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Trend in agricultural growth and cassava productivity in Nigeria (1961 – 2020)

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Abstract

This study analyzed the trend in agricultural growth and cassava productivity in Nigeria (1961 – 2020). Time series on variables of interest were sourced from the Central Bank of Nigeria (CBN) statistical bulletin, the National Bureau of Statistics (NBS), and FAOSTAT. The secondary data obtained were analysed using trend analysis, instability index, compound growth rate model, and the Granger causality test. The results showed that Nigeria's agricultural output generally experienced an upward trend from 1960-2020. The findings also revealed a general increase in the output of cassava produced in an area in the country within the study period. The yield however experienced some relatively stable trend with mild fluctuations and a noticeable decline in 2013. Across the major policy line considered in this study, the pre-SAP era (1961 – 1985) had the lowest mean output, while the SAP and post-SAP era had the highest mean output of 24772.15 and 45181.94 respectively. The values of instability of production and land put under cassava cultivation are more pronounced in Period II [1986–1998] and Period III [1999–2020]. During period I, (Pre – SAP; 1961 – 1985), the compound growth rate (CGR) for production accelerated while yield stagnated with a CGR of 0.2%. In period II, (CGR for production (6.2%) and area (6.3%) for cassava accelerated; both CGR and instantaneous growth rate for yield experienced stagnation. For period III, there was an acceleration in output and area. There was unidirectional causality between production (output) and area under cultivation, agricultural growth and cassava production, agricultural growth and area under cassava cultivation at a 5% level of significance; while area under cassava cultivation and cassava productivity, productivity and area under cultivation exhibited a bi-directional causality at 5% significant level. The findings are compelling reasons for encouraging cassava production for sustainable food production in Nigeria as it is a versatile staple to address food security.

Keywords: Agriculture; Trend; Productivity; Cassava production; Policies and programmes

1. Introduction

Agriculture plays a significant role in Nigeria's economy, contributing substantially to both domestic production and employment. Historically, the agricultural sector was Nigeria's largest source of foreign exchange in the 1960s, as reported by the National Bureau of Statistics (NBS, 2018). Among various sub-sectors, crop production remains crucial for food security, especially with the global population projected to surpass 9 billion by 2050 (FAO, 2020).

Cassava, a staple crop, is particularly important for food security and poverty alleviation in Nigeria. It serves not only as a dietary staple but also holds economic value through its diverse applications, including the production of flour, animal feed, starch, and bio-degradable products (Agricultural Research Council, ARC, 2019). As the world's leading cassava producer, Nigeria accounts for 19% of global production, contributing 34% to Africa's output and 46% to West Africa's cassava production (FAO, 2015). The crop's adaptability to various soil types and extreme weather conditions makes it a reliable food source, especially in sub-Saharan Africa (Philip, 2004). Despite Nigeria's status as the top cassava

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producer, productivity remains low due to challenges such as smallholder farm sizes, limited mechanization, and reliance on family labour.

Despite Nigeria's position as the largest cassava producer globally, the country faces challenges in improving cassava yield per hectare. While the total area under cassava cultivation and production levels have increased significantly over the years, yields remain stagnant, highlighting a lack of technological advancements and resource optimization in cassava farming systems. This issue is particularly concerning as cassava is critical for food security and poverty alleviation in Nigeria, where most of the production is managed by smallholder farmers with limited resources (FAO, 2018).

Moreover, the impact of various policy periods on cassava productivity has not been sufficiently explored. The Structural Adjustment Programme (SAP), introduced in 1986, aimed to transform agriculture from subsistence to commercial-scale production to increase its contribution to GDP. However, the long-term effects of SAP and subsequent policies on cassava production remain under-researched, especially concerning the growth rate of cassava during different policy periods. The need for this study is further amplified by concerns over instability in cassava production, which can lead to price volatility and affect food security (Kronher, 2014; Sulewski & Kłoczko-Gajewska, 2014).

This study, therefore, seeks to analyze the trends in cassava production and productivity in Nigeria over three key policy periods—Pre-SAP, SAP, and Post-SAP—to understand how these policies have influenced cassava farming and to identify strategies for improving cassava yield and stability in the face of increasing food demand.

1.1. Agricultural Production and Productivity in Nigeria

Nigeria has a vast agricultural land area of 70.8 million hectares, predominantly cultivated with crops like maize, cassava, guinea corn, yam, beans, millet, and rice. For example, Nigeria's rice production increased from 3.7 million metric tons in 2017 to 4.0 million metric tons in 2018 (FAO, 2020). Despite this, Nigeria produces only 57% of the 6.7 million metric tons of rice it consumes annually, leaving a deficit of about 3 million metric tons, filled through imports or smuggling. To boost local production, the government banned rice imports in 2019.

Livestock farming remains underutilized, with goats (76 million), sheep (43.4 million), and cattle (18.4 million) predominantly raised by smallholders, particularly in northern Nigeria (FAO, 2020). Poultry farming, with 180 million poultry, also faces a shortfall in domestic supply despite numerous interventions (FMARD, 2017).

Nigeria is the world's largest cassava producer, generating 59 million tons in 2017, accounting for approximately 20% of global production (IITA, 2018). This production holds significant economic potential through both domestic value addition and export revenue, further boosted by improved varieties and agricultural practices.

In Sub-Saharan Africa (SSA), agricultural growth has been positive, with an average annual growth rate of 3.1% since 1991, improving from 0.78% in the 1970s (FAO). However, agricultural productivity in SSA remains low compared to other regions, mainly due to weak national investments in agricultural research and technology, leading to slower adoption of modern technologies (Eicher, 1990; Pardey, Roseboom, and Beintema, 1997).

Agricultural productivity is defined as the ratio of farm output value to the inputs used in production (Olayide and Heady, 1982). Increasing agricultural productivity is essential for improving living standards and national economic growth (Oni et al., 2009). However, productivity remains low in SSA due to underinvestment in research and technology dissemination, unlike in Asia and Latin America, where modern agricultural practices have been widely adopted (Evenson and Gollin, 2003).

Agricultural productivity can be measured through partial productivity measures such as yield (output per hectare) and labour productivity (output per worker), or through total factor productivity (TFP), which considers all inputs like land, labour, and capital (Fuglie and Wang, 2012). TFP growth, often considered a measure of technological progress, is crucial for sustainable agricultural development, particularly as global productivity gaps persist between developing and industrialized nations.

Improving productivity in Nigeria and SSA is critical to ensuring food security and alleviating poverty, as the majority of Africa's population is engaged in agriculture. Increased agricultural productivity can also lower food prices, benefiting urban populations where food costs constitute a large portion of household expenditures (Sahn et al., 1997).

From a macroeconomic perspective, agriculture plays a central role in SSA, contributing 15% of total value added and offering substantial potential for growth, particularly through policy reforms like those implemented during Nigeria's Structural Adjustment Programme (SAP) in the 1980s. These reforms aimed to transform agriculture from subsistence to commercial production and increase its contribution to GDP (Idachaba, 2006). This study is structured around the SAP periods.

2. Methodology

The study area is Nigeria. The longitudinal survey design was adopted for this study. Annual time series data on cassava production, area harvested, productivity (yield), and agricultural growth from 1961 to 2020 was used. The data was sourced from the Central Bank of Nigeria (CBN) statistical bulletin, the National Bureau of Statistics (NBS), and FAO Statistics (FAOSTAT). Time series (secondary) data on cassava production, yield, and land area were collected for a period of sixty years (1961 – 2020). However, the analysis spanned three policy periods. Period I (1961 to 1985 Pre – SAP period), Period II (1986 to 1998 SAP period) and Period III (1999 to 2020 Post – SAP period). The pooled period is the combination of the three periods (1961 -2020).

The secondary data was analysed using descriptive and econometric statistical tools. Trend analysis was used to ascertain the trend in agricultural growth, the trend in area, production, and productivity of cassava in Nigeria during the study period. The instability in the growth of area, production, and productivity of cassava was measured using the instability index. The direction and growth rate in area, production, and productivity of cassava under different policy periods were achieved using a compound growth rate model. The direction of causality between area, production, and productivity of cassava and agricultural growth in Nigeria was achieved using Granger causality test.

The trend equation is given as:

$$Yt = \alpha + \beta t + e \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y = area (ha); production (1000 tonnes); yield (tonnes/ha) α = intercept β = slope/coefficient t = time (year) e = error term

The study adopted the simple coefficient of variation (CoV) as measure for instability in cassava production. Following Sandeep *et al.* (2016) and Boyal *et al.* (2015), the Coefficient of Variation (CoV) to measure the variability in the time series of cassava production indicators is stated below:

$$CoV = \frac{Standard\ Deviation}{Mean} \quad (2)$$

The compound annual growth function is specified as a semi-log equation as follows (Rehman *et al*., 2011):

$$lnYt = \alpha + \beta t + e \quad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Where Y = area (ha); production (1000 tonnes); yield (kg/ha) α = intercept β = 1 + r (the slope coefficient 'β' measures the instantaneous relative change in Y for a given absolute change in the value of explanatory variable 't') – instantaneous growth rate.

t = time (year) e = error term r = growth rate when the relative change in Y is multiplied by 100, the percentage change or growth rate in Y for an absolute change in variable 't' is obtained while the slope coefficient 'b' measures the instantaneous rate of growth. Therefore, the compound growth rate is then estimated using the following equation:

$$CGR = [antilog\ \beta - 1] * 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

NOTE: multiplying β by 100, will give the instantaneous growth rate (IGR) at a point in time. Eq. (4) was estimated using the Ordinary Least Square (OLS) method hence the t-test was applied to test the significance of β. The underlying assumption in this estimation is that a change in cassava output in a given year would depend upon the output in the succeeding year (Deosthali and Chandrehekkar, 2004).

Finally, if β is positive and statistically significant there is an acceleration in growth, if β is negative and statistically significant there is a deceleration in growth, if β is not statistically significant there is stagnation in the growth process.

Granger causality is based on the Wald procedure and makes use of chi statistics which is expressed as:

$$\sum\left(\frac{\beta 1}{S1}\right)^2 + \sum\left(\frac{\beta 2}{S2}\right)^2 + \sum\left(\frac{\beta 3}{S3}\right)^2 + \text{----------} \sum\left(\frac{\beta n}{Sn}\right)^2 + (t_1)^2 + (t_2)^2 + (t_3)^2 + \text{--------}(t_n)^2\text{----------} \quad (5)$$

Where β are the coefficients associated with area, production, and productivity.

$$\sum\left(\frac{\phi 1}{S1}\right)^2 + \sum\left(\frac{\phi 2}{S2}\right)^2 + \sum\left(\frac{\phi 3}{S3}\right)^2 + \text{----------} \sum\left(\frac{\phi n}{Sn}\right)^2 + (t_1)^2 + (t_2)^2 + (t_3)^2 + \text{--------}(t_n)^2\text{----------} \quad (6)$$

And ϕ are the coefficients associated with agricultural growth and t are t-values

3. Results

3.1. Trend in Agricultural Production

The trend in agricultural production within the study period is presented in Figure 1. The result shows that Nigeria's agricultural output generally experienced an upward trend during the period under study.

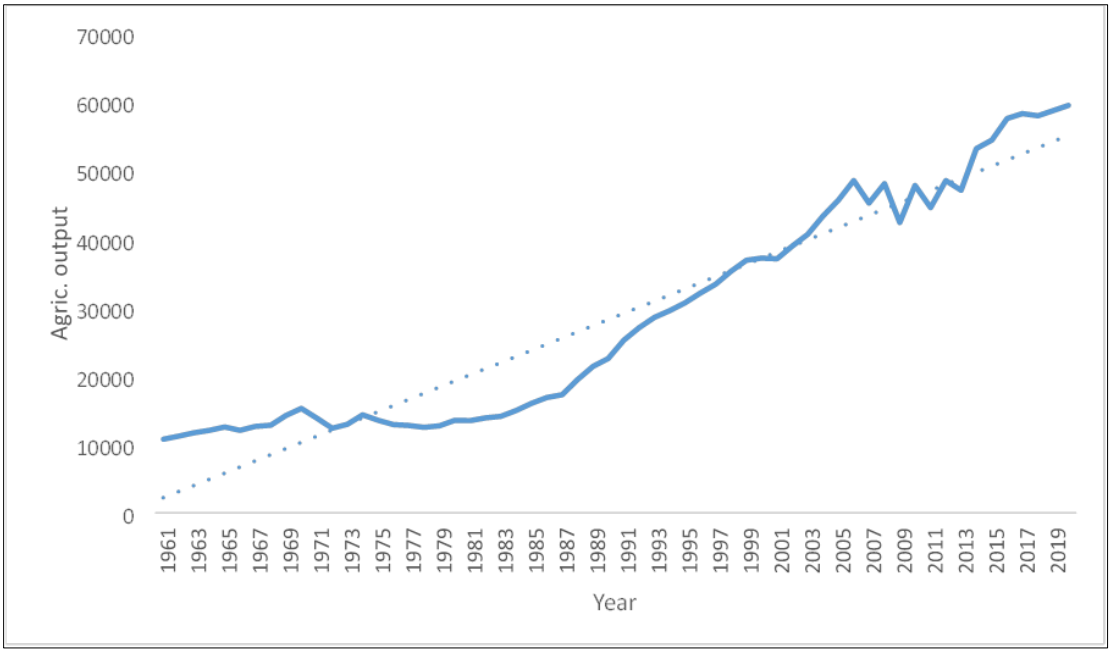


Figure 1 Trend of Agricultural Production in Nigeria, 1961 – 2020

3.2. Trend in output, area Harvested, and Yield of Cassava in Nigeria

The graph of cassava output in Nigeria, the area harvested, and the yield of cassava are presented in Figures 2-4. Figure 2 shows a general increase in cassava produced and the area harvested in the country within the study period. The yield however experienced some relatively stable trend with mild fluctuations and a noticeable decline in 2013.

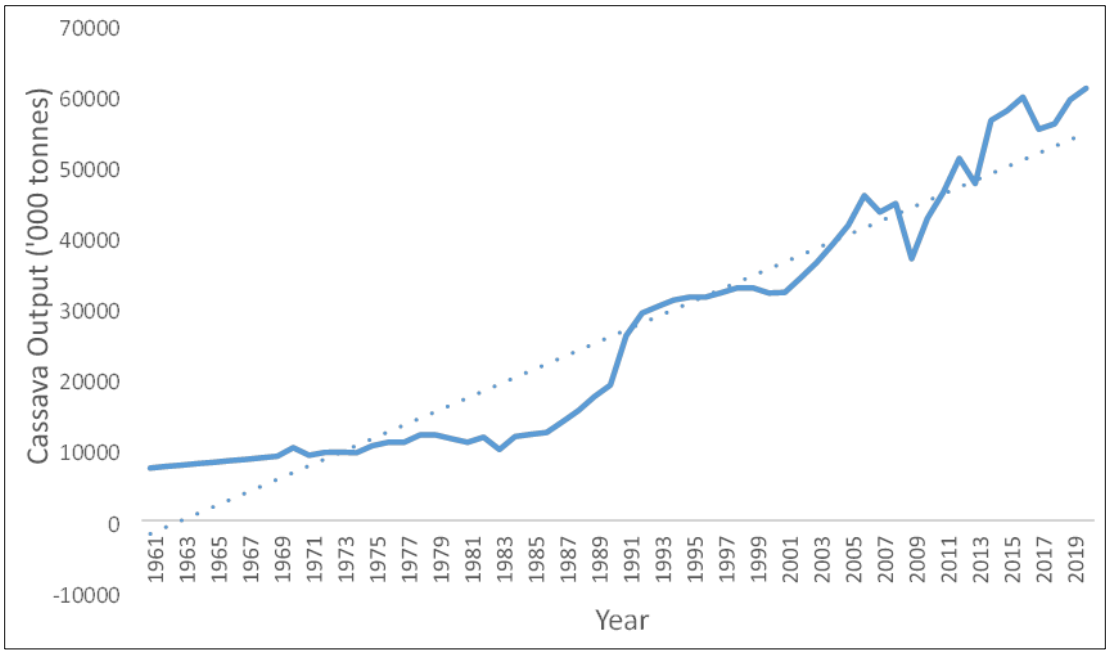


Figure 2 Trend in cassava production in Nigeria, 1961 – 2020

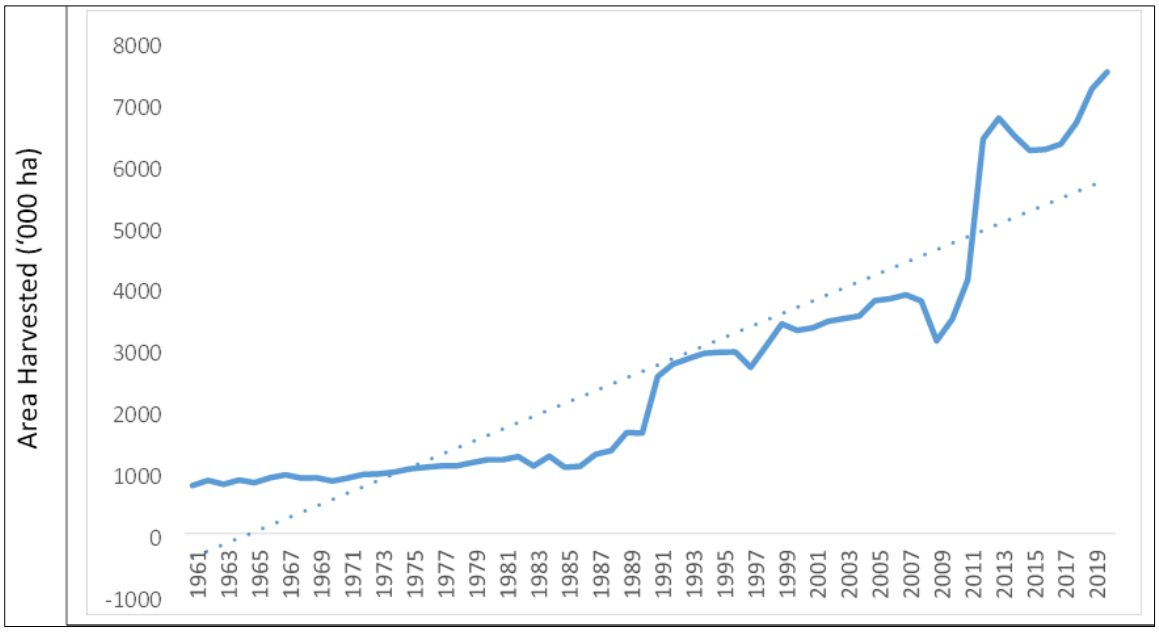
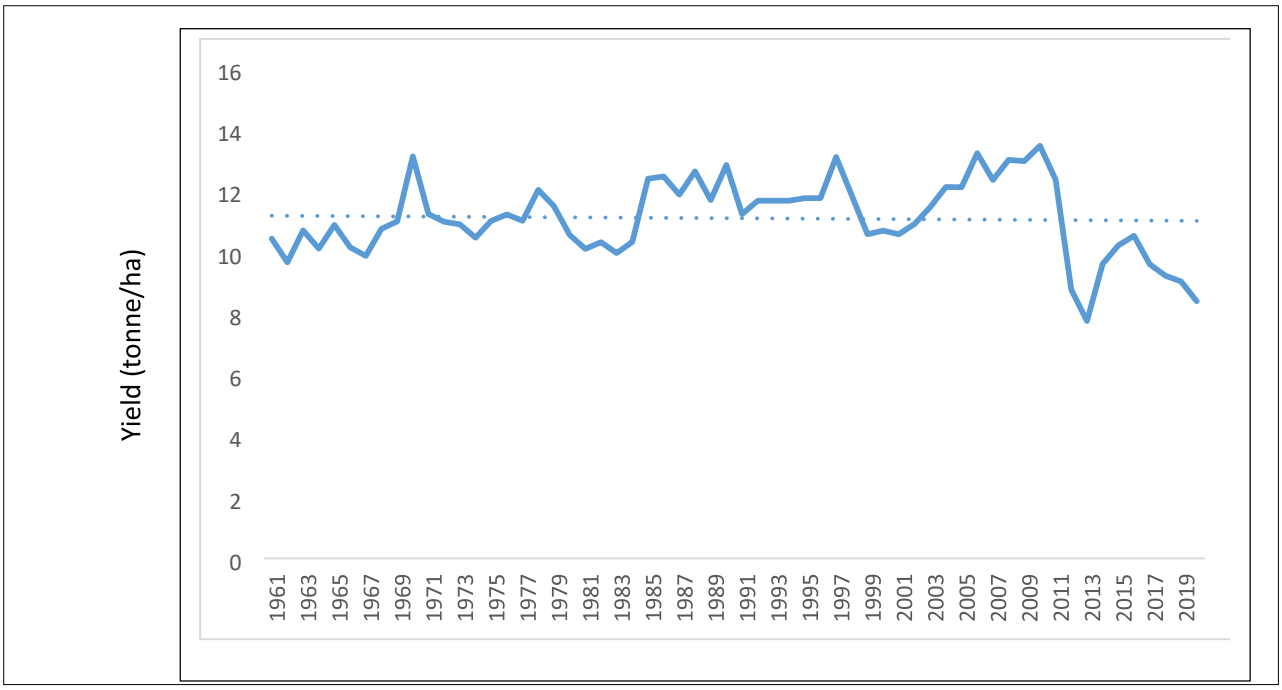


Figure 3 Trend in area harvested for cassava production



Source: Author's Computation (2021), Using FAOSTAT, 2021

Figure 4 Trend in Yield of Cassava in Nigeria, 1961 – 2020 Year

3.3. Instability in the Growth of Area, Output and Yield of Cassava

The mean output of cassava in Nigeria under different policy periods is presented in Table 1.

Table 1 Comparison of Mean Outputs of Cassava between pre-SAP, SAP, and post-SAP policy period and the entire period

Year	Policy Period	Mean ('000tonne)	Std. Error	t-value
1961 – 1985 1961 – 2020	Period I (Pre-SAP)	9852.24 25714.66	307.54 2217.35	4.63***
1986 – 1998 1961 – 2020	Period II (SAP)	24772.15 25714.66	2176.09 2217.35	0.19NS
1999 – 2020 1961- 2020	Period III (Post – SAP)	45181.94 25714.66	2052.21 2217.35	4.96***

Source: Author's Computation (2021) *** and NS = Mean significant at 1% and Not Significant respectively.

The computed coefficient of variation as a measure of instability index for area, yield and production is presented in Table 2

Table 2 Instability index for area, yield and production of cassava in Nigeria, 1961 – 2020

Period	Production	Area	Yield
Period I (1961 – 1985)	15.61	14.25	7.41
Period II (1986 – 1998)	31.67	32.87	4.61
Period III (1999 – 2020)	20.81	31.89	14.82
Pooled (1961 – 2020)	66.23	73.14	10.86

Source: Author's Computation (2021)

3.4. Direction and Growth Rate in Area, Production and Productivity of Cassava

The compound growth rate of area, yield and production of cassava in Nigeria during the study period is presented in Table 3.

Table 3 Compound growth rate (CGR) for area, yield and production of cassava

Period	Production	Area	Yield
Period I (1961 – 1985)	0.0201*** (0.0016) [12.31] {1.4} Decision: acceleration	0.0179*** (0.0015) [11.74] {1.3} Decision: acceleration	0.0022 NS (0.0020) [1.12] {0.2} Decision: stagnation
Period II(1986 – 1998)	0.0865*** (0.0101) [8.53] {6.2} Decision: acceleration	0.0878*** (0.0125) [7.01]{6.3} Decision: acceleration	0.0013 (0.0035) [-0.38]NS {-0.09} Decision: stagnation
Period III (1999-2000)	0.0321*** (0.0026) [12.28] {2.3} Decision: acceleration	0.0435*** (0.0050) [-2.28] {-0.78} Decision: acceleration	-0.0114** (0.0055) [7.93] {3.1} Decision: deceleration
Pooled(1961 – 2020)	0.0405*** (0.0012) [32.97] {2.8} Decision: acceleration	0.0406*** (0.0016) [28.81] {2.8} Decision: acceleration	-0.00007NS (0.00086) [-0.08] {-0.005} Decision: stagnation

Source: Author's Computation (2021), Using FAOSTAT, 2021 Figures in ( ), [ ] and { } are standard errors, t-values and CGR respectively *** and ** = sig. @ 1% and 5% respectively.

3.5. Direction of Causality among Area, Output, and Productivity of Cassava and Agricultural Growth

The outcome of the Granger causality analysis on the direction of causality among area, production and productivity (yield) of cassava and agricultural growth in Nigeria within the study period is presented in Table 4.

Table 4 Granger causality test of the relationship among area, output and yield of cassava and agricultural growth

Null Hypothesis:	F-Statistic	Prob.	Decision
YIELD does not Granger Cause PRDN	0.00887	0.9912	Accepted
PRDN does not Granger Cause YIELD	1.61303	0.2089	Accepted
AREA does not Granger Cause PRDN	0.63785	0.5324	Accepted
PRDN does not Granger Cause AREA	3.59286	0.0344	Rejected
AGROWTH does not Granger Cause PRDN	4.49978	0.0157	Rejected
PRDN does not Granger Cause AGROWTH	1.59426	0.2126	Accepted
AREA does not Granger Cause YIELD	3.78514	0.0291	Rejected
YIELD does not Granger Cause AREA	4.11801	0.0218	Rejected
AGROWTH does not Granger Cause YIELD	0.68957	0.5062	Accepted
YIELD does not Granger Cause AGROWTH	0.62320	0.5401	Accepted
AGROWTH does not Granger Cause AREA	7.44545	0.0014	Rejected
AREA does not Granger Cause AGROWTH	2.11401	0.1308	Accepted

Source: Author's Computation (2021), Using FAOSTAT, 2021

4. Discussion

The trend of agricultural output in Nigeria from 1960 – 2020 is presented in Figure 1. The country's agricultural output generally experienced an upward trend during the period under study. Specifically, the trend shows that, during the independence and first decade, the country's agricultural output was relatively low. The increase was somewhat impressive in the early 1980 to early 2000. After some staggered growth, the country's agricultural output experienced rapid slight increase before 2015 and continued to increase after 2016. The increase in agricultural output may have implications on food security in terms of food availability. The observed output pattern in this study is similar to the report of Shaibu (2021), Abah *et al*. (2021), and Kalikume (2015) who found that agricultural output in Nigeria has risen substantially over the years.

The graph of cassava production in Nigeria, the area harvested, and the yield of cassava are presented in Figures 2-4. The trend shows a general increase in the output of cassava produced and the area harvested in the country within the study period. The yield however experienced some relatively stable trend with mild fluctuations and a noticeable decline in 2013. Relevant Factors which could be associated with the increased level of cassava production in the country are the application of appropriate soil nutrient replenishment; pest management and varieties well-suited to local conditions; the provision of support services and infrastructure; guaranteed producer prices and output markets; high input-credit recovery rates; and organized village level associations (Sabo and Adeniji, 2009). According to Figure 2, the output of cassava was very low in 1985 which was the end of the pre-SAP era and a slight decline in 1999 (the end of SAP). Indicatively, cassava production in Nigeria gained a significant increase during the Structural Adjustment Programme (SAP) period (1986 – 1998). Also, cassava production in recent times has been on a continuous increase, except for a slight decline in 2013. It could be that output decreased precisely due to the decrease in area cultivated and other factors of production which might have remained largely unchanged – particularly labour and capital.

The mean outputs of cassava production in Nigeria under different policy periods are presented in Table 1. The result indicated that the pre-SAP era (1961 – 1985) had the least mean output, while the SAP and post-SAP era had the highest mean output of 24772.15 and 45181.94 respectively. Further tests of significance between the output of the respective periods and that of the entire period (1961 – 2020) indicated that the mean output of the aggregate period (1961 – 2020) and that of the SAP period was insignificant at the level of measurement ($P < 0.05$), while the mean output of the entire periods and the pre-SAP and post-SAP periods was significant at 1% each. The computed coefficient of variation as a measure of instability index for area, yield and production is presented in Table 4.2.2. The result shows that the values of instability of output (production) and land put under cassava cultivation are more pronounced in Period II [1986–1998] and Period III [1999–2020]. The instability in cassava yield declined from 7.41% in Period 1(1961–1985) to 4.61%% in Period II (1986 – 1998). The instability value for yield however jumped to 14.82 in Period III (1999 – 2020). In the pooled data, which is the combination of periods I, II & III, the area allocated to the production of cassava (73.14) is the most uncertain and closely followed by production (66.23) and production per hectare (10.86). Since instability/uncertainty is an indication of unpredictable future outcomes (area, yield of cassava and cassava output), it thus implies that future markets and prices are also uncertain.

The compound growth rate of area, yield and production of cassava in Nigeria during the study period is presented in Table 4.3. During the period I, (Pre – SAP; 1961 – 1985), CGR for production (1.4%) and area (1.3%) are positive. The accelerated instantaneous growth rate is significant at 1%. Thus, it implies that changes in area and output are significantly influenced by time trends during this period. The reverse is however the case for output per ha (yield) as the period experienced stagnation (insignificant) with a CGR of 0.2%. Also in period II, (SAP; 1986 – 1998), CGR for production (6.2%) and area (6.3%) for cassava are positive and statistically significant accordingly at a 1% level of significance. In this period, both CGR and instantaneous growth rate for yield are negative and not statistically significant (stagnation). It means that time trend is significant in the growth of area and production of cassava during the period II. In period III the result shows a positive relationship between time and production (2.3%). Also, time trends influenced the area under cassava cultivation (3.1%). Both the coefficient of area and production were statistically significant at the 1% level of significance. The result however showed that the CGR (-0.78%) for cassava yield during this period experienced deceleration. This implies that the time trend inversely influenced the yield of cassava during the post–SAP era. The results from the analysis of the pooled data (1961 – 2020) show that CGR for the area (2.8%) and production (2.8%) of cassava are positive and significant at a 1% level of significance. In this period, the growth in yield of cassava was not influenced by time trends. Nigeria's rate of performance for yield (0.005%) within the study period is ridiculously low.

The outcome of the Granger causality analysis on the direction of causality among area, production and productivity (yield) of cassava and agricultural growth in Nigeria within the study period is presented in Table 4.4. The result showed that there is a significant relationship between production (output) and area under cultivation, agricultural growth and

cassava production, area under cassava cultivation and cassava productivity, productivity and area under cultivation, agricultural growth and area under cassava cultivation. Specifically, the results showed that there is unidirectional causality between the variables at a 5% significant level; except for the area under cassava cultivation and cassava productivity, productivity and the area under cultivation exhibited a bi-directional causality at a 5% significant level. The results imply that the past values of cassava production (output) can predict the future value of area under cassava cultivation, the past values of agricultural growth can predict the future value of cassava production in the country, the past values of area under cassava cultivation can predict the future value of cassava productivity, the past values of cassava productivity or yield can predict the future value of area under cassava cultivation, the past values of agricultural growth can predict the future value of area under cassava cultivation in Nigeria.

5. Conclusion

The analysis of the compound growth rate (CGR) of cassava production, area, and yield in Nigeria during the periods before, during, and after the Structural Adjustment Programme (SAP) reveals significant trends in the country's agricultural sector. While cassava production and the area under cultivation experienced consistent growth across all periods, productivity (yield per hectare) stagnated, particularly during the SAP and post-SAP eras. The significant expansion in cassava cultivation suggests that policy interventions like SAP promoted agricultural expansion but did not lead to corresponding improvements in yield efficiency.

Based on findings from this study, the following recommendations are critical:

- The government and stakeholders should invest in research and development to introduce improved cassava varieties and farming practices aimed at increasing yield.
- Agricultural extension services should be strengthened to ensure that farmers are aware of and can adopt improved cassava farming technologies. Extension services should bridge the gap between research and practical application in the field.
- The government should facilitate access to critical agricultural inputs like fertilizers, pest control, and disease management, which are essential to improving cassava yield. Subsidies or credit facilities could be introduced to make these inputs more affordable for small-scale farmers.
- Infrastructure improvements, such as better irrigation systems and transportation networks, are necessary to support the growth of cassava production and reduce post-harvest losses, thereby increasing overall efficiency in the value chain.
- Policymakers should develop a coherent agricultural policy framework that prioritizes productivity over land expansion. Policies should incentivize investments in high-yield technologies and sustainable farming practices.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Agricultural Research Council, ARC (2019). Cassava production and its importance to the world. https://www.arc.agric.za/arc-iic/Pages/Cassava.aspx

[2] Eicher, C.K. (1990). Agricultural development in sub-Saharan Africa: A critical survey. Agricultural Economics, 41(3-4), 223-238.

[3] FAO (2015). Cassava market assessment. Food and Agriculture Organization of the United Nations. http://www.fao.org/es/esc/en/20953/21029/highlight28829_en.html

[4] FAO (2018). FAOSTAT database. http://www.fao.org/faostat/en/#dta/.

[5] FAO (2020). Nigeria at a glance. Food and Agriculture Organization of the United Nations. http://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/

[6] Fuglie, K. & Wang, S.L. (2012). Productivity growth in global agriculture: Shifting to developing countries. The Magazine of Food, Farm, and Resource Issues, 27(4). https://ageconsearch.umn.edu/record/143193/files/cmsarticle_273.pdf

[7] Idachaba, F. S. (2006). Good intentions are not enough: Collected essays on government and Nigerian agriculture. University Press PLC.

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

[9] Kronher, P. (2014). Risk management in agriculture. Journal of Agricultural Economics, 3(2), 67-81.

[10] Olayide, S. O., & Heady, E. O. (1982). Introduction to agricultural production economics. Ibadan University Press.

[11] Oni, T. O., Durojaiye, A. B., & Lawal, F. K. (2009). Agricultural productivity in Nigeria: Trends and policy implications. Nigerian Journal of Agricultural Economics, 1(1), 19-31.

[12] Pardey, P.G., Roseboom, J., & Beintema, N. M. (1997). Investments in agricultural research and development: Human and financial resources in the public and private sectors. Food Policy, 22(2), 131-146.

[13] Philip, J. (2004). Cassava as a food crop in sub-Saharan Africa: A review. African Journal of Agricultural Research, 12(4), 333-341.

[14] Sabo, E. & Adeniji, O. T. (2009). Economic analysis of cotton production in Adamawa State, Nigeria. African Journal of Agricultural Research, 4(5), 438-444.

[15] Shaibu, U.M. (2021). Sustainable Development Goal 2: Assessment of Nigeria's food security situation from 1960 – 2020. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 21(4), 513-518.

[16] Sulewski, P., & Kłoczko-Gajewska, A. (2014). Farmers' risk perception, risk aversion and strategies to cope with production risk: An empirical study from Poland. Studies in Agricultural Economics, 116(3), 140-147