nigeria as a cash crop around the savanna agro – ecological zones, specifically in the central and northern part of the country such as Kano, Jigawa, Benue, Gombe, Plateau, Kaduna, Nasarawa, and Borno States and the Federal Capital Territory (Musa, Abdullahi, Ibrahim & Nekabari, 2022; Garba, Idrisa & Abdulhamid, 2018; Haruna, Ajayi, Aliyu & Namaka, 2015). The sesame industry in Nigeria is the second largest agricultural export earner after cocoa (NBS, 2022; Musa *et al*., 2022; The Guardian, 2019).

The industry is important to Nigeria in several ways. Firstly, it contributes immensely to the diversification of Nigeria's economy and secondly, Sesame cultivation, has become a billion-dollar crop, generating significant revenue alongside oil and gas, reducing the country's over-dependence on petroleum-related revenue. Thirdly, there are valuable

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investment opportunities in the production of sesame. The growth of this crop has attracted investments in agriculture, including the establishment of processing plants, storage facilities, and logistics companies. These investments create a positive ripple effect on the economy (Musa *et al*., 2022). However, the crop is cultivated by small scale farmers with inadequate resources and on relatively poor soils. This challenge leads to an average lower output of 275 kg per hectare in Nigeria compared with 1,083 kg per hectare output in Saudi Arabia and 1, 960 kg per hectare output in Venezuela (FAO STAT, 2021; Ikwuakam, Iyela, & Sangotegbe, 2016; Abubakar, Onyibe & Tologbonshein 1998). In addition, other major challenges curtailing the expansion of the industry in Nigeria are lack of adequate finance and processing plants, hindering the production of high-quality seeds and thereby stifling its potential as a multi- billion-dollar crop (Ayemere & Onyeukwu, 2022; The Guardian, 2019).

Today, enormous market potential exists for sesame due to the high demand for its oil and other products at both the national and international levels. From the sesame industry in Nigeria, approximately 90% of the produce is exported for processing although the crop has the ability to generate 1.5 billion dollars for the Northern States and providing about one million jobs annually (Musa *et al*., 2022). It has wide varieties in Africa though classified into two groups on the basis of its colour - white and brown. The white variety is the food grade type used by bakeries for cuisines and salads while the brown variety is the oil grade grown mainly for the oil.

There has been remarkable growth in sesame production in Nigeria since 1960 to date due to the increasing demand at the domestic and international markets (Haruna and Alhassan, 2005). The demand for sesame is likely to continue to grow considering the growing preference for organic foods and its health benefits. Experts believe that the global demand for the crop is expected to continue to grow at 4.2 per cent compound annual growth rate between 2018 and 2024 (Musa *et al*., 2022). Nigeria can positively key into this opportunity considering her vast arable land and the fact that sesame is drought resistant, requiring almost no fertilizer and relatively easier and cheaper to cultivate than most other cash crops. Sesame production in Nigeria has many advantages which includes direct employment generation, rural development, enhanced rural income and improved livelihood of farming households. The processing plants will supply oil for the food and drug manufacturing industries and cake for livestock and poultry industry. Other forms, such as raw seeds, crushed unrefined and refined oil could be supplied as desired (Musa *et al*., 2022; Veerral Agro Tech, 2019).

Sesame possesses numerous health and industrial benefits ranging from animal feeds to medicine, baking and cosmetics. Awareness about the health benefits when consumed is very low in Nigeria though familiar in many developed countries (Musa *et al*., 2022; The Guardian, 2019). Sesame has exceptional source of high-quality oils; it is stable and free from undesirable fat and flavour components. Its oil possesses natural antioxidants which is important for vital organs of the body such as the heart and liver and also prevents aging. It is also resistant to rancidity therefore it is referred to as the "Queen of vegetable oil". The sesame industry has played a role in poverty alleviation, especially in rural areas. Increased employment opportunities and income from sesame farming have helped lift many households out of poverty (Oyedepo, 2016). Nevertheless, inadequate finance and unfavourable government policies are critical problems facing the industry (Lawal, Omonona & Oyinloye 2011; Omolola, Obayelu & Owuru 2022).

Several past literatures underscore the significance of the sesame production in Nigeria for economic growth. The industry has exhibited substantial growth over the years,

though it faces challenges related to infrastructure, quality control, and limited value addition. Nonetheless, its implications for economic diversification, foreign exchange earnings, poverty alleviation, and investment opportunities are evident. To maximize these benefits and ensure sustained growth, policymakers and stakeholders must address the industry's constraints and promote value addition and quality control measures. A well-developed sesame industry can play a pivotal role in Nigeria's journey toward economic prosperity and resilience (Omonona & Oyinloye, 2011; Gizaki, Madukwe, Iwuchukwu & Eze, 2014; Evbuomwam, 2016; Akande & Olaniyi 2018; Ogunniyi & Ayinde, 2018; Lawal, Evbuomwan, Olokoyo, Adesina & Okoye, 2020; NBS, 2021; FAOSTAT, 2021; Oniah & Edem 2021; Wacal *et al*., 2021; Yahaya, Makinde, Oyediran, Ishaku & Oyewole 2022).

It was against this backdrop, that this study was carried out to ascertain the relationship between sesame output in Nigeria and the country's real GDP. It also specifically seeks to evaluate the effect of sesame output on the share of agricultural GDP.

METHODOLOGY

Data Source

This research was carried out with the use of annual time series data straddling between 1981 and 2021. The data were obtained from FAOSTAT (2021) and CBN Statistics (2021). Data obtained from FAOSTAT include sesame output (tonnes), exchange rate (₦) and value of production per hectare (₦). Other data such as the Agricultural GDP (Agricultural Gross domestic product (₦), Real GDP (₦), Commercial Bank Credit to the Agricultural sector (₦), Inflation rate (%) and Gross Fixed Capital formation (₦) (domestic investment) were obtained from CBN Statistics (2021). Real Gross Domestic Product, Agricultural GDP and Gross Fixed Capital Formation were valued at 2010 annual Constant Basic Prices (in ₦ 'Billions).

Model Specification

Two models were adopted in this study. The first one was used to verify the relationship between Real GDP and sesame output (Yield) aside other variables such as the exchange rate, gross fixed capital formation and the agricultural sector GDP while the second model was used to estimate the relationship between the Agricultural GDP and sesame output, aside other specified variables such as exchange rate, commercial bank credit to the agricultural sector, investment and inflation. The models are specified as follows

The Real GDP was the dependent variable. Other variables were the sesame output, exchange rate, gross fixed capital formation and agricultural sector GDP. The variables were converted to logarithm forms to normalize the data for easy interpretation, after which Ordinary Least Squares regression analysis was used to verify the relationship between the variables.

$$logREALGDP = \gamma_0 + \gamma_1 logSESAY + \gamma_2 logEXCH + \gamma_3 logGFCF + \gamma_4 logAGGDP + \varepsilon t \; .. \text{Eq.1}$$

Where:

$logREALGDP$ = logarithm of Real National GDP (₦ 'Billion).

$logSESAY$ = logarithm of Sesame Yield (Tonnes)

$logEXCH$ =logarithm of Official Exchange rate (₦)
$logGFCF$ = logarithm of Gross Fixed Capital Formation (₦ 'Billions)
$logAGGDP$ = logarithm of Share of Agricultural GDP (₦ 'Billion)

In equation 2, the share of agricultural GDP was the dependent variable while sesame output, exchange rate, commercial bank credit to the agricultural sector, gross fixed capital formation and inflation rate were the explanatory variables. The Ordinary Least Squares multiple regression analysis was also used to verify the relationship between the share of Agricultural GDP and sesame output. The log forms of the data were taken to normalize the data set.

The model is specified as follows:

$$Log\ AGGDP = \gamma_0 + \gamma_1 logSESAY + \gamma_2 logEXCH + \gamma_3\ logCBCA + \gamma_4\ logGFCF + \gamma_5\ INF + \varepsilon \ldots\ldots\ldots \text{Eq. 2}$$

Where:
$logAGGDP$ = logarithm of Share of Agricultural GDP (₦ 'Billion).
$logSESAY$ = logarithm of Sesame Yield (Output in Tonnes)
$logEXCH$ = logarithm of Exchange rate (₦/USD)
$logCBCA$ = logarithm of Commercial Bank Credit to the Agricultural sector (₦ 'Billion)
$logGFCF$ = logarithm of Gross Fixed Capital Formation (₦ 'Billions)
INF = Inflation rate (%)
εt = Error term

RESULTS AND DISCUSSION

Descriptive Statistics

The result of descriptive statistics is presented on Table 1. The study reveals that the mean values of the REALGDP (Real National GDP) and AGGDP (Agricultural GDP) were ₦37,710.48 billion and ₦8,473.15 billion respectively. Mean sesame output over the period of study was 189, 199.70 tonnes while mean value of the Gross Fixed Capital Formation (GFCF) was ₦8,637.71 billion). Maximum sesame yield was produced in 2012 at 994,800 tonnes while the lowest yield was produced in 1983 at 30,000 tonnes. The average value of sesame production per hectare (VALPHA) was ₦275,442.40.

Table 1: Results of descriptive statistics

	Real GDP	Agric GDP	GFCF	EXCH	SESAY	VALPHA	INF
Mean	37710.48	8473.15	8637.71	147.38	189199.70	275442.4	18.94
Median	26658.62	5024.54	8246.21	100.63	73000.00	153000.0	12.88
Maximum	72393.67	18738.41	15789.67	536.91	994800.00	1012730.	72.83
Minimum	16048.31	2303.51	5668.87	49.78	30000.00	85500.00	5.39

Source: Author's computations (Year 2024) from FAO (2021) & CBN Statistics (2021) data sources
Real GDP – Real National GDP
Agric GDP – Agricultural Gross Domestic Product
GFCF – Gross Fixed capital Formation
EXCH – Exchange rate
SESAY – sesame yield/output
VALPHA – Value per hectare
INF - Inflation

Trend Analysis

Figure 1 shows the trend analysis for sesame production from 1960 to 2021. The result reveals sesame output trending upward from 2006 and then peaking at 2012 to fall back in subsequent years. In 2016, sesame production picked up again but dropped in the following years. From figure 1 we deduce that sesame production in Nigeria which peaked in 2012 continued to fall up till 2021.

Figure 2 shows the trend analysis for value of sesame production per hectare from 1960 to 2021. The value of produce per hectare was relatively stable between 1960 and 2006; it started increasing from 2006 while reaching its peak between 2016 and 2019 (Figures 1 and 2).

Trend Analysis of sesame production in Nigeria (Tonnes)

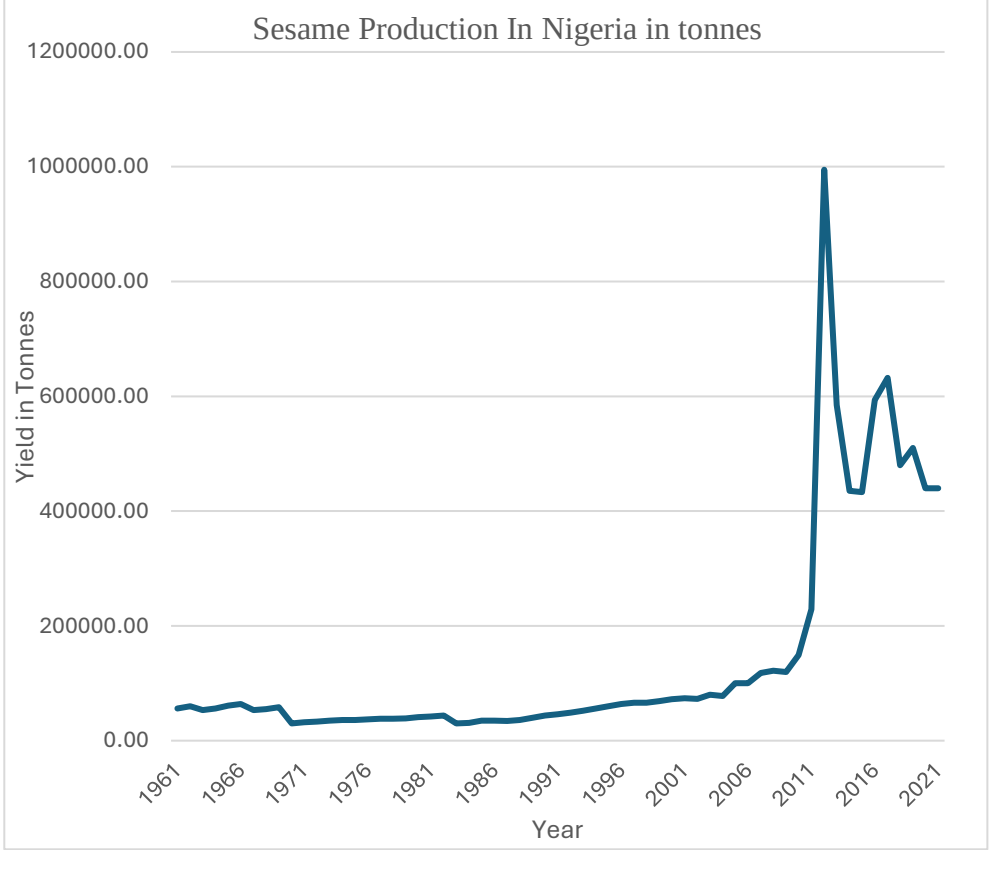

Figure1: Trend analysis showing sesame production in Nigeria from 1960 to 2021 tonnes)
Source; Author's computations, 2024 from FAO (2021) data

Trend Analysis of sesame production in Nigeria (Kg/Hectare)

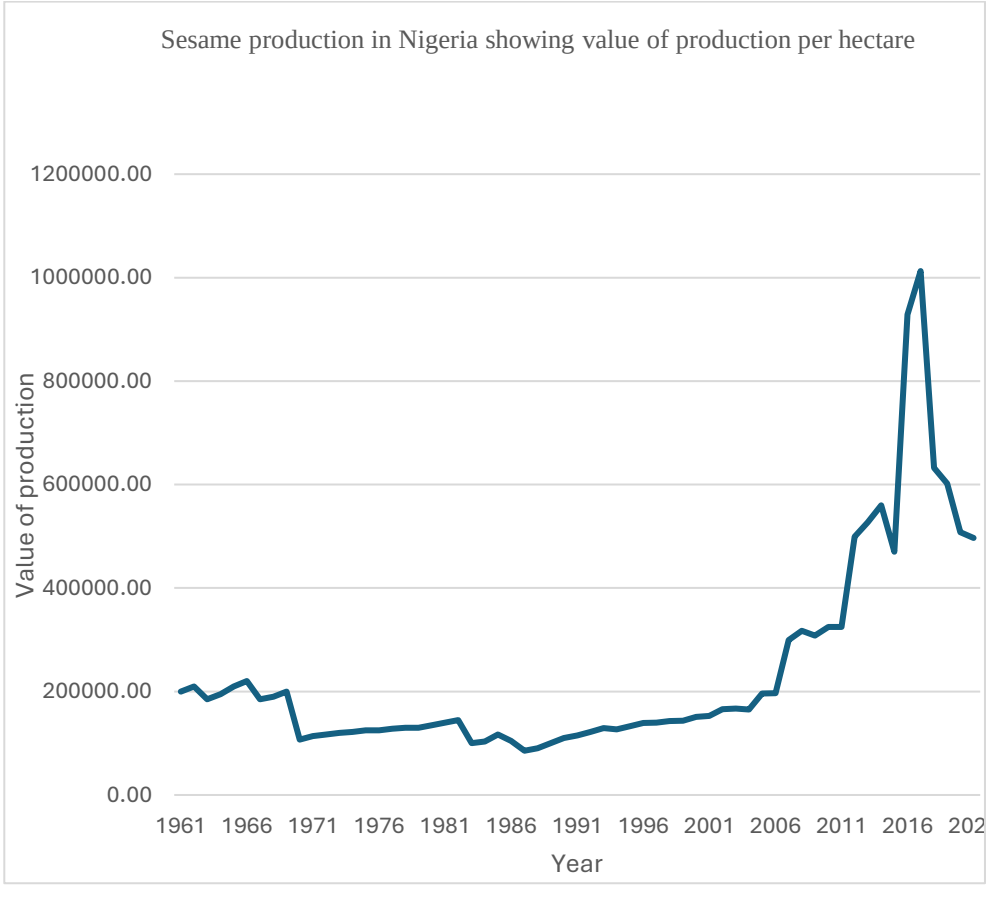

Figure 2: Value of sesame production per hectare (1960 -2021)
Source; Author's computations, Year, 2024 from FAO (2021) data source

Unit Root Test

Augmented Dickey Fuller (ADF) and Phillips Perron unit root tests were carried out to determine if the variables specified were stationary and to determine the most suitable model for data analysis. After the unit root test, all variables were found to be stationary at first difference, that is I (1) for Phillips Perron test while there was a mixture of I (1) and One I (0) stationary variable for ADF test. Since all variables were found to be stationary, we applied Ordinary Least Squares regression model to the data set to determine the relationship among the specified variables. According to literature, OLS can be used to determine the underlying relationship between variables provided the variables are stationary and the assumption of no correlation of the error terms is not violated (i.e. no autocorrelation is not violated). Results of the unit root test are presented in Tables 2 and 3.

Table 2: Phillips Perron unit root test (intercept, linear trend)

Variable	PP Test Statistic	1% Critical Values	5% Critical Values	10% Critical Values	Order of Integration	p-Value
Log REALGDP	-3.7350	-4.2119	-3.5298	-3.1964	I (1)	0.0316
Log SESAY	-7.0797	-4.2119	-3.5298	-3.1964	I (1)	0.0000
Log AGGDP	-5.9269	-4.2119	-3.5298	-3.1964	I (1)	0.0001
Log GFCF	-6.0754	-4.2119	-3.5298	-3.1946	I (1)	0.0001
Log EXCH	-5.8782	-4.2119	-3.5298	-3.1964	I (1)	0.0001
Log CBCA	-7.0906	-4.2119	-3.5298	-3.1964	I (1)	0.0000
INF	10.6988	-4.2119	-3.5298	-3.1964	I (1)	0.0000

Source; Author's computations

Table 3: Augmented Dickey Fuller unit root test (intercept, linear trend)

Variable	ADF Test Statistic	1% Critical Values	5% Critical Values	10% Critical Values	Order of Integration	p-Value
Log REALGDP	-3.8769	-4.2119	-3.5298	-3.1964	I (I)	0.0227
Log SESAY	-6.1388	-4.2119	-3.5629	-3.1964	I (1)	0.0000
Log AGGDP	-5.9269	-4.2119	-3.5298	-3.1964	I (1)	0.0001
Log GFCF	-5.2884	-4.2191	-3.5331	-3.1983	I (1)	0.0000
Log EXCH	-5.74676	-4.2119	-3.5298	-3.1964	I (1)	0.0006
Log CBCA	-7.09056	-4.2119	-3.5298	-3.1964	I (1)	0.0000
INF	-4.10224	-4.2119	-3.5298	-3.1964	I (0)	0.0131
INF	-5.7525	-4.2110	-3.5298	-3.1964	I (1)	0.0001

Source; Author's computations

Effects of Sessame Production on Nigerian GDP

Table 4 shows the results of the Ordinary Least Squares regression model showing the relationship between Real GDP, sesame yield and other explanatory variables. The adjusted R^2 value was 99.28%, the probability of F statistic is significant at 1 % (0.0000) showing that the model is of good fit. Residual diagnostic statistics reveal that the data is stable (Jaque Bera probability of 0.6480). No serial auto correlation and no heteroskedasticity were determined in the model. We then imply that our results are suitable for policy inferences.

Furthermore, results reveal that there is a significant positive relationship ($p < 0.01$) between sesame output and Real GDP over the period under study. Consequently, we deduce that a unit increase in sesame output in Nigeria will increase Real GDP by 9.74%. On the other hand, the exchange rate has an inverse significant relationship with real GDP at ($P<0.05$). Technically, a unit increase in the exchange rate will decrease real GDP by 2.35 %. Furthermore, a unit increase in investment (GFCF) will increase real GDP by 15.10 %. In addition, Agricultural GDP was found to have a positive significant relationship with real GDP at 1 percent level of significance. In a similar study, Haruna (2015) and Garba *et al.*, (2018) also highlighted the positive impact of sesame production on the Nigerian economy.

Table 4: Relationship between real GDP and sesame yield in Nigeria
Dependent Variable: LOGREALGDP

Variable	Coefficient	Standard Error	t-Statistic	P-value
LOGSESAY	0.0974***	0.0191	5.1126	0.0000
LOGAGGDP	0.6393***	0.0386	16.5459	0.0000
LOGGFCF	0.1510***	0.0402	3.7561	0.0006
LOGEXCH	-0.0235**	0.0092	-2.5482	0.0152
C	1.0280	0.1445	7.1154	0.0000
R-squared	0.993490			
Adjusted R-squared	0.992767			
Log likelihood	105.4318			
F-statistic	1373.534			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	1.497634			
Residual Diagnostics	F Statistics	Probability	Decision	
Breusch-Godfrey Serial Correlation Test	1.8529	0.1723	No autocorrelation	
Breusch-Pagan-Godfrey Heteroskedasticity test	0.2913	0.8817	No heteroskedasticity	
Jaque Bera Statistics	0.8677	0.6480	Stable	

Source: Author's computations, 2023 from Data source; FAO, 2021 & CBN Statistics, 2021
***, ** and * represents significance at 1%, 5% and 10%

Regression Results Showing the Relationship between Agricultural GDP and Sesame Yield

Table 5 presents the regression results showing the relationship between agricultural GDP, Sesame yield and other explanatory variables. The result indicates that there is a positive relationship between Agricultural GDP and sesame yield in Nigeria. Specifically, 1 unit increase in sesame yield will contribute about 19.58 % to the share of Agricultural GDP in Nigeria. In a similar study, Garba *et al*. (2018) indicated that adopters of improved sesame seeds obtained higher outputs and by implication higher income thereby contributing more to agricultural GDP.

Correspondingly, commercial bank credit to the agricultural sector has a significant inverse relationship with agricultural GDP. Indicating that a unit increase in commercial bank credit will increase agricultural GDP by 21 %. Exchange rate had a negative effect on agricultural GDP though insignificant. The results also reveal that 1 unit increase in inflation rate will reduce agricultural GDP in Nigeria. Rising inflation is a constant drawback to growth in the agricultural sector.

The model is of good fit with an adjusted R^2 of 93.62 % and a probability of the F – statistic of 0.000000. The results of the residual diagnostic statistics also reveal that there is no heteroskedasticity and no autocorrelation in the model. The probability of the Jaque Bera statistics also show that the data used was stable.

Table 5: Relationship between Agric GDP and sesame yield in Nigeria

Variable	Coefficient	Standard Error	t-Statistic	Prob.
Log SESAY	0.1958**	0.0758	2.5844	0.0141
Log CBCA	0.2095***	0.0351	5.9708	0.0000
Log GFCF	0.0951	0.1675	0.5678	0.5738
Log EXCH	-0.0801	0.0600	-1.3348	0.1905
INF	-0.0019**	0.0008	-2.3398	0.0251
C	2.3411	0.5851	4.0015	0.0003
R-squared	0.9442			
Adjusted R-squared	0.9362			
Log likelihood	48.6925			
F-statistic	118.3795			
Prob(F-statistic)	0.0000			
Residual Diagnostics	F- Statistic	Probability	Decision	
Breusch-Godfrey Serial Correlation Test	1.9650	0695	No autocorrelation	
Breusch-Pagan-Godfrey Heteroskedasticity test	1.0372	0.3664	No heteroskedasticity	
Jaque Bera Statistics	0.3634	0.8338	Stable	

Source: Author's computations from the data source; FAO, 2021 & CBN Statistics, 2021
***, ** and * represents significance at 1%, 5% and 10%

CONCLUSION

This study concludes that sesame is a billion-dollar crop with immense potentials to improve the Nigerian agricultural sector and the economy in general. Findings from this study show that the sesame output has significant positive impact on both the agricultural sector and economic growth in Nigeria. The result reveals that 1 unit increase in sesame yield could improve agricultural gross domestic product (GDP) by 19.58%. Consequently, a unit increase in sesame yield could improve economic growth in Nigeria by 9.74%.

Consequently, rising value of the exchange rate and inflation is a drawback to growth of the economy and the Nigerian agricultural sector. Exchange rate was found to have an inverse relationship with agricultural gross domestic product due to the fact that many farm inputs are imported and the constant devaluing value of the naira against the dollar on a yearly basis constitute a problem.

The study recommends effective policies necessary to provide subsidies, loans and other incentives necessary to support farmers and enhance the growth of the sesame industry in Nigeria. Policies necessary to curb the constantly rising inflation rate and stabilize the exchange rate are also recommended. This action will directly impact the agricultural sector and contribute significantly to the Nigerian economy as a whole.

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