International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

Trend Analysis of Wheat Production in Nigeria (1981-2018): Impact on Agricultural Output

Abah, D, and Ochoche, O.C
Department of Agricultural Economics Federal University of Agriculture, Makurdi
P.M.B 2373, Makurdi, Nigeria

Submitted: 10-03-2021 Revised: 27-03-2021 Accepted: 31-03-2021

ABSTRACT: The study assessed the trend of wheat production in Nigeria and it's implication on agricultural output (1981-2018). Time series data obtained from archives of food and Agriculture organization (FAO) and Central Bank of Nigeria (CBN) for a period of (37) years were used in the study. The data collected were analyzed using both descriptive and inferential statistics such as mean, maximum and minimum with graphs, trend models and vector error correction model [VECM] were used. The result of the study revealed that the trend of wheat production has fluctuated tremendously over the 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 wheat production was 3.9% and stagnating while agricultural output was 4.4% and accelerating respectively during the period of study. The result of VECM indicated that in a long run, the coefficient of wheat production is rightly signed with a coefficient of 9.248 as expected and statistically significant at 1% probability level. The result showed that the coefficient of determination (R^2) is 0.43. This implies that 43% of the total variation in agricultural output was explained by wheat production. The result also showed that the F-statistics (10.356) was positive and significant at 1% indicating the overall significance of the model. The study therefore recommended that, there is aneed for a conscious effort by the government, NGOs, Ministry of Agriculture and other relevant agencies to encourage high production of wheat in Nigeria so as to boost agricultural production.

Keywords: Trend, Wheat, Output, VECM, Co-integration

I. INTRODUCTION

Agriculture, in the 1960s, was both the mainstay of the Nigerian economy and the chief foreign exchange earner (Chigbu, 2005); and accounted for well over 80 percent of the export earnings and employment; about 65 percent of the GDP (gross domestic product) and about 50 percent of the government revenue (FGN, 2000). As noted by the Vision 20: 2020, National Technical Working Group (NTWG) on agriculture and food security, agriculture has always played a key role in the nation's economy, currently contributing about 42% of Gross Domestic Product (GDP) as against 13% for Oil & Gas; and employing two thirds of the entire labour force, but, over the past 20 years, value added per capita in agriculture has risen by less than one (1) percent annually (NTWG, 2009).

The competitiveness of agriculture was eroded with the discovery of oil and subsequent neglect of the agricultural sector. However, Oil is a limited asset and subject to unpredictable fluctuation in price; hence a non-sustainable resource. Therefore, its production has a potential ending thus indicating that, since agriculture accounts for a major share of the country's GDP and generates a large amount of employment; Nigeria's strategy for stimulating the growth of non-oil sector should focus on agriculture. And, as Ukeje (2002) observed, Nigeria's enormous resource base if well managed could support a vibrant agricultural sector capable of ensuring the supply of raw materials for the industrial sector as well as providing gainful employment for the teeming population.

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 forestry (0.59%) (Balamiet al., 2011). According to NEARLS (1996), 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. Cereals are a major contributor to agriculture and food security in Nigeria; consisting of about 55 - 60% of subsistent farmers output, and

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

provide incomes as well as form the basis of many a households' diets both in the rural and urban areas (Balamiet al., 2011).

Cereals like Sorghum, Millets, Wheat, Maize and Rice are major staple foods of the most population.These cereals are grown over an area of 98.6 m ha producing 162 m tons (Food and Agriculture Organisation [FAO], 2015). Wheat is one of the most important staple food grains in Nigeria. It is leading cereal food produced, consumed and traded in Nigeria averaging 533 metric tonnes annually representing almost one third of all cereal production (CBN, 2008).

Globally, wheat (Triticumaestivum) is an important industrial and food grain. It ranks second among the most important cereal crops in the world, after rice (Najafi, 2014). It is the most important cereals traded on international markets (FAO, 2009). In Nigeria, wheat is consumed in one form or the other in virtually every home, restaurants and hotels throughout the country. Besides, the crop is the main raw material in the Nigeria flour mills. Its flour is used for making bread, confectionaries, biscuits and other snacks. The offal (residue) is used in the feed-mills in compounding livestock feeds (Ahmed, 2014).

In all African countries, wheat consumption has been steadily increasing during the past 20 years as a result of growing population, changing food preferences and a strong urbanization trend which has led to a growing 'food gap' in all regions, largely met by imports. In 2013 alone, African countries spent over $12 billion dollars to import more than 40 million metric tons of wheat, equating to about a third of the continent's food imports (Harold, 2015).

Considering the growing importance wheat has for food security in Africa, African Union Heads of State endorsed their Agriculture Ministers' endorsement in January 2013, to add wheat to the list of strategic crops for Africa. Africa has the potential to become self-sufficient for wheat, through government commitment, appropriate policies and the contribution of female farmers and young people. This Wheat framework for Africa's Agricultural Transformation Agenda contributes to the goal of greatly reduce Africa's dependency on wheat import and on the long-term make Africa a wheat self-sufficient continent.

The average wheat productivity in SSA is 1.7 tons/ha (FAOSTAT, 2014), nearly 50% below the world average. Yield data from experimental stations and crop models indicate a very high yield potential, among the highest reported for spring wheats. Therefore, the yield gap between yield potential and average farm yields is significant, often greater than 5-fold (Harold. 2015). This yield gap can be filled through use of improved technologies (improved varieties/seeds, agronomic practices, fertilizer and pesticides), and better institutional and market arrangements creating incentives to wheat producers and other actors involved in wheat marketing and processing.

In view of the overriding need to enhance the level of agricultural productivity, particularly of food grains, in the face of increasing population and declining agricultural output/yield in developing countries such as Nigeria, the importance of determining empirically quantitative relationships that provide estimates of changes in current and expected output and yield of wheat and overall agricultural output cannot therefore be overemphasized.

Various scholars have re-echoed the importance of cereal crops in general and wheat in particular in Nigeria such as Maikasuwa(2013) who assessed factors affecting cereal crops in Nigeria; Ahmed et al. (2011) who focused on wheat production and economics, amongst others. However, there is no known study that addressed the trend of wheat production and its corresponding impact onagricultural output in Nigeria hence, the need for this study to fill thisresearch gap.

II. METHODOLOGY

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

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

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 cereal crops productionwere collected from the archives of the Food and Agriculture Organization (FAO).

Analytical Techniques

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

The trend model is given as:

$Yt = Y_0(1+r)^t$……..……..…(1)

Where;

Y_t = Wheat production in year t.

Y_0=Wheat production in the base year.

r = compound rate of growth of Y,

t = time in chronological years.

Taking the natural log of equation (1) to make it linear, it is stated thus

$InYt = In\ Y_0 + tIn(1+r)$ ...……(5)

Substituting in InY_0 with β_1 and $In(1+r)$ with β_2, equation (5) is rewritten as

$InYt = \beta_1 + \beta_2 t$…….…… (2)

Adding the disturbance or error term to equation (6), we obtain

$InYt = \beta_1 + \beta_2 t + Ut$……..…….. (3)

Equation (4) is the growth rate model developed for this study. A semi-log growth model was developed for this study instead of a linear trend model because the point of interest in this study is both absolute and relative in the parameters of interest. The most important parameter in equation (3) is the coefficient of β_2 which is the slope and measures the constant proportion or relative change in Y for a given absolute change in the value of the regressor t. multiplying β_2 by 100 gives the instantaneous growth rate at a point in time.

$IGR = b_2 \times 100$……..…. (4)

Where IGR = Instantaneous growth rate.

b_2 is the least square estimate of the coefficient of β_2, then taking the anti-log of b_2 and subtracting it 1 and then multiplying the difference by 100 will give the compound growth rate (CGR) over a period of time.

$CGR = [antilog\ b_2 - 1] \times 100$……. (5)

If the coefficient of b_2 is positive and statistically significant or negative and statistically significant, there is acceleration or deceleration in the growth respectively. If $b_2$is not statistically significant there stagnation in the growth process.However, if the coefficient of b_2 is not statistically significant, then there stagnation in the growth.

The linear trend analysis model with the form $Q = b_0 + b_1T + e$ and the quadratic model with the form $Q = b_0 + b_1T + b_2T^2 + e$ was also tested to determine the best fit.

RESULTS AND DISCUSSION

Trends of Wheat Production in Nigeria (1981-2018)

Figure 1 presents the trend of wheat production in Nigeria. The result shows that the trend of wheat production in Nigeria ranges between 26000 tonnes and 165000 tonneswith a mean of 67960.45 during the period under study. This can be attributed to the fact that, wheat consumption (and consequently production) has been steadily increasing as a result of growing population, changing food preferences and a strong urbanization trend (Harold, 2015). Specifically, from 1981 to 1984 wheat production was fairly constant but increased sharply from 1984 to 1987. Between 1987 and 1988 there was a drastic decrease in wheat production and continued to decreased till 1993. However, wheat production increased from 1993 to 2000. Between 2000 and 2006 there was a fluctuation in wheat production but increased sharply from 2006 to an all time high in 2010. From 2010 wheat production has been on a downward slide and continued to decrease till 2018. This is in contract with the report of CBN (2008) that the national output of wheat has increased progressively over the years.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

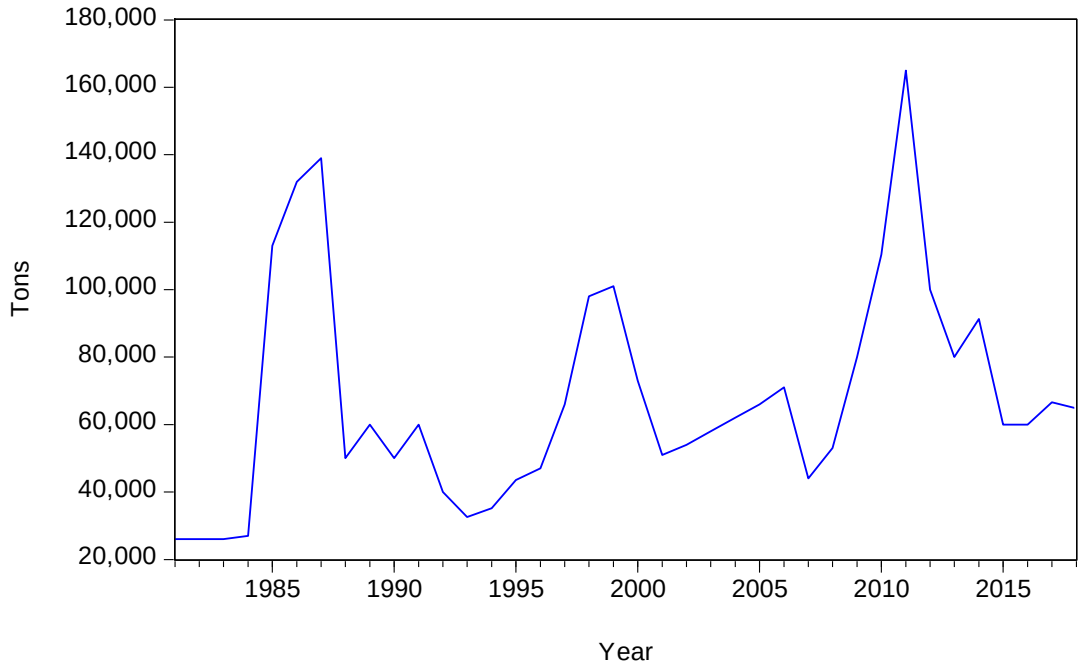

Figure 1: Trends Wheat Production (1981-2018)

Source: Data analysis, 2019.

Trends of Agricultural Output in Nigeria (1981-2018)

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 from 2016 till 2018. This is in line the findings of Kalikume (2015) who asserted that agricultural output in Nigeria has risen substantially over the years, with annual average of 7.4 per cent in the last decade. But the growth has not been inclusive, broad-based and transformational.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

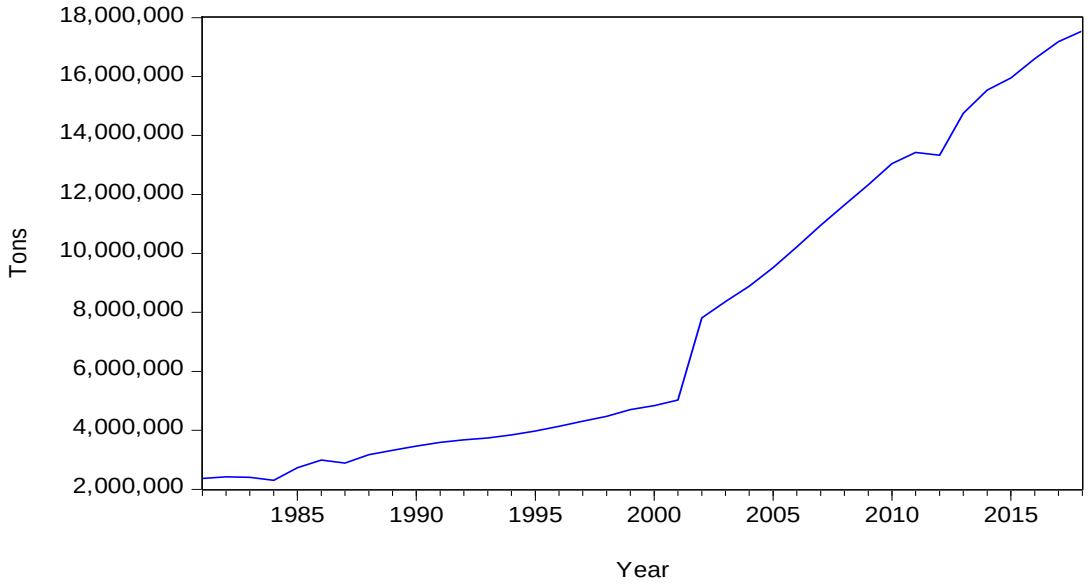

Figure 2: Trends of agricultural output in Nigeria (1981-2018)
Source: Data analysis, 2019.

Growth Rates and Direction of Wheat Production in Nigeria (1981-2018)

The result of the trend analysis of wheat production is shown in Table 1. The trend equation revealed that the growth rate of wheat production was positive which implies a positive growth rate. The coefficient for estimating the growth (0.039) was positive and significant at 10%. The instantaneous growth rate (growth at a point) of wheat production is 3.9% while the compound growth rate is 4.3%.

The direction of growth of wheat production shows that there was stagnation in wheat production over the years. This implies that wheat production had not improved appreciably over the years. This is consistent with the findings FAOSTAT (2014) that theaverage growth rate of wheat production in SSA is low; nearly 50% below the world average.

Table 1. Trend Analysis of Wheat Production

Variables	Coefficient	t-statistics
Constant	10.569	52.39
@ trend	0.0389	1.53*
@ trend^2	-0.0006	-0.88
R^2	0.18	
F-statistics	3.93	

** Significant at 5%
Source: Data analysis, 2019.

Growth Rates and Direction of Agricultural Output in Nigeria

The result of the trend analysis 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 acceleration 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 relativeto annual GDP growth rate.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

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%, ** significant at 5%
Source: Data analysis, 2019.

Table 3. Growth Rates and Direction of Wheat Production and Agricultural output

Variables	Growth rate	Direction of growth
Agricultural Output	4.4%	Acceleration
Wheat	3.9%	Stagnation

Source: Data analysis, 2019.

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 rationale was to overcome the problems of spurious regression. A stationary series tends to always return to its mean value and variations around this mean value. 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 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				
	ADF	1%	5%	10 %	ADF	5%	1%	10 %	Inference
Agricultural Output	-0.814	-3.736	-2.994	-2.638	-3.814***	-3.743	-2.951	-2.614	I (1)
Wheat Production	-2.679	-3.736	-2.994	-2.638	-4.773***	-3.743	-2.951	-2.614	I (1)

*** Significant at 1%
Source: Data analysis, 2019.

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 Cointegration Trace test; the result is presented in Table 4. 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 (40.056) is greater than the critical value (35.192) 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.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 3 Mar. 2021, pp: 871-878 www.ijaem.net ISSN: 2395-5252

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

Hypothesized No. of CE(S)	Eigenvalue	Trace Statistics	0.05 critical value	Prob**
None*	0.763	40.056	35.192	0.0105
At most 1	0.392	23.773	22.683	0.3434
At most 2	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, 2019.

Vector Error Correction Model result for Effect of Wheat Production on Agricultural Output in Nigeria

Given the existence of a co integrating relationship between the variables, implying long run relationship exist among the variables, the Vector Error Correction Model (VECM) was estimated. The result of VECM as shown in Table 6 indicates that in a long run, the coefficient of wheat production is rightly signed as expected and statistically significant at 1% probability level. Thus, this implies that a unit increase in wheat production will increase agricultural output by 9.248 units. This shows that wheat is a very important food grain in Nigeria therefore; its production will inevitably bring about a significant increase in agricultural output in Nigeria in the long run. This is consistent withthe findings of CBN (2008) who posited that wheat production contributes significantly to cereal outputand agricultural production in general in Nigeria

The result of the short run Vector Error Correction Term [VECM (-1)] is positive (0.005) as expected, indicating a quick speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where 0.005 of the disequilibrium is removed immediately in each period). The result shows that the speed of adjustment where wheat production will equilibrate agricultural outputin Nigeria is at 0.5% in the short run and statistically significant at 5% probability level. Moreso, the coefficient of multiple determination (R^2) is 43%. This implies that the independent variable is found to explain 43% of the movement of the dependent variable.

Table 6. The Vector Error Correction Model of long and short-run relationship betweenwheat production and agricultural output in Nigeria

Long run Estimates		
Regressors	**CointEq1**	
Agricultural output	1.000000	
Wheat production	9.248(5.396***)	
Constant	-219.802	
Short-run Estimates		
Error Correction Model	**Agricultural output model**	**Wheat production model**
CointEq1	0.005 (2.269*)	0.004 (-1.827*)
Agricultural output-1	-0.0040 (-0.0713)	-0.186 (-1.135)
Wheat production-1	0.0815 (0.664)	0.149 (1.183)
Constant	0.0121 (2.238**)	0.019 (2.159)**

R^2 = 0.429; Adjusted R^2 = 0.408; F statistics = 10.356 Likelihood 69.908
Akaike Information Criteria -7.663
Schwarz Criteria -7.215
Figures in parentheses are t-values,*significant at 10% ** significant at 5%
Source: Data analysis, 2019.

III. CONCLUSION AND RECOMMENDATIONS

The study used annual time series data for the period (1981-2018) toassess the trend ofwheat production in Nigeria and it's impact on agricultural output.The study revealed that, wheat 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 wheat is been produced in Nigeria, the more the improvements in the performance of agricultural output in Nigeria. Also, the trend of wheat production has fluctuated tremendously while agricultural output has been experiencing an appreciable level of increase over the yearsin Nigeria. The study therefore recommended that:

i. There is need for a consciouseffort by the government, NGOs, Ministry of Agriculture

and other relevant agencies to encourage high production of wheat in Nigeria so as to boost agricultural production.

ii. In order to boost production, government should ensure timely and adequate provision of inputs, provide affordable credit to farmers and fund extension services adequately.

iii. The needed growth in production/productivity of wheatwill continue to be a mirage unless investments in agricultural research and education are maintained or increased.

REFERNCES

[1]. Adekanye, D.O. (1993). Public Enterprises Reforms in West Africa: Issues and Research Agenda". Res. Dev. 11(1&2):13-24.

[2]. Ahmed, E., Sulaiman, J. and Mohd, S. (2011). Wheat Production and Economics. American Journal of Agricultural and Biological Sciences 6 (3): 332-338.

[3]. Ahmed, F. F. (2014). Economics of wheat marketing in Maiduguri metropolis, Borno State, Nigeria. The International Journal of Social Sciences and Humanities Invention, 1(1):1-10, 2014.

[4]. 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.

[5]. Central Bank of Nigeria. (2008). Central bank of Nigeria Statistical Bulletin and Annual Report, 2008.

[6]. Central Intelligence Agency [CIA] (2009). The World Fact Book. Available online at http:www.cia.gov/library/publications/the-world-factbook/goes/ni.html.

[7]. Chigbu, U.E. (2005). Agriculture as the only saviour to Nigeria dyeing economy. http://www.nigerianvillagesquare.com/articles/guest/2005/03/agric-as-only-saviour-to.html.

[8]. FAOSTAT. (2014). Food and Agricultural Organisation Statistical Data Base. http://faostat.fao.org.

[9]. FGN (2008). National Investment Brief. High Level Conference on Water for Agriculture and Energy in Africa: the Challenges of Climate Change, Sirte, Libyan Arab Jamahiriya, December 15-17.

[10]. Food and Agricultural Organisation (FAO) (2015). FAO Statistical Data Base, http://apps.fao.org/

[11]. Food and Agricultural Organizations (2009). Agricultural commodities: profiles and relevant WTO negotiating issues, 2009. Retrieved fromhttp://www.fao.org/docrep/006/y4343e/y4343 e02.htm#TopOfPage.

[12]. Harold, M. (2015). Cereal Crops: Rice, Maize, Millet, Sorghum, Wheat. An action plan for agricultural transformation.

[13]. Kalikume, A. I. (2015). The role of agriculture in economic development. Nigeria Economic Review. 51(4): 556-593

[14]. 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).

[15]. Najafi, A. (2014). Wheat production price performance prediction in the Iranian north province. African Journal of Agricultural Research, 9(1), 74 – 79.

[16]. NEARLS (1996). Prospects and problems of the 1996 Cropping season. (Res. Report) National Agricultural Extension Research and Liaison Services (NEARLS) and Agricultural planning Monitoring and Evaluation Unit (APMEU). A.B. U. Zaria.

[17]. NPC (2006). National Population Commission Census. National Economic Census Board, 2006, Abuja, Nigeria.

[18]. NTWG (2009). Report of the Vision 2020 National technical working group on agriculture and food security. Federal Government of Nigeria, Abuja.

[19]. 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.

[20]. Ukeje, E.U. (2002). "Towards Accelerated industrial crop production: problems and prospects" CBN Bullion, July/ Sept 2002, Vol 26(3), pp 1-2.