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Growth and Instability in Selected Cereal Crops in Benue State, Nigeria and Its Implications for Food Security

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Authors' contributions

This work was carried out in collaboration between both authors. Author Orefi Abu designed the study, performed most of the statistical analysis, interpreted the results and prepared the manuscript. Author Omojo Adakole collected data for the study and carried out part of the analysis. Both authors read and approved the final manuscript.

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ABSTRACT

This study was carried out to determine growth rate and instability in area, output and yield of selected cereals and its implications for food security in Benue State, Nigeria from 1986 to 2012. In addition, sources of growth in output were also examined. To achieve this, exponential trend equation, Cuddy-Della Valle index (CDVI) and decomposition analysis were employed. The estimated compound growth rates for area of maize, millet, rice and sorghum were 4.3%, 9.8%, 1.8% and -2.4% respectively. Compound growth rates of output were 4.7%, 13.1%, 12.6% and 0.9% for maize, millet, rice and sorghum respectively and were significant. While compound growth rate for yield on the other hand showed growth rates of 1.8%, 2.5%, -0.8% and 3.2% for maize, millet, rice and sorghum in that order. Results for instability showed that area, output and yield of the selected cereals were unstable during the period under study owing to instability index of over 10%.

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Sources of output growth for the selected cereals showed that increase in maize output was due largely to yield effect. While growth in of millet output was due to yield, area and interaction effect. Source of output growth for rice was due mainly to yield effect while increase in output of sorghum on the other hand, was due to area effect. Therefore, appropriate policy aimed at increasing the growth rates of less performing crop such as investing in agricultural research, timely supply of inputs on the use of high yielding varieties ought to be put in place to narrow the productivity gap, reduce instability, enhance availability and improve food security.

Keywords: Cereals; growth rate; instability exponential equation; cuddy-della valle index; decomposition analysis.

1. INTRODUCTION

Cereal crops are members of the grass family grown for their edible starchy seeds [1]. Cereals are grown in greater quantities and provide more energy worldwide than any other type of crops, they are therefore staple food crops [2]. The significance of cereals to modern society is clearly reflected in the value of cereals in diets throughout the world, globally, they account for about 50 per cent of total per capita calories supply and 45 per cent per capita of protein supply [3]. The major cereal crops in Nigeria are rice, maize, sorghum, wheat and sorghum [4] and [5]. Among these cereals, maize, rice, millet and sorghum are the most available, affordable and important sources of energy [6]. Crop production plays immense role in enhancing food security at household level. In view of this, the role of cereal crops production has been given a lot of consideration. According to [3], cereals have become the foundation of world food security all over the world. Hence, increasing the production of cereals is critical for food security. Therefore, importance of cereals must be over emphasized.

Food security concepts has been defined as a situation in which all people, at all times, have adequate access to safe and nutritious food to meet food needs and food reference for a more energetic and healthy life [7]. According to [8], food security is a condition in which all households have both physical and economics access to sufficient food for all members and where households are not at risk of losing such rights. Food security is an integrated notion that revolves around four areas, namely the availability of food, the stability of supplies, access to such supplies and an accurate use of foods. Food security is important to alleviate hunger, poverty and disease, and for economic development [9]. Consequently, achievement of food security in any country is usually an indemnity against hunger and malnutrition, both of which hamper economic development [10]. According to [11] and [12] agriculture is a very crucial sector that may reduce poverty in several ways given that increase in crop productivity directly create more employment opportunities and improve the level of food security. Food security therefore is an essential factor for economic growth and development of a nation [13] and [14]. As a result, attainment of food security in any country is usually a protection against hunger and malnutrition, both of which hamper economic development [10].

Growth and instability in agricultural production has become a subject of great concern from the view point of food security [15]. Variability in production affects both producers and consumers along with intermediaries involved in the movement of products through price fluctuations [16]. Examining growth and instability is important for improving the livelihood of the majority small-scale farmers who accounts for the majority of the food grains produced in the country. Instability in agricultural production raises risk in farm production, which in turn affects farmers' incomes and possibly their decisions for investment on new technology [17]. According to [16], variability also affects price stability and vulnerability of low income households to market swings. Instabilities in cereal production causes increased market and price instabilities and hence food insecurity [18]. Consequently, maintaining increase in farm production with minimum variability in order to achieve sustained economic growth is always desirable [15].

To assess the possibility of meeting the food security needs in Benue state, this study was undertaken to examine growth rate and instability of selected cereal crops in terms area, output and yield over the period of 1986 to 2012. Finding from this study could improve the

understanding of how growth rate, instability and sources of growth would affect future cereal production and food security in the state. Examining growth and instability is also valuable for policy making by facilitating an understanding of both the magnitude and direction of the changes taking place in the cereal sector.

2. METHODOLOGY

2.1 Study Area

This study was carried out in Benue State, Nigeria. The state is located in the north-central geopolitical zone of Nigeria. The state occupies a land mass of 32.518 sqkm with geographical coordinates of longitude 7° 47 ' and 10° East and latitude 6° 25 ' and 8° 8 ' North. Farming is the main occupation of the people in the State. The state has a population of 4780.389 [19]. Key crops grown in the state include millet, cowpea, sorghum, maize, rice, vegetables, yam, soybean and fruits to mention a few.

2.2 Data Collection and Analysis

This study was based on a time series data on area ('000 ha), output ('000 metric tons) and yield (ton/ha) of selected cereal crops (maize, millet, rice and sorghum) collected from the National Bureau of Statistics (NBS) for the period 1986-2012. Descriptive statistics such as mean, standard deviation and coefficient of variation were computed for the data. In modeling time trend, the exponential trend or log linear equation was employed. Cuddy-Della Valle index (CDVI) was employed to estimate instability in area, output and yield of the selected cereals and decomposition analysis given by [20] and [21] were used to determine the sources of growth.

2.3 Model Specification

2.3.1 Growth rate

The exponential trend equation for the selected cereal crops was specified as follows:

$$Y_t = e^{\beta_0} + \beta_1 t_1 + \varepsilon_t \quad (1)$$

Taking natural logarithm of equation (1), the following linear relationship is obtained:

$$\ln Y_t = \beta_0 + \beta_1 t_1 + \varepsilon_t \quad (2)$$

where Yt is Area, output or yield in time t, t_1 is time trend variable, β_0 is intercept of the trend equation, β_1 is trend coefficient, ε_t is the error term. The compound growth rate was computed from equation (1) as follows:

$$r = \left(e^{\beta_1} - 1\right) * 100 \quad (3)$$

where *r* is compound growth rate, β_1 is estimated coefficient from equation (2), *e* = eular's exponential constant (2.71828).

2.3.2 Measuring instability

Instability in area, output and yield of the selected cereal crops was estimated using Cuddy- Della Valle index (CDVI) for measuring the instability in time series data that is characterized by trend [22]. Although the coefficient of variation (CV) is frequently used for the estimation of dispersion with comparability across various units, it cannot be used in case of time series data characterized by time trend [23]. According to Ayalew [23], measures of instability need to eliminate the deviation in the data series that may arise due to secular trend or growth. The equation was specified as follows:

$$INST = CV \times \sqrt{\left(1 - R^2\right)} \quad (4)$$

Where INST is the instability index in percent, CV is the coefficient of variation in percent and *R2* is the coefficient of determination.

2.3.3 Sources of output growth

Changes in the output of a crop in physical terms depend essentially on the changes in the area under the crop and its average yield. Hence, to determine the sources of output growth and measure the effect of area, yield and their interaction in the selected cereals crops output a method outlined by [20] and [21] was employed. This is expressed as:

$$Q^1 - Q^0 = A^1 Y^1 - A^0 Y^0 \quad (5)$$

$$Q^1 - Q^0 = \left(A^1 - A^0\right) Y^0 + \left(Y^1 - Y^0\right) A^1 \quad (6)$$

The right hand side of equation 5 can further be decomposed as follows:

$$Q^1 - Q^0 = \left(A^1 - A^0\right)Y^0 + \left(Y^1 - Y^0\right)A^0 + \left(A^1 - A^0\right)\left(Y^1 - Y^0\right) \quad (7)$$

$$\Delta Q = \Delta A Y^0 + \Delta Y A^0 + \Delta A \Delta Y \quad (8)$$

The first expression on the right hand side of equation (8) is considered as the yield effect, the second expression as the area effect and the third as the interaction effect. Where ΔQ is change in output, ($Q1$, Q 0), ($A1$, $A0$) and ($Y1$, $Y0$) stand for current period and base period of output, area and yield in that order. Consequently, the total change in output can be divided into three effects, these are yield effect, area effect and interaction effect due to change in yield and area.

3. RESULTS AND DISCUSSION

3.1 Summary Statistics

Summary Statistics of variables used in the analysis is presented in Table 1. Results show that an average of 91.13 thousand hectares, 30.630 thousand hectares, 128.740 thousand hectares and 134.670 thousand hectares were dedicated to the cultivation of maize, millet, rice and sorghum respectively in Benue State during the period of study. On average, the output of maize, millet, rice and sorghum were 130.790 metric tons, 46.420 metric tons, 255.030 metric tons and 185.140 metric tons respectively. Average yield was 1.55 ton/ha, 1.33 ton/ha, 1.97 ton/ha and 1.38 ton/ha for maize, millet, rice and sorghum respectively. The result shows that the average yield of the selected cereal crops (maize, millet rice, and sorghum) between 1986-2012 in Benue state, Nigeria was far below their potential average yield of 4.0, 2.4, 7.0 and 3.2 tonnes per hectare respectively [24]. Suggesting considerable room for raising yield through improved seeds, irrigation and fertilizer use. This large gap between the potential and actual yield have serious implications for food security in the state, given the rising population.

3.2 Growth Rate of Area for the Selected Cereal Crops

The estimated compound growth rates (CGR) of area for the selected cereal crops are presented in Table 2. The compound growth rate for area of maize was 4.4%. This implies an in increase in the area devoted to maize cultivation during the period of study. The Adjusted R^2 value was 0.487 for area of maize. Suggesting that time trend as a variable was very essential accounting for 48.7% of the variations observed in area of maize. The compound growth rate for area of millet was 10.3% and positive, indicating an increase in the area devoted to millet cultivation. The Adjusted R^2 value was 0.626 for area of millet. This implies that time trend as a variable was very important accounting for 62.6% of the differences observed in the area devoted to millet.

Table 1. Summary statistics of variables used in the analysis

Crop	Variables	Descriptive statistics					
		Mean	Median	Maximum	Minimum	Std. Dev.	CV (%)
Maize	Area	91.13	104.17	116.79	27.75	30.77	33.76
	Output	130.79	135.34	238.34	66.60	38.14	29.16
	Yield	1.55	1.32	2.40	1.13	0.44	28.39
Millet	Area	30.63	41.85	50.90	2.39	17.94	58.57
	Output	46.42	63.19	89.50	3.90	29.91	68.43
	Yield	1.33	1.51	2.01	0.80	0.44	33.08
Rice	Area	128.74	137.40	166.70	81.79	24.99	19.41
	Output	255.03	272.08	341.88	146.87	49.43	19.38
	Yield	1.97	2.00	2.50	0.94	0.49	24.87
Sorghum	Area	134.67	112.26	302.14	103.50	47.13	34.99
	Output	185.14	190.60	293.01	138.83	31.39	16.95
	Yield	1.38	1.73	1.79	1.14	0.48	34.78

The compound growth rate for area of rice was 1.8% and positive, signifying an increase. The Adjusted R^2 value was 0.417 for area rice, an indication that time trend as a variable was also extremely vital accounting for 41.7% of the disparity detected in the area committed to rice cultivation. Thus, farmers should be encouraged to engage more farmlands for the cultivation rice through sensitization and mobilization of local farmers in the study area. In contrast to maize, millet and rice areas, the compound growth rate for sorghum area had a negative growth rate of -2.4% per annum. Suggesting a decline in the area dedicated to sorghum cultivation for the period under study. This is line with [25] who found a decrease in the per annum area dedicated to sorghum cultivation from 1983 to 2012 in Sokoto State and [26] who also found a decline in the area of sorghum cultivated from 1970/71-1999/2000 in Andhra Pradesh, India. Consequently the existing negative trend in area must be overturned if land area used for sorghum production is to be sustained. This may possibly be achieved through sensitization and recruitment of farmers mainly smallholder farmers who accounts for majority of the cereal produced in the study area on the need to put extra farmlands into the cultivation of sorghum. The Adjusted R2 value was 0.423 for area of sorghum. A sign that time trend as a variable was furthermore very vital in explaining 42.3% of the variation noticed in the area devoted to sorghum production in Benue state during the period under study.

3.3 Growth Rate of Output for the Selected Cereal Crops

The compound growth rate (CGR) of output for the selected cereal crops are presented in Table 3. The compound growth rate for maize output was 4.7% and positive. This implies a moderate increase in output of maize mostly during the period of study. The Adjusted R2 value was 0.487 for output of maize. This means that time trend as a variable was very essential accounting for 48.7% of the variations observed in the output of maize. The compound growth rate for millet output was 13.1% and positive, indicating an increase in the output of millet during the period of study. The Adjusted R2 value was 0.651 for millet output. This implies that time trend as a variable was very important accounting for 65.1% of the differences observed in the output of millet. The compound growth rate for sorghum output was 0.9%. Suggesting that there was 0.9% increases in sorghum output for the period under study.

3.4 Growth Rate of Yield for the Selected Cereal Crops

The compound growth rate (CGR) of yield for the selected cereal crops are presented in Table 3. The compound growth rate for maize yield was -1.8%, an indication of negative growth rate during the period under study. The compound growth rate for millet yield was 2.5% and positive, indicating an increase in yield of millet. The compound growth rate of rice yield was -0.8%, even though it was not significant, implies a decline of -0.8% during the period under study. The compound growth rate for sorghum yield was 3.3% during the period under study, suggesting an increase in yield.

3.5 Instability in Area, Output and Yield of the Selected Cereal Crops

Instability results for the selected cereal crops are presented on Table 5. Instability in area was found to be highest in millet (35.82%) followed by sorghum (26.58%), maize (24.18%) and rice (14.82%). Instability in output was also found to be highest in millet (40.43%) followed by maize (20.89%), rice (17.66%) and sorghum (15.24%). On the other hand, instability in yield for maize was 24.27%, millet (25.94%), rice (25.39%) and sorghum (24.07%). Results suggest that in spite of the relatively wide difference in the instability index of area and output of the selected cereals, instability index in yield appeared to be close. Overall, instability in area, output and yield was higher for millet as compared to the other cereals.

3.6 Sources of Output Growth of Selected Cereal Crops

The contribution of area, yield and their interaction effect towards increasing or decreasing output of the selected cereal crops is presented in Table 6. Results show that increase in maize output growth was due largely to yield increase as the effect of area and interaction effect were negative. In the case of millet, yield, area as well as interaction between area and yield contributed considerably to output growth. Output growth of rice was due mainly to yield effect, given that the effect of area and interaction effect were also negative. Increase in output of sorghum on the other hand, was due

Table 2. Growth rate of area of selected cereal crop in Benue State, 1986 to 2012

Crop	Coefficient	Standard error	R2	t-statistics	CGR (%)
Maize	0.043***	0.008	0.487	5.072	4.4
Millet	0.098***	0.015	0.626	6.467	10.3
Rice	0.018***	0.004	0.417	4.358	1.8
Sorghum	-0.024***	0.005	0.423	-4.481	-2.4

*Note: CGR = Compound growth rate; *** denotes significance at 1% level*

Table 3. Growth rate of output of selected cereal crop in Benue State, 1986 to 2012

Crop	Coefficient	Standard error	R2	t-statistics	CGR (%)
Maize	0.046***	0.006	0.487	4.982	4.7
Millet	0.123***	0.017	0.651	7.041	13.1
Rice	0.119**	0.005	0.170	2.519	12.6
Sorghum	0.009**	0.003	0.192	2.677	0.9

*Note: CGR = Compound growth rate; **, *** denotes significance at 5% and 1% levels respectively*

Table 4. Growth rate of yield of selected cereal crop in Benue State, 1986 to 2012

Crop	Coefficient	Standard error	R^2	t-statistics	CGR (%)
Maize	-0.018***	0.006	0.269	-3.186	-1.8
Millet	0.025***	0.006	0.385	4.083	2.5
Rice	-0.008	0.005	-0.042	-1.6	-0.8
Sorghum	0.032***	0.006	0.521	5.311	3.2

*Note: CGR = Compound growth rate; *** denotes significance at 1% level*

Table 5. Instability in Area, Output and Yield of the Selected Cereal Crops in Benue State, 1986 to 2012

Crop	Area	Output	Yield
Maize	24.18	20.89	24.27
Millet	35.82	40.43	25.94
Rice	14.82	17.66	25,39
Sorghum	26.58	15.24	24.07

Table 6. Sources of output growth of selected cereal crops in Benue State, 1986 to 2012

Crop	Yield effect	Area effect	Interaction effect
Maize	213.82	-24.98	-80.18
Millet	30.58	3.42	186.56
Rice	123.25	-86.06	-61.96
Sorghum	-14.93	62.16	-5.97

for the most part to area effect. Overall, yield effect was the most important source of growth in the output of three out of the four selected cereals.

4. CONCLUSION AND IMPLICATIONS

4.1 Conclusion

This study examined growth and instability in area, output and yield of selected cereal crops in terms of growth rate and instability and its implication for food security in Benue state, Nigeria over the period of 1986-2012. To achieve this, exponential trend equation was fitted to area, output and yields of maize, millet, rice and sorghum to examine their growth patterns. Cuddy-Della Valle index (CDVI) was employed to estimate instability in area, output and yield of the selected cereals. Decomposition analysis was employed to determine the sources of growth. Findings revealed that estimated compound growth rates of area, were 4.3%, 9.8% and 1.8% for maize, millet and rice

respectively and were positive and significant. While the compound growth rate of sorghum area was negative (-2.3%) and significant, implying that maize, millet and rice performed better that sorghum in terms of area cultivated. In terms of output all the selected cereals had positive growth rate. Yield on the other hand, only performed well for millet and sorghum. Results revealed that instability in area was found to be highest in millet (35.82%) followed by sorghum (26.58%), maize (24.18%) and rice (14.82%). Instability in output was also found to be highest in millet (40.43%) followed by maize (20.89%), rice (17.66%) and sorghum (15.24%). Furthermore, instability in yield of maize was 24.27%, millet (25.94%), rice (25.39%) and sorghum (24.07%). Results for sources of output growth for the selected cereals show that increase in maize output growth was due largely to yield effect. In the case of millet, yield, area as well as interaction between area and yield contributed considerably to output growth. Output growth for rice was due mainly to yield effect while increase in output of sorghum on the other hand, was due to area effect.

4.2 Implications

Results suggest that there exist substantial scopes for enhancing the performance of the selected cereal crops through improvement in production technology of cereal farmers in Benue state, Nigeria. The instability in the area, output and yield of the selected cereals could create problems for food security given that majority of the population relies on cereals for food, in view of the fact that it is relatively cheaper than other food items. Given that cereal contributes for the most part to attainment of food security of developing country, factors that affects output of cereals would have direct effect on food security. Therefore, improving cereal productivity growth and reducing instability cannot be overemphasized because of the role of cereals in ensuring food security which is an essential part in eradicating hunger and poverty. Consequently, appropriate strategy aimed at the less performing crop such investing in agricultural research, timely supply of agricultural inputs such as improved seeds and fertilizer, education of farmers on the use of high yielding technologies ought to be put in place to narrow the productivity gap. This could help reduce instability, promote the desired growth in the cereal sector and enhance the availability and access to the selected cereals which in turn will lead to attainment of food security.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Canadian Encyclopedia. Cereal crops. Available:www.theCanadian encyclopedia.ca/en/article/cereal crops/ (Retrieved on 8th February, 2017)
2. Sarwar MH, Sarwar MF, Sarwar M, Qadri NA, Moghal S. The importance of cereals (Poaceae: Gramineae) nutrition in human health: A review. Journal of Cereals and Oilseeds. 2013;4(3):32-35.
3. Muhammed-Lawal A, Omotesho OA. Cereals and farming househols' food security in Kwara State, Nigeria. Agricultural Journal. 2008;3(3):235-240.
4. Wudiri BB. Recent development in cereal production in Nigeria. IITA, Ibadan, Nigeria; 1992.
5. NEARLS. Prospects and problems of the 1996 cropping season. A report of a study conducted by the National Agricultural Extension Research and Liaison Services (NEARLS) and Agricultural Planning Monitoring and Evaluation Unit (APMEU), 2-3 Oct. (NEARLS), Ahmadu Bello University, Zaria. 1996;62.
6. Maxiya-Dixon BI, Akinyele O, Oguntona EB, Nokoe S, Sanusi RA, Harris E. Nigeria food consumption and nutrition survey 2001-2003 summary. IITA, Ibadan, Nigeria; 2004
7. Worlds Food Summit. World Food Summit Newsletter. Dr. Jacques Diouf- Director General of FAO. Food Agricultural Organization Corporate Document Repository; 1996. Available:http://www.fao.org/wfs/index en.htm
8. FAO. International Rice Commission Newsletters. Dat Van Tran, Food and Agriculture Organization. Rome, Italy. 2003;52. ISSN: 0538- 9550
9. Postnote. Food security in developing countries. The Parliamentary Office of Science and Technology. 2013;274. Available:www.parliament.uk/post (Accessed 2/12/13)
10. Davies AE. Food security initiatives in Nigeria: Prospects and challenges. Journal of Sustainable Development in Africa. 2009;11(1):186-202.

11. Goswami PK, Chatterjee B. Linkage between rural poverty and agricultural productivity across the districts of Uttar Pradesh in India. Journal of Development and Agricultural Economics. 2010;2(2):26-40.
12. Salami A, Brixiova Z, Kandil H, Mafusire A. Toward food security in Africa: Challenges, policies and the role of the African development bank. Africa Economic Brief. 2011;2(2).
13. Akanji B. Some critical considerations in rural nutritional health status in Nigeria. Perspectives on Food Security in Nigeria. Olomola, A. and S. Nwosu (eds) Nigerian Rural Sociological Association. 1993;39-51.
14. Adegboye RO. Land, agriculture and food security in Nigeria. Faculty of Agriculture Lecture Series, University of Ilorin; 2004.
15. Bera BK, Jha Chakraborty A, Nandi AK, Sarkar A. Growth and instability of food grains production of India and West Bengal. Journal of Crop and Weed. 2011;7(1):94-100.
16. Chand R, Raju SS. Instability in Indian agriculture during different phase of technology and policy. Indian Journal of Agricultural Economics. 2009;64(2):283-285.
17. Arya A, Mehta N. Performance of Gujarat economy: An analysis of growth and instability. MPRA Paper No. 35712. 2012;19.Available:http://mpra.ub.uni-muenchen.de/35712/
18. Alemu ZG. Causes of instability in cereal production in Ethiopia. Working Paper Department of Agricultural Economics Faculty of Natural and Agricultural Sciences at the University of the Free State. 2005;25.
19. National Population Commission, (NPC). Population of Benue State. National Population Commission, Abuja; 2006.
20. Sharma KL. Measurement of effect of area, yield and prices in the increase of value of crop output in India. Agricultural Situation in India. 1977;32(6).
21. Sagar V. Decomposition of growth trends and certain related issues. Indian Journal of Agricultural Economics. 1980;35(2):42-59.
22. Cuddy JAD, Della Valle PA. Measuring instability of time series data. Oxford Bulletin of Econ, Stat. 1978;40(1):79-85.
23. Ayalew B. Trends, growth and instability of finger millet production in Ethiopia. Research Journal of Agriculture and Environmental Management. 2015;4(2): 078-081.
24. Nkoya E, Pender J, Kato E, Omobawale O, Philip D, Ehul S. Enhancing agricultural productivity and profitability in Nigeria. The Nigeria Strategy Support Program (NSSP). International Food Policy Research Institute, Brief No. 19; 2010.
25. Maikasuwa MA, Ala AL. Trend analysis of area and productivity of sorghum in Sokoto State, Nigeria, 1993-2012. European Scientific Journal. 2013;9(16):69-75.
26. Prabakaran K, Sivapragasm C. Analysis of growth rates of rice and sorghum in Andhra Pradesh. International Journal of Farm Science. 2013;3(1):1-9.

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