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Trends, instability and decomposition analysis of root and tuber crops in Nigeria (1981–2020): implications for food security

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ABSTRACT

This study assessed the trend, instability and variance decomposition of root and tuber crops and their implication on food security in Nigeria. The study basically relied on the use of time series data spanning from 1981 to 2020. Data on the variables for the study were collected from Food and Agriculture Organization (FAO) database. Data for the study were analyzed using trend graphs, Cuddy-Della Valle index (CDVI) and decomposition analysis. The result of the trend analysis showed that the mean area, production and productivity of root and tuber crops were 7747210 hectares, 66175248 tonnes, and 8.910 tonnes/hectares respectively during the period of the study. The study also revealed that instability in area cultivated was found to be 14.36%, production of root ant tuber crops had instability index of 10.53% while productivity had instability index of 9.68%. The study of the decomposition analysis further revealed that the contribution of area effect was not only positive but also very high (103.98%). However, both productivity and interaction effects were negative and contributed -0.935% and -5.86% respectively to increase in root ant tuber crops production in Nigeria. The study concluded that improving root and tuber crops productivity growth and reducing instability is vital towards the attainment of food security in Nigeria. The study therefore recommended that research, investment and technological innovations should be intensified in the root and tuber crops sub-sector in order boost productivity and not merely increasing area cultivated so as to increase agricultural growth and reduce food insecurity.

Keywords: Root & Tubers, Instability, Cuddy-Della Valle Index and Decomposition Analysis.

1. INTRODUCTION

The agricultural sector comprises crop production, livestock production, fishery and forestry. Crop production is the dominant activity accounting for 87.6%, relative to livestock (8.1%), fishery (3.2%) and forestry (1.1%) (NBS, 2020). Growth performance of agriculture is therefore largely driven by the performance of crop

sub-sector on account of its dominance. Root and tuber crops are the second most important group of crop plants after the cereals (Karya and Otsanjugu, 2019). Both farmers and consumers prefer root and tuber crops and are they a significant component of programmes, policies and strategies aimed at ameliorating the economic wellbeing of the rural populace (National Research Council, 2006).

In the debate over enhancing food security and alleviating poverty in developing nations, the enormous importance of roots and tubers as a source of revenue for poor farmers and food for the rural and urban poor is sometimes underestimated. In many African countries, food production has not kept pace with population growth during the last four decades. Severe food insecurity persists, with food import bills skyrocketing and agricultural export earnings plummeting. African countries have been urged to enhance agricultural productivity in order to reverse these trends. Roots and tubers are one group of commodities that holds much potential for reversing this trend (Joel, 2009).

In all, sub-Saharan African produces about 20% of the world's total production of root and tuber crops, for about 10% of the world's total human population (FAOSTAT, 2013). Roots and tuber crops are critical for global food security since they are important sources of energy in developing nations characterized by fast population growth. Nigeria's position in the production of some of these root and tuber crops is quite outstanding especially with regards to cassava and yam.

According to FAO (2009), the production of root and tuber crops in Africa and especially Nigeria increased drastically over the last two and a half decades, however this increase has kept pace with rising food demand due to high population pressure and inadequate infrastructural facilities to expedite processing into food forms. Production and growth rates of some root and tuber crops in the past 25 to 30 years ago were drawn by expansion in cultivated area rather than yields.

Furthermore, IITA (2015) posited that although root and tuber crops have shown tremendous growth over the past three decades relative to other crops, virtually all production increases have resulted from increasing the land area planted and not significant yield increases. The crops are plagued by diseases and pests and this has constrained yield improvement and produce quality. Consequently, this results to low productivity of roots and tuber crops which in turn retards agricultural growth in Nigeria.

Food insecurity in Nigeria is intrinsically linked to under-production (Nigeria produces 8.41%, 1.09%, and 2.85% of global production of roots and tubers, cereal, and legumes respectively) implying the need to step up production, this is in tune with the assertion of CBN (2001) that the rate of increased food production of 2.5% per annum does not measure up with the annual population growth of 2.8%. Stepping up production is, therefore, a panacea for food insecurity in Nigeria (Adegbola *et al*., 2011).

Growth and instability in agricultural production has become a subject of great concern from the view point of food security (Bera *et al*., 2011; Abu and Adakole, 2017). Instability is a very essential characteristic of agriculture. Because agriculture is so reliant on weather conditions, crop area, production and productivity are subject to significant fluctuations over time (Shabana and Madhulika, 2018). Production instability denotes unpredictable phenomena with potentially harmful consequences for those whose livelihoods are dependent on this stream of production (Ikuemonisan *et al*., 2020). Put more succinctly, it connotes inefficiency and undermines sustainability of production growth.

Instability in agricultural and food production is also important for food security and macroeconomic stability (Chand and Raju, 2009). A variety of variables, including erratic rainfall pattern, low irrigation coverage, and increase in frequency and intensity of natural disasters, are all contributing to an increase in agricultural production instability (Shabana and Madhulika, 2018). Instability in agricultural production increases farm production risk, which has an impact on farmers' incomes and perhaps their decisions to investment in new technologies (Arya and Mehta, 2012). Furthermore, when this affects food production and distribution in developing or low-income countries, the consequences on the preponderance or majority of the low-income farmers can be disastrous (Ikuemonisan *et al*., 2020). This study will therefore assess the trend, instability and decomposition analysis of root and tuber crops in Nigeria in order to facilitate the understanding of how the root and tuber sub-sector would improve food security in Nigeria.

2. METHODOLOGY

2.1. Study Area

The study area is Nigeria. Nigeria is located on the Gulf of the Guinea in West Africa with a geographical area of 923, 768 square kilometers. 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 an estimated population of about 210.87 million in 2021 (www.statista.com). Nigeria lies wholly within the tropics along the Gulf of Guinea on the western coast of Africa. The topography ranges from mangrove swampland along the coast to tropical rain forest and savannah to the north. Nigeria is located between latitude 4°16 and 13°53 north and longitude 2°40 and 14°41 east (CIA Fact Book, 2009).

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Because Nigeria has a highly diversified agro-ecological climate, agriculture is one of the most important sectors of the Nigeria economy. The climate varies with Equatorial in South, Tropical in Centre and in the North. In the North, the vegetation is grassland savannah and in the south, forest. Because of this vegetation, agriculture is the major employer of labour in the country. In terms of employment, at least 60% of Nigeria's projected population of 210.87 million, is estimated to be engaged or employed in agriculture (mainly small holders). Women make up to 60-80 percent of work or labour and produce two thirds of food crops.

2.2. Methods of Data Collection and Analysis

The study basically relied on the use of time series data spanning from 1981 to 2020. Data on the variables for the study (area, production and productivity of root and tuber crops) were collected from the archives of Food and Agriculture Organization (FAO). Cuddy-Della Valle index (CDVI) was employed to estimate instability in area, production and productivity of root and tuber crops and decomposition analysis was used to determine the sources of growth.

2.3. Model Specification

2.3.1. Cuddy- Della Valle Index (CDVI)

Agricultural instability can be measured by different methods, such as the coefficient of variation (CV), dispersion, Cuddy Della Valle Index (CDI), Coppock Instability index, etc. For this study, instability in area, production and productivity of root and tuber crops was estimated using Cuddy-Della Valle index (CDVI) for measuring the instability in time series data that is characterized by trend following Abu and Adakole (2017); Shabana and Madhulika (2018). Cuddy Della Valle index first de-trends the given series and gives a clear direction about the instability.

Cuddy-Della Valle index attempts to de-trend the CV by using coefficient of determination ($\bar{R}^2$). Thus, it is a better indicator of instability in agricultural production (Shabana and Madhulika, 2018). A low CDVI signals the low instability in farm production and vice-versa. CDVI was originally developed by Cuddy and Valle (1978) for measuring the instability in time series data that is characterized by trend. The estimable form of the equation is as follows:

$$CDVI = CV \times \sqrt{(1 - \bar{R}2)}$$

Where;

CV is the coefficient of variation in percent

$\bar{R}^2$ is the coefficient of determination from time trend regression adjusted by the number of degree of freedom

2.3.2. Decomposition Analysis

According to Abu and Adakole (2017), changes in the production of a crop in physical terms depend essentially on the changes in the area under the crop and its average productivity (yield). Therefore, to determine the sources of production growth and measure the effect of area, productivity and their interaction in root and tuber crops production, the following method was employed.

$$\Delta P = \frac{A_0 \Delta Y * 100}{\Delta P} + \frac{Y_0 \Delta A * 100}{\Delta P} + \frac{\Delta A \Delta Y * 100}{\Delta P}$$

Change in Production = Productivity effect + Area Effect + Interaction effect

Where: $\Delta P = P_c - P_o$ = Change in Production

$\Delta Y = Y_c - Y_o$ = Change in Productivity

$\Delta A = A_c - A_o$ = Change in Area

A_o, P_o and Y_o are the area, production and productivity of root and tuber crops for the base year. A_c, P_c and Y_c are the area, production and productivity of root and tuber crops for the current year.

Thus, the total change in root and tuber crops output/production is attributed to area and yield/productivity by decomposing production output into three effects i.e; yield, area and interaction effects.

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3. RESULTS AND DISCUSSION

3.1. Summary Statistics of the Variables

The summary statistics of the variables used in the study is presented in Table 1. The result showed that the variable "area" was positively skewed to the right tail implying the presence of more values that are higher than the sample mean while the variables production and productivity were negatively skewed to the left tail implying the presence of more values that are lower than the sample mean.

The result further showed that the variables area, production and productivity were platykurtic (negative kurtosis) with a kurtosis value less than 3 implying that the distribution had a flatten curve relative to the normal. This shows that there were more values that are lower than the sample mean.

More so, the result of the Jarque-Bera probability test of normality showed that all the variables (area, production and productivity of root and tuber crops) were not statistically significant at 5% significant level having probability values greater than 0.05 (5%) which indicated the normal distribution of the variables.

Table 1. Summary Statistics of the Variables

	Area	Production	Productivity
Mean	7747210	66175248	8.910043
Median	7634000	65355500	8.853800
Maximum	16500407	117649974	10.88330
Minimum	2004000	15310000	6.421800
Std. Dev.	4618691	33208711	1.296687
Skewness	0.483462	-0.068837	-0.107991
Kurtosis	2.089833	1.914837	1.719849
Jarque-Bera	2.938908	1.994220	2.809057
Probability	0.230051	0.368944	0.245483
Sum	310000000	2650000000	356.4017
Sum Sq. Dev.	8.32E+14	4.30E+16	65.57452
Observations	40	40	40

Source: Data Analysis, 2021.

3.2. Trends of Area, Production and Productivity of Root and Tubers in Nigeria

3.2.1. Trend of area of root and tubers in Nigeria

The trend of area of root and tuber crops is presented in Figure 1 with the descriptive statistics presented in Table 1. The result showed that the area cultivated of root and tuber crops ranged between 2004000 hectares and 16500407 hectares with a mean of 7747210 hectares during the period of the study. Specifically, the area of root and tuber crops was fairly constant between 1981 and 1989 but however had a sharp increase from 1990 to 1992 where it continued to increase till 1995. There was a noticeable slight decrease between 1996 and 1997 from when a drastic increase was noticed till 2007. There was a sharp decline in area of root and tuber crops between 2008 and 2010. However, from 2010 to 2019 area of root and tuber crops experienced a sharp and steady increase until a slight noticeable decrease in 2020.

This implies that the area cultivated for root and tuber crops has experienced an upward trend over the years howbeit at a slow rate. This is in line with the findings of Kenyon *et al.* (2006) who reported that the area of root and tuber crops annually planted in SSA (Nigeria inclusive) has progressively increased inch by inch over the years. This could be attributed to the fact that root and tuber crops has gained popularity over the years as they play vital roles in promoting food security both at household and national levels. This is also consistent with the findings of Karya and Otsanjugu (2019) who posited that the importance of root and tuber crops is well reflected by the large area the occupy and the increase in land devoted to their cultivation year after year.

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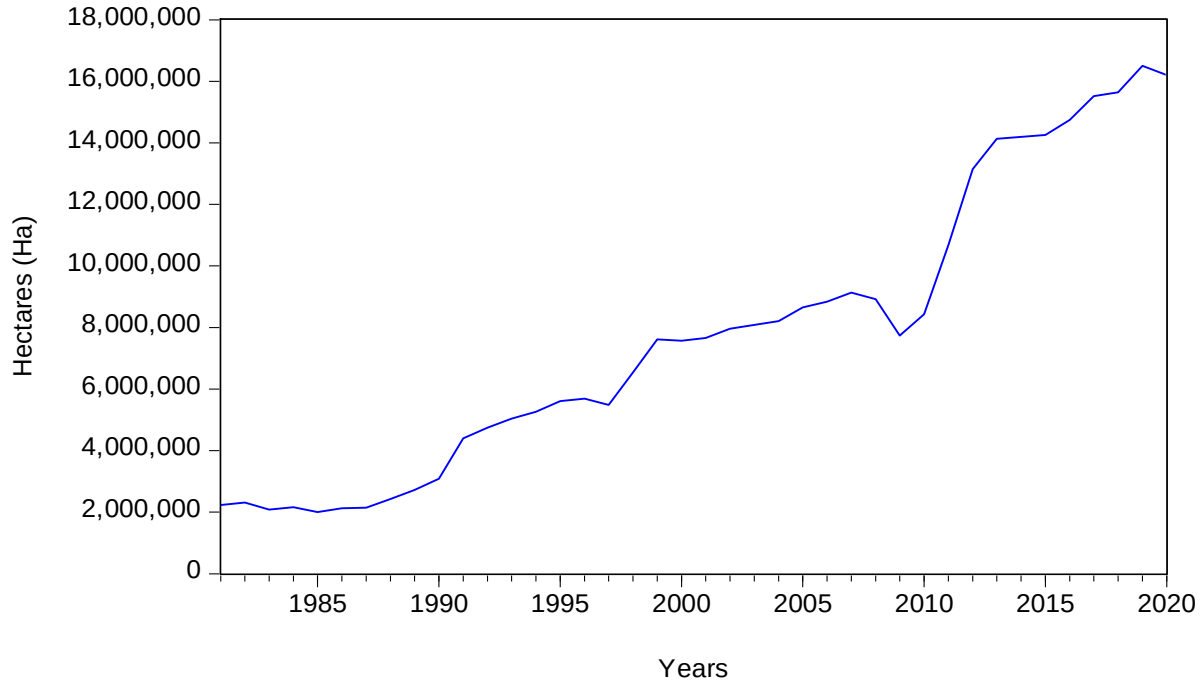

Figure 1: Trend of Area of Root and Tuber Crops in Nigeria (1981-2020)
Source: Data Analysis, 2021.

3.2.2. Trend of production of root and tuber crops in Nigeria

The trend of production of root and tuber crops is presented in Figure 2. The result showed that production of root and tuber crops ranged between 15310000 tonnes and 117649974 tonnes with a mean of 66175248 tonnes during the period under study. Specifically, the production of root and tuber crops was fairly constant between 1981 and 1988 from thence, production of root and tuber crops experienced a drastic increase till 2000 when a slight decrease was noticed. There was a sharp increase in root and tuber crops production between 2001 and 2005.

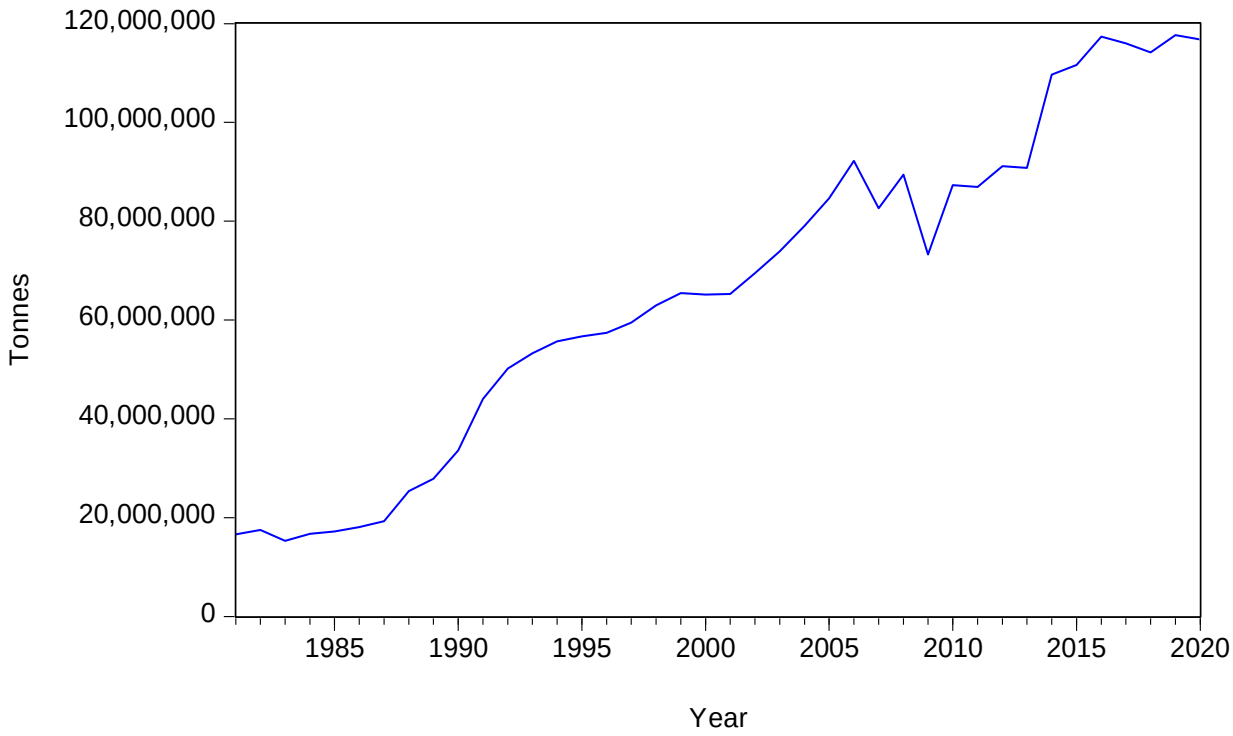

Figure 2: Trend of Production of Root and Tuber Crops in Nigeria (1981-2020)
Source: Data Analysis, 2021.

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The increase in the production of root and tuber crops could be attributed to the various policies and programmes initiated by the Government such as the Roots and Tubers Expansion Programme (RTEP). However, production of root and tuber crops had continued to fluctuate tremendously from 2006 till 2020. This implies that despite the various policy initiatives by the Government, the production of rot and tuber crops in Nigeria has not been satisfactory. Though trending upward, it's performance as evidenced by the trend has fluctuated over the years. This is similar to the findings of Verter and Bečvářová (2015) who reported that root and tubers production Nigeria has been quite inconsistent over the years. This could be attributed to the fact that there are multifaceted problems rooted in institution, ecology, technical and economy bedeviling the root and tuber sub-sector. Mignouna *et al*. (2014) also holds a similar view about the root and tuber sub-sector.

3.2.3. Trend of productivity of root and tubers in Nigeria

The trend of productivity of root and tubers is presented in Figure 3. The result showed that productivity of root and tuber crops ranged between 6.422 tonnes/hectares and 10.883 tonnes/hectares with a mean of 8.910 tonnes/hectares during the period under study. Specifically, the root and tuber crops productivity increased between 1981 and 1982 and then decreased slightly from 1982 to 1983. However, productivity of root and tuber crops increased drastically from 1983, it decreased slightly in 1985 and continued to increase till 1990. Productivity of root and tuber crops undulated between 1991 and 1999 but reduced drastically from 1999 to 2000. The trend increased from 2001 to 2005 and became undulating between 2006 and 2009 and subsequently reached its lowest ebb in 2013. Productivity of root and tuber crops increased sharply between 2013 and 2016 but rather unfortunately had continued to decrease from 2016 till 2020.

This implies that the productivity of root and tuber crops in Nigeria has been quite low and perhaps termed disappointing. This is consistent with the findings of Kenyon *et al.* (2006) who posited that the pattern of yields/productivity of root and tuber crops over the years in Nigeria is not easy to interpret as it is marked with inconsistencies. This could be attributed to the prevalence of institutional, ecological, technical and economic factors that has plighted the root and tuber crops production in Nigeria. This is synonymous to the findings of Gildemacher *et al.* (2009) who observed that one major problem of increasing agricultural productivity is the availability of and access to good quality planting materials among other factors.

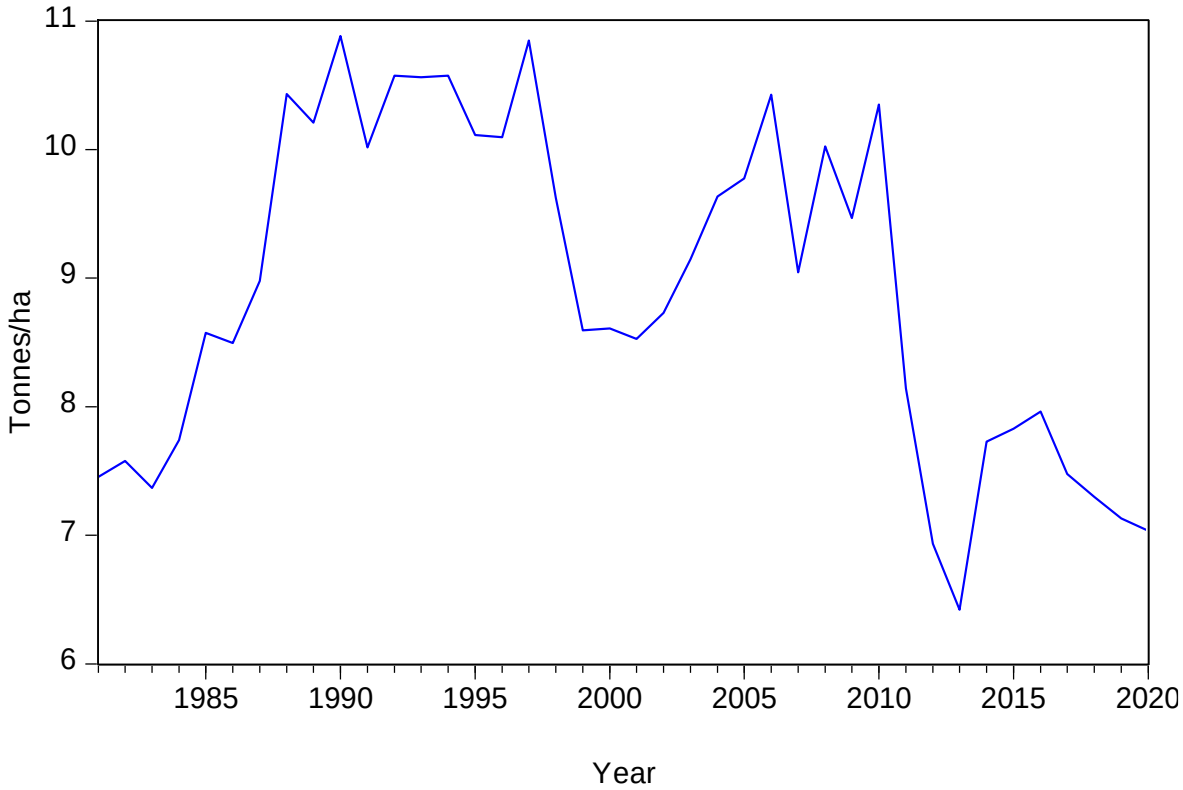

Figure 3: Trend of Productivity of Root and Tuber Crops in Nigeria (1981-2020)
Source: Data Analysis, 2021.

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3.3. Instability in Area, Production and Productivity of Root and Tuber Crops in Nigeria

The instability index for area, production and productivity of root ant tuber crops in Nigeria is presented in Table 2. The result revealed that instability in area cultivated was found to be highest (14.36%). This implies that land put under the cultivation of root ant tuber crops in Nigeria is quite unstable and most uncertain of the production indices of root ant tuber crops in Nigeria. Furthermore, production of root ant tuber crops had instability index of 10.53% while productivity had instability index of 9.68%. Ikuemonisan *et al*. (2020), posited that instability/uncertainty is an indication of unpredictable future outcome (area that can be allocated for production, yield and output). It thus implies that future market and prices are also uncertain. This will therefore have negative implications for food security in Nigeria.

Table 2. Instability in Area, Production and Productivity of Root and Tuber Crops in Nigeria

Variables	CV (%)	Adj R^2	CDVI (%)
Area (ha)	59.62	0.942	14.36
Production (tonnes)	50.18	0.956	10.53
Productivity (tonnes/ha)	14.55	0.558	9.68

Source: Authors' Computation, 2021.

3.4. Decomposition Analysis of Production of Root and Tuber Crops in Nigeria

The analysis of the contribution of area, productivity and their interaction effect towards increasing or decreasing production of root ant tuber crops in Nigeria is presented in Table 3. To achieve this, a decomposition analysis was carried out. The results revealed that increase in root ant tuber crops production growth was due largely to area increase as the effect of productivity and interaction effect were negative. Specifically, the contribution of area effect was not only positive but also very high (103.98%). However, both productivity and interaction effects were negative and contributed -0.935% and -5.86% respectively to increase in root ant tuber crops production in Nigeria. The harvested area indemnifies the negative effects of the productivity and interaction between productivity and area effects. This implies that increase in production of root ant tuber crops over this period occurred as a result of expanded area of land cultivated signifying that overall, area effect was the most important source of growth in the root ant tuber crops production in Nigeria.

Table 3. Percentage Decompositions of Area and Yield Interactions to Increase Root and Tuber Crops Production in Nigeria

Variable	Root & Tuber Crops
Yield effect	-0.935
Area effect	103.98
Interaction effect	-5.86

Source: Authors' Computation, 2021.

4. CONCLUSION, POLICY IMPLICATIONS AND RECOMMENDATIONS

Root and tubers are multifarious mainstay crops that can help in addressing food security in Nigeria, thus there are many compelling reasons to encourage them for sustainable food production. This study assessed the trend, instability and variance decomposition of root and tubers and their implication on food security in Nigeria. The study revealed that the root and tuber sub-sectors' performance had fluctuated over the years as evidenced by the trend of the area, production and productivity of root and tuber crops during the period under study. The study also revealed that instability in area cultivated was found to be 14.36%, production of root ant tuber crops had instability index of 10.53% while productivity had instability index of 9.68%. The study revealed that increase in root ant tuber crops production growth was due largely to area increase as the effect of productivity and interaction effect were negative.

The instability in the area, production and productivity of root and tuber crops could be detrimental for food security given that roots and tubers is a source of income for poor farmers and of food for the rural and urban poor. Therefore, reducing instability will ensure sectorial growth and enhance food security which is an essential part in eradicating hunger and poverty in the country.

Improving root and tuber crops productivity growth and reducing instability is vital towards the attainment of food security in Nigeria. Therefore, research, investment and technological innovations should be intensified in the root and tuber crop sub-sector in order to boost productivity and not merely increasing area cultivated so as to increase agricultural growth and reduce food insecurity. More so, high yielding varieties should be developed and adopted by farmers so as to enhance the productivity of root

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and tuber crops in Nigeria. Finally, timely supply of agricultural inputs such as improved seeds and fertilizer, capacity building and development for farmers should be periodically carried out in order to enhance their efficiency so as to increase root and tuber crops productivity.

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Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Abu, O. and Adakole, O. (2017). Growth and Instability in Selected Cereal Crops in Benue State, Nigeria and Its Implications for Food Security. *Asian Research Journal of Agricul*ture, 5(2): 1-8.
2. Adegbola J. A., Bamishaiye E. I. and Daura, A. M. (2011). Food security in Nigeria: Government's intervention and the place of effective storage. *Asian Journal of Agriculture and Rural Development,* 1(2):56-63.
3. Arya, A. and Mehta, N. (2012). Performance of Gujarat economy: An analysis of growth and instability. MPRA Paper No. 35712. Available: http://mpra.ub.unimuenchen.de /35712/
4. Bera, B.K., Chakraborty, A., Nandi, A.K. and Sarkar, A. (2011). Growth and instability of food grains production of India and West Bengal. *Journal of Crop and Weed*, 7(1):94-100.
5. Central Bank of Nigeria [CBN] (2004). Central Bank of Nigeria – Annual Reports and statement of Accounts for the year ended 31st December, 2004.
6. Central Intelligence Agency (2009). The World Fact Book. Available online at http:www.cia.gov/library/publications/ the-world-factbook/goes/ni.html.
7. Chand, R. and Raju, S.S. (2009). Instability in Indian agriculture during different phase of technology and policy. *Indian Journal of Agricultural Economics*. 64(2):283- 285.
8. Cuddy, J.D.A. and Della Valle, P.A. (1978). Measuring the Instability of Time Series Data Oxford *Bulletin of Economics and Statistics,* 40(10):79-84.
9. Food and Agriculture Organization [FAO] (2009). Food and Agriculture Data. http://www.fao.org/faostat/en/#data/
10. Food and Agriculture Organization [FAOSTAT] (2013). Food and Agriculture Organization of the United Nations Production Year book, FAO Rome. Retrieved from http://faostat.fao.org/site/567/DesktopDe fault.aspx#ancor
11. Gildemacher, P.R., Maina, P., Nyongesa, M., Kinyae, P., Gebremedhin, W., Lema, Y., Damen, B., Shiferaw, T., Kakuhenzire, R., Kashaija, I., Musoke, C., Mudiope, J., Kahiu, I. and Ortiz, O. (2009). Participatory Analysis of the Potato Knowledge and Information System in Ethiopia, Kenya and Uganda. In: Sanginga, P.C., Waters-Bayer, A., Kaaria, S., Njuki, J., Wettasinha, C. (eds) Innovation Africa: enriching farmers' livelihoods. Earthscan, London, pp 153-167.
12. Ikuemonisan, E.S., Mafimisebi, T.E., Ajibefun, I. and Adenegan, K. (2020). Cassava production in Nigeria: trends, instability and decomposition analysis (1970–2018). *Heliyon*, 6:1-9.
13. International Institute of Tropical Agriculture [IITA] (2015). Root and Tuber Crops (Cassava, Yam, Potato and Sweet Potato). An action plan for African agricultural transformation. Feeding Africa, 21-23rd October, 2015. Abdul Diouf International Conference Centre, Dakar Senegal.
14. Joël, V. W. (2009). "Financing Development: Debt Versus Equity." DNB Working Paper No. 38
15. Karya, K. N. and Otsanjugu, A. T. N. (2019). The Contribution of Root and Tuber Crops to Food Security: A Review. *Journal of Agricultural Science and Technology,* 9 (1):221-233.
16. Kenyon, L., Anandajayasekeram, P. and Ochieng, C. (2006). A synthesis/lesson-learning study of the research carried out on root and tuber crops commissioned through the DFID RNRRS research programmes between 1995 and 2005. A study commissioned by the Crop Protection Programme (CPP) of the UK Department for International Development (DFID; R1182). 77p.
17. Mignouna, D. B., Akinola, A. A., Suleman, I., Nweke, F. and Abdoulaye, T. (2014). Yam: A Cash Crop in West Africa. YIIFSWA Working Paper Series No. 3, Yam Improvement for Income and Food Security in West Africa International Institute of Tropical Agriculture. ISBN 978-978-8444-38-1.
18. National Bureau of Statistics (2020). "LSMS: Integrated Surveys on Agriculture: General Household Survey Panel." General Household Survey Panel, Microdata Library.

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS

19. National Population Commission (NPC) (2006). National Economic Census Board, 2006, Abuja, Nigeria.
20. National Research Council (2006). Lost Crops of Africa: Vegetables. Vol. 11. Washington, DC: The National Academies Press. DOI: 10.17226/11763.
21. Shabana, A. and Madhulika, A. (2018). Growth and instability analysis in Indian agriculture. *International Journal of Multidisciplinary Research and Development*, 5(11): 119-125.
22. Verter, N. and Bečvářová, V. (2015). An Analysis of Yam Production in Nigeria. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 63(2): 659–665.
23. www.statista.com/statistics/382264/total-population-of-nigeria/ Accessed 4th April, 2021

ISSN 2278–5469 EISSN 2278–5450 I OPEN ACCESS