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Understanding Drivers and Risks for Policy: A Comparative Assessment of Cassava Production Systems in Africa

Abstract. Cassava is a critical staple crop for food security and livelihoods across sub-Saharan Africa, yet its production dynamics vary significantly between major producing nations. This study conducts a comparative analysis of cassava production trends, drivers of change, and sources of instability from 1993 to 2024 in five leading African producers: Angola, Congo, Ghana, Nigeria, and Tanzania. Utilising a decomposition analysis framework on FAO time-series data, the research quantifies the contributions of area expansion and yield improvement to production growth and identifies the statistical components of output volatility. The results reveal two distinct models: Ghana exemplifies a productivity-led intensification path, where rising yields contributed most to growth, while Nigeria and Tanzania followed an area-driven extensification model, where massive land expansion offset declining yields and introduced higher instability linked to volatile area allocation. Angola and Congo demonstrated more balanced growth. The primary sources of instability differed: Nigeria's risk was dominated by fluctuations in cultivated area, while Ghana's was driven by increasing yield variance. The study concludes that sustainable growth in the cassava sector requires a strategic shift from extensification to intensification. Policy implications advocate for differentiated national strategies prioritising investment in yield-enhancing technologies, climate-resilient practices, and stabilised land-use policies to ensure long-term productivity and reduced volatility.

Keywords: cassava, extensification, intensification, production, trend, Africa

JEL Classification: Q01, Q17, Q18

Introduction

Cassava (Manihot esculenta Crantz) is a vital staple crop and a cornerstone of food security for over 800 million people globally, with sub-Saharan Africa accounting for approximately 60% of worldwide production (Aigbokie et al., 2025; Gmakouba et al., 2024; FAO, 2022; Fu, 2021; Szyniszewska, 2020). Its resilience to drought, ability to thrive in

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marginal soils, and versatile uses for human consumption, animal feed, and industrial starch make it a critical crop for rural livelihoods and economic development across the continent (Omodara et al., 2023; Ngongo et al., 2022; Acheampong et al., 2021; Amelework et al., 2021; Acheampong et al., 2018). In recent decades, concerted efforts have been made to transform cassava from a subsistence food crop into a competitive commodity, driven by national policies, research into high-yielding and disease-resistant varieties, and growing market demand (Dankwa et al., 2025; Gmakoubaet et al., 2024; Udochukwu, 2024; Otun et al., 2023; Tafesse et al., 2021; Pipitpukdee et al., 2020; Darko-Koomson et al., 2020). Understanding the dynamics of its production is therefore essential for guiding agricultural policy, ensuring nutritional security, and fostering inclusive economic growth in Africa.

Despite its importance, cassava production systems in Africa face persistent and evolving challenges. Production trends are characterised by significant spatial and temporal variability, with growth patterns differing markedly between major producing nations. While some countries have achieved substantial gains through improved yields, others have relied predominantly on expanding cultivated area, often with implications for sustainability and stability (Ikuemonisan et al., 2020a&b). Furthermore, production remains highly vulnerable to an array of biotic and abiotic stresses, including cassava mosaic and brown streak diseases, fluctuating climate patterns, and volatile market prices, leading to considerable instability in output (Sakadzoet al., 2025; Enesi et al., 2022; Becerra-Lopez Lavalle et al., 2021). This instability threatens household income and regional food supply chains. A nuanced comparative analysis of the sources of production growth and instability is currently lacking, limiting policymakers' ability to design targeted, context-specific interventions that enhance both productivity and resilience.

This study is justified by the urgent need to move beyond aggregate production statistics and dissect the underlying components of change and risk in Africa's cassava sector. A comparative assessment of top-producing countries can reveal successful models of sustainable intensification and highlight systemic vulnerabilities. Such an analysis provides critical evidence for informing strategic investments in agricultural research, extension services, climate-smart practices, and infrastructure development. By identifying whether production increases are driven by yield improvements or area expansion, and by pinpointing the key sources of volatility, stakeholders can prioritise interventions that maximise long-term, stable benefits for farmers and consumers alike.

The primary objective of this research is to conduct a detailed comparative analysis of cassava production trends, drivers of change, and sources of instability across five major African producing countries: Angola, Congo, Ghana, Nigeria, and Tanzania, from 1993 to 2024. Specifically, the study aims to: (1) analyse and compare the long-term production, area, and yield trends across these nations; (2) decompose the causes of changes in production between the periods 1993-2008 and 2009-2024; (3) quantify the contributions of area expansion, yield enhancement, and their interaction with changes in average production; and (4) identify and compare the fundamental sources of instability in cassava production within each country's context..

Theoretical Framework

This study is anchored in the "Theory of Production" from agricultural economics, which posits that output is a function of inputs such as land, labour, capital, and technology

(Heady, 1952). To analyse cassava production dynamics, we apply a "Decomposition Analysis Framework", a methodological approach that disentangles changes in total output into distinct, quantifiable components. Specifically, we adopt an "Output Decomposition Model" where changes in total production (P = Area * Yield) are attributed to variations in the mean cultivated area, changes in mean yield (representing technological and efficiency improvements), and the interaction between these two factors (Ikuemonisan & Akinbola, 2021; Ikuemonisan *et al*., 2020). This is expressed as:

$$\Delta P \approx \Delta A\bar{Y} + \Delta Y\bar{A} + \Delta A * \Delta Y$$

where A is area and Y is yield. Furthermore, to understand volatility, the analysis extends to decomposing the variance of production, identifying sources of instability stemming from fluctuations in area, yield, their covariance, and mean shifts. This framework, supported by the conceptual models of Minot (2014) for agricultural growth decomposition, allows for a systematic, comparative assessment of whether production growth is driven by land expansion (extensification) or productivity gains (intensification), and what factors underpin production risks in different national contexts.

Conceptual Framework

This study is guided by a conceptual framework that posits total cassava production (P) as the central outcome variable, determined by the interactive components of cultivated area (A) and yield per hectare (Y). Changes in production over time are therefore conceptualised as stemming from variations in area, yield, or their synergistic interaction. These components are themselves influenced by a set of external factors categorised into environmental, policy/technological, and socioeconomic domains, which include climate, research & development, market forces, and agricultural policies. This framework allows for the systematic decomposition of production trends and instability into these core elements, facilitating a comparative analysis of growth drivers and risk sources across different national contexts, as adapted from decomposition models used in agricultural economics (Minot, 2014; Ikuemonisan et al., 2020).

Key Elements:

1. External factors: Environmental (climate, soil), Policy/Technological (R&D, policies), and Socioeconomic (markets, labour) factors that influence production components.
2. Core components: Cultivated Area (A) and Yield per Hectare (Y) as the fundamental production factors.
3. Production function: Total Production (P) determined by the multiplicative interaction of A and Y.
4. Analytical framework: Systematic decomposition approach to compare growth drivers and instability sources across countries.

This visualisation shows how external factors influence the fundamental production components (Area and Yield), which combine to determine total output, enabling a comparative analysis of production dynamics across different agricultural contexts.

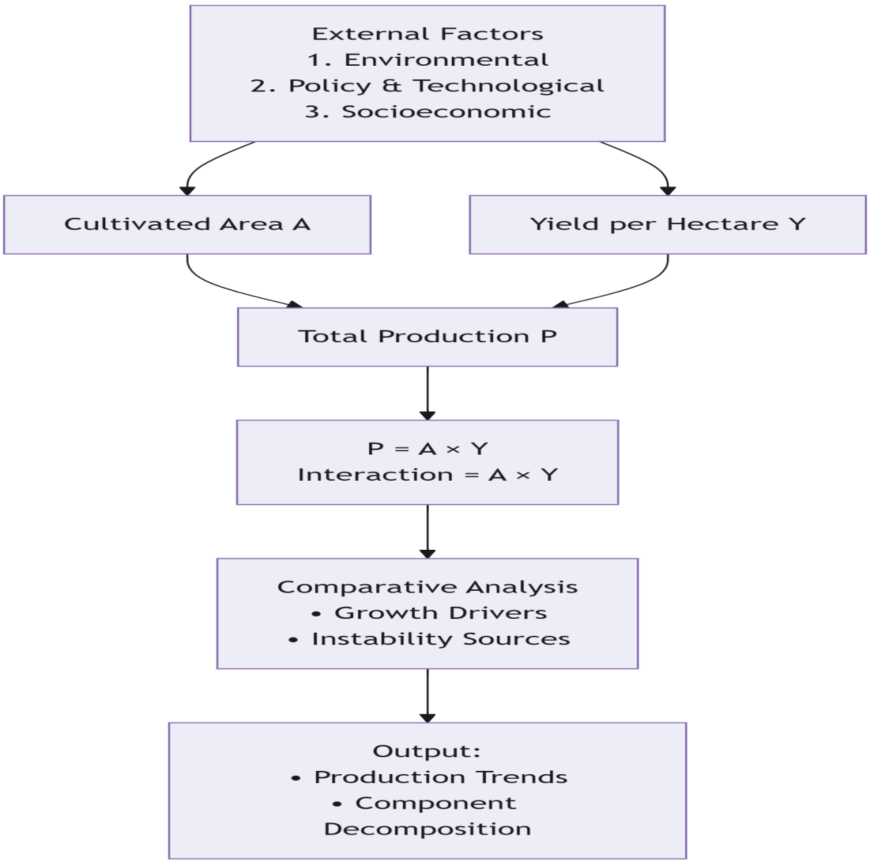

Fig. 1. Conceptual framework

Source: own study.

Empirical Review

Empirical research on cassava production in Africa has extensively documented varied growth patterns and underlying drivers. Studies on Nigeria, the global leading producer, consistently identify area expansion as the primary driver of output growth, with yield stagnation or decline being a major concern. Ikuemonisan et al. (2020) confirmed this through a decomposition analysis for 1970-2018, finding that area contributed over 80% to production increases, while yield growth was minimal and unstable. Conversely, Ghana is often highlighted as a success story for productivity-led growth. Research by Acheampong et al. (2021) attributes this to the successful adoption of improved, high-yielding varieties supported by effective extension services and market linkages, a finding corroborated by Pauw (2022) in their evaluation of national input subsidy programmes.

Comparative studies reveal these divergent models. Liverpool-Tasie et al. (2015) note that while land expansion offers a quick path to increased output, it often involves cultivating less suitable lands, leading to lower average yields and greater environmental pressure—a pattern evident in Nigeria and Tanzania. In contrast, the intensification model, as seen in Ghana, relies on enhanced technical efficiency but may introduce new vulnerabilities, such as greater sensitivity of modern varieties to climate shocks, as discussed by Abotbina et al.(2022).

As for instability, the empirical literature points to multiple sources. Sakadzo et al. (2025) emphasise climate variability as a critical destabilising factor, particularly in East African countries like Tanzania. Other studies, including Minot (2014), identify volatile input and output prices, pest and disease outbreaks (notably cassava mosaic and brown streak diseases), and policy inconsistencies as key contributors to production variance. The decomposition of instability into area and yield components, as applied in this study, is less common but builds upon the methodological foundations laid by earlier agricultural economic analyses to provide a nuanced understanding of risk sources (Jayne et al., 2018).

Beyond the established literature on production decomposition, recent empirical studies have provided deeper insights into the micro-level dynamics and external factors shaping cassava production across Africa. A comprehensive panel analysis of 37 African countries from 1961 to 2020 by Adebayo (2023) revealed that approximately 95.6% of the variability in cassava production is explained by changes in area harvested, while yield variability accounts for merely 1.1%, with consumer price index (27.6%) and temperature changes (1.8%) also playing significant roles. This finding corroborates the extensification narrative observed in Nigeria and Tanzania while highlighting the limited contribution of productivity gains continent-wide.

In Eastern Africa, recent research on cassava response to weather variability using panel regression across 15 countries from 1961 to 2023 found that while rainfall impacts on yields are insignificant, temperature effects are significantly positive, indicating yield and area increases with warming climate (Bacsi & Jarso, 2026). However, the study cautioned that expansion of cassava-growing areas coupled with growing rural populations contributed to declining yields due to the spread of smallholder subsistence farming constrained by limited resources. This suggests that even if climate change may benefit cassava production, other factors create severe limitations on improving yields.

For Ghana, micro-level evidence from field surveys in the Ashanti and Volta regions documents a local-level agricultural transformation characterised by growing farm sizes, adoption of new technologies, higher productivity, expanding market opportunities, and shifting labour structures (Andersson et al., 2024). The study observed that medium-sized farms (5-100 ha) are increasing in number, driven by reinvestment of incomes by local farmers rather than foreign investment. Average cassava yields in these regions increased substantially from 10-14 t/ha to 22-24 t/ha between 2008 and 2018, demonstrating the tangible outcomes of Ghana's productivity-led approach.

In Tanzania, disease stress and climate shock remain critical constraints. Masisila et al. (2025) found that among smallholder cassava producers in the Mtwara and Lindi regions, 84% suffered from insufficient rainfall, 65% experienced late onset rainfall, and 58% faced high temperatures and prolonged dry spells. Crucially, 76% of farmers reported poor root quality and 88.5% reported reduced yields due to Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD). Similarly, research by Aregbesola et al. (2021) revealed that 66.8% of Tanzanian farmers produce cassava primarily for food, relying on friends (43.8%) and their own farms (41.9%) for planting materials, with significantly more farmers controlling viruses (38.1%) than whiteflies (19.7%), highlighting critical gaps in pest management capacity.

For Nigeria, emerging evidence points to growing industrial opportunities alongside persistent structural barriers. The Nigeria Cassava Initiative reports that while Nigeria produces over 60 million metric tons annually, it captures only 2% of the $180 billion global cassava processing market (Edike et al., 2025; Ikejemba & Brock, 2024). National yields remain low at approximately 6 t/ha, far below the global benchmark of 25 t/ha. However, pilot projects demonstrate that yields can double or triple with consistent access to improved stems, soil inputs, and agronomic support. Recent international partnerships, such as the collaboration between the Chinese Academy of Tropical Agricultural Sciences and Nigeria's National Root Crops Research Institute established in 2023, aim to introduce new cassava varieties and advanced farming techniques across over 500,000 hectares, potentially transforming productivity through germplasm exchange, technology transfer, and capacity building (Onyediako & Adiele, 2022; Oluwabiyi & Duruji, 2021).

Research Methodology

This study employs a quantitative decomposition analysis using secondary time-series data (1993–2024) from the FAO database for five major African cassava producers: Angola, Congo, Ghana, Nigeria, and Tanzania. The methodology follows output decomposition frameworks (Sadıq et al., 2020; Sadıq et al., 2021; Minot, 2014). The change in mean production between two periods (I: 1993-2008 and II: 2009-2024) is disaggregated into components attributable to changes in mean cultivated area, mean yield, and their interaction. Subsequently, the variance of production is decomposed to identify the statistical sources of instability, including variance in area and yield, their covariance, and changes in mean values. Key limitations of the methodology include reliance on the accuracy of reported FAO data, the model's inherent assumption that production is a direct product of area and yield, and its inability to causally attribute the observed changes to specific external factors like climate or policy shifts.

Empirical model

The empirical analysis employs a two-stage decomposition model. First, the change in average production between Period I and Period II is decomposed as follows (Sadiq et al., 2025a&b):

$$\Delta\overline{P} = \Delta A * \overline{Y}_1 + \Delta Y * \overline{A}_1 + \Delta A * \Delta Y \quad \text{.............................. (1)}$$

Where:

$\Delta\overline{P}$ - Change in mean production;

ΔA - Change in mean area $(\overline{A}_2 - \overline{A}_1)$;

ΔY - Change in mean yield $(\overline{Y}_2 - \overline{Y}_1)$;

$\overline{A}_1, \overline{Y}_1$ - Mean area and yield in Period I.

This attributes the total change to contributions from area expansion $(\Delta A * \overline{Y}_1)$, yield improvement $(\Delta Y * \overline{A}_1)$, and their interaction $(\Delta A * \Delta Y)$.

Second, the change in the variance of production (instability) is decomposed using the general formula for the variance of a product:

$$\mathrm{Var(P)} = \mathrm{Var(A * Y)} \approx$$
$$\overline{\mathrm{A}}^2 * \mathrm{Var(Y)} + \overline{\mathrm{Y}}^2 * \mathrm{Var(A)} + 2 * \overline{\mathrm{A}} * \overline{\mathrm{Y}} * \mathrm{Cov\,(A, Y)} + higher - order - terms \; \ldots..(2)$$

The change in Var(P) between periods is then statistically attributed to changes in Var(A), Var(Y), Cov(A,Y), and the squared means ($\overline{\mathrm{A}}_2, \overline{\mathrm{Y}}_2$). This follows the decomposition methodology outlined by Sadiq *et al*. (2025a&b), Sadiq et al. (2021), Sadiq et al. (2020), and Minot (2014) for analysing agricultural output volatility.

Results and discussion

Production Trend of Cassava across the Selected Countries

The analysis of cassava production trends from 1993 to 2024 across Angola, Congo, Ghana, Nigeria, and Tanzania reveals distinct growth patterns and productivity levels (Figure 2). Nigeria consistently dominated in absolute production volume, with an average of 45.3 million tonnes, far surpassing other nations (Figure 2d). This aligns with its status as the world's largest cassava producer, a position supported by extensive land allocation, despite exhibiting lower average yield (9,362 kg/ha) compared to its potential, as noted by earlier studies which attribute this yield gap to predominant smallholder farming and limited adoption of improved varieties (Sadiq et al., 2025c; FAO, 2022). Ghana demonstrated the most impressive growth trajectory, with average production reaching 14.1 million tonnes and achieving the highest average yield (16,252 kg/ha) among the group (Figure 2c). This significant increase, particularly post-2008, reflects successful agricultural modernisation efforts, including the promotion of high-yielding, disease-resistant varieties, which has been documented as a key driver of Ghana's root and tuber crop revolution (Acheampong et al., 2021). In contrast, Angola showed volatile but generally increasing production, averaging 8.1 million tonnes, with notable peaks and troughs linked to post-conflict agricultural recovery and later climatic shocks (Figure 2a). Congo and Tanzania presented more moderate production scales, averaging 1.2 million and 6.3 tonnes, respectively (Figure 2b&e). Tanzania's trend was marked by high instability, particularly in yield, which remained the lowest on average (6,820 kg/ha), indicating persistent challenges such as variable rainfall and pest pressures, consistent with findings by Sakadzo et al. (2025) on climate vulnerability in Eastern African cassava systems. Congo, while small in scale, displayed steady growth, suggesting incremental improvements in a stable but constrained agricultural environment.

Causes of Changes between Period I (1993-2008) vs. Period II (2009-2024)

The decomposition of changes between the two 16-year periods highlights divergent strategies and outcomes (Table 1). For Angola, Congo, and Ghana, the second period (2009-2024) was characterised by simultaneous increases in both mean cultivated area and mean yield (Tables 1a, b & c). Ghana's performance was particularly striking, with a mean yield increase of 8,057 kg/ha, the largest absolute gain, coupled with substantial area expansion (Table 1c). This synergy between area and yield growth underscores the effectiveness of integrated national programmes focusing on input access and extension services, a success factor echoed in studies on Ghana's Planting for Food and Jobs initiative (Pauw, 2022). Nigeria and Tanzania, however, followed a different path. Nigeria witnessed a massive 4.1-million-hectare expansion in mean area but suffered a significant decline in mean yield (-

2,694 kg/ha) (Table 1d). This inverse relationship suggests an extensification strategy where production growth was achieved primarily by bringing more land under cultivation, often at the expense of yield per hectare, potentially due to cultivation on marginal lands or dilution of management intensity, a pattern observed in studies on Nigerian agricultural land use (Awotide et al., 2016). Similarly, Tanzania expanded its mean area but experienced a yield decline (-1,452 kg/ha) (Table 1e). The variance in area increased dramatically in Nigeria and Tanzania in Period II, pointing to greater volatility in land committed to cassava, possibly due to price fluctuations or competing land uses. The covariance between area and yield turned increasingly negative for Nigeria, indicating that higher area years were associated with lower yields, reinforcing the extensification narrative.

Sources of Change in Average Production of Cassava across the Selected Countries

The contribution analysis of changes in average production clearly distinguishes between yield-led and area-led growth models (Table 2). In Ghana, the change in mean yield was the predominant source, contributing 49.3% to the total production increase, followed by area expansion (29.6%) and their positive interaction (19.5%) (Table 2c). This demonstrates a productivity-intensive growth model. Similarly, in Angola and Congo, area expansion was the largest contributor (63.5% and 62.8%, respectively), but yield increases also played a substantial role (26.2% and 25.8%), showing balanced growth (Table 2a&b). The situation was reversed for Nigeria and Tanzania. In Nigeria, the massive area expansion contributed 211.9% to the mean production change, but this was severely offset by negative contributions from yield change (-42.7%) and the negative interaction between area and yield (-53.3%) (Table 2d). This results in a net increase where area expansion compensated for falling productivity, a pattern of unsustainable extensification that raises concerns about long-term land degradation, as cautioned by research on sub-Saharan Africa's crop production frontiers (Jayne et al., 2018). Tanzania's pattern mirrored this, with area expansion contributing 183.4% but being counteracted by large negative yield and interaction effects (Table 2e). The positive change in area and yield covariance in Tanzania (14.2%) was a minor mitigating factor, suggesting some weak alignment between area and yield gains in the latter period.

Sources of Instability in the Production of Cassava across Selected Countries

The sources of instability, derived from changes in production variance, reveal the underlying risk factors in each country's cassava sector (Table 3). Nigeria exhibited the most complex and extreme sources of instability (Table 3d). The overwhelming positive contribution came from the change in area variance (2,311.3%), indicating that fluctuations in the amount of land planted are the primary driver of production volatility. This is compounded by a huge negative contribution from changes in area and yield covariance (-1,108.4%), meaning that in years of high area, yields were disproportionately low, amplifying production risk. This aligns with studies identifying land tenure insecurity and erratic input supply as key sources of volatility in Nigerian agriculture (Liverpool-Tasie et al., 2015). For Tanzania, the main positive contributors to increased variance were changes in area variance (92.9%) and area and yield covariance (77.1%), while yield variance change was strongly negative (-72.3%) (Table 3e). This suggests that Tanzania's instability is less about fluctuating yields per se and more about unpredictable area allocation and its inconsistent relationship with yield, likely tied to climatic variability and market signals. Ghana's increased production variance was primarily driven by positive changes in yield variance (27.6%), mean yield (19.2%), and area and yield covariance (16.7%) (Table 3c). This indicates that as Ghana intensified production, it also introduced new vulnerabilities, potentially related to greater sensitivity of high-yielding varieties to climate shocks or pests, a trade-off noted in high-input agricultural systems (Acheampong et al., 202; Tambo & Abdoulaye, 2012). Angola and Congo showed more mixed component contributions (Tables 3a&b, respectively), with negative contributions from changes in mean area and yield dominating in Angola, suggesting a dampening of earlier volatility, possibly due to post-war stabilisation.

Conclusions, Recommendations and Policy Implications

Conclusions

The analysis reveals two distinct cassava production models in Africa: a sustainable, productivity-led intensification model exemplified by Ghana, and a less stable area-driven extensification model dominant in Nigeria and Tanzania. While all countries increased average production, Ghana achieved this through significant yield gains, whereas Nigeria and Tanzania relied on land expansion accompanied by yield decline and higher instability, primarily from volatile area allocation.

Recommendations

For Nigeria and Tanzania, policy must urgently shift from extensification to sustainable intensification by prioritising improved seed systems, soil fertility management, and irrigation. Ghana should focus on consolidating gains by enhancing climate resilience and value chain development. Angola and Congo should continue their balanced path with strengthened research and extension services.

Policy Implications

National agricultural policies must be differentiated based on each country's dominant growth driver and source of instability. Investment should target yield-enhancing technologies and climate adaptation to de-risk production. Regional cooperation is vital to share best practices from Ghana’s success, promoting a continental shift towards resilient and productive cassava systems that ensure long-term food security without ecological degradation.

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Appendix

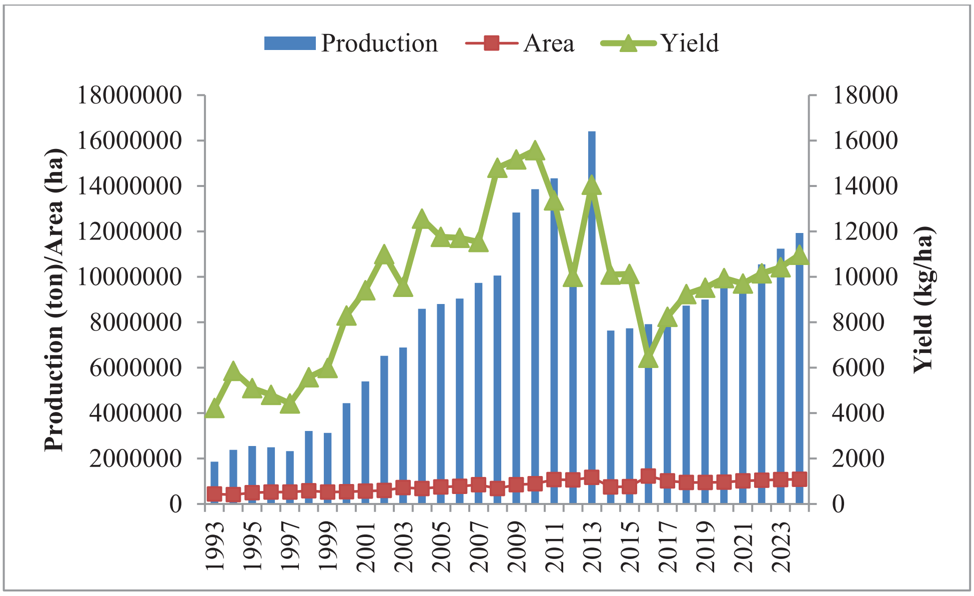

Fig. 2a. Production trend of cassava in Angola

Source: FAO, 2026.

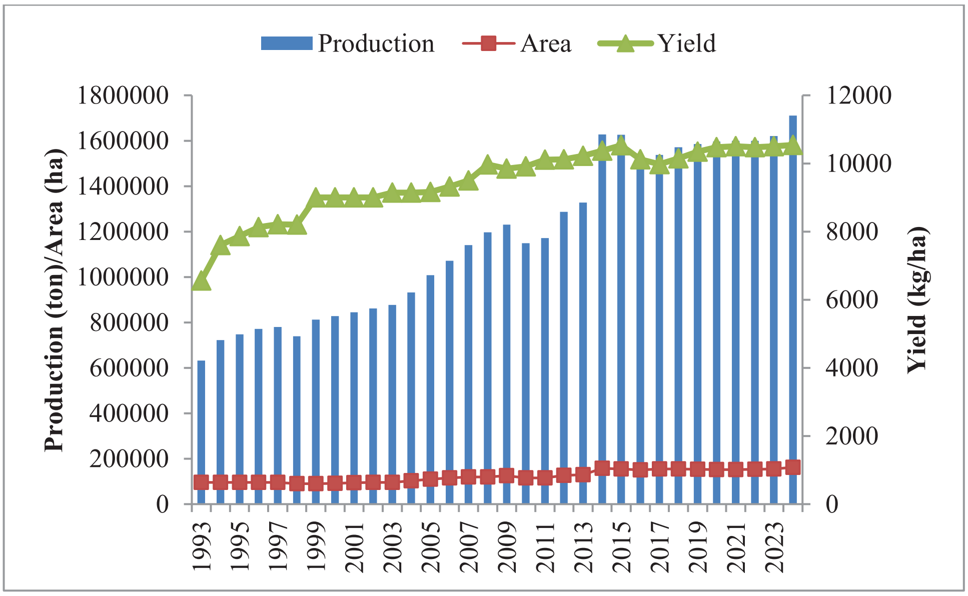

Fig. 2b. Production trend of cassava in Congo

Source: FAO, 2026.

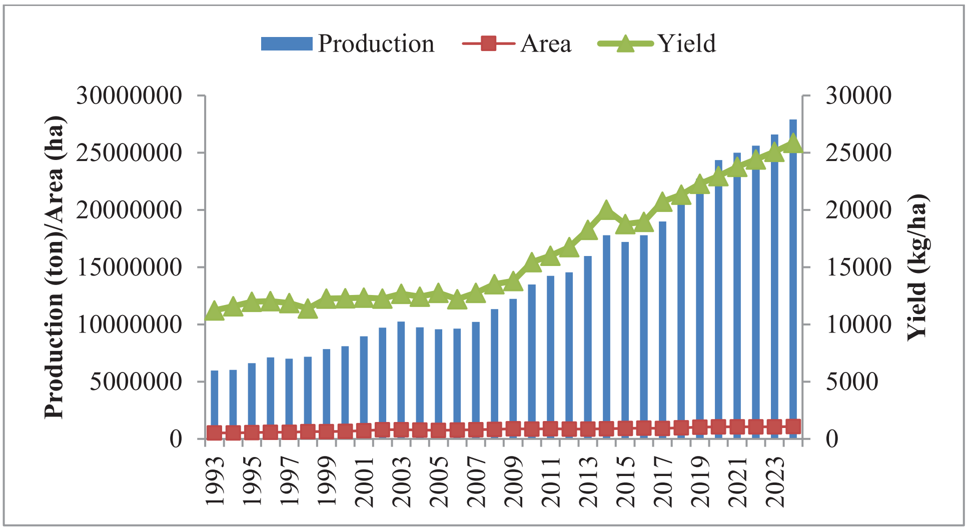

Fig. 2c. Production trend of cassava in Ghana

Source: FAO, 2026.

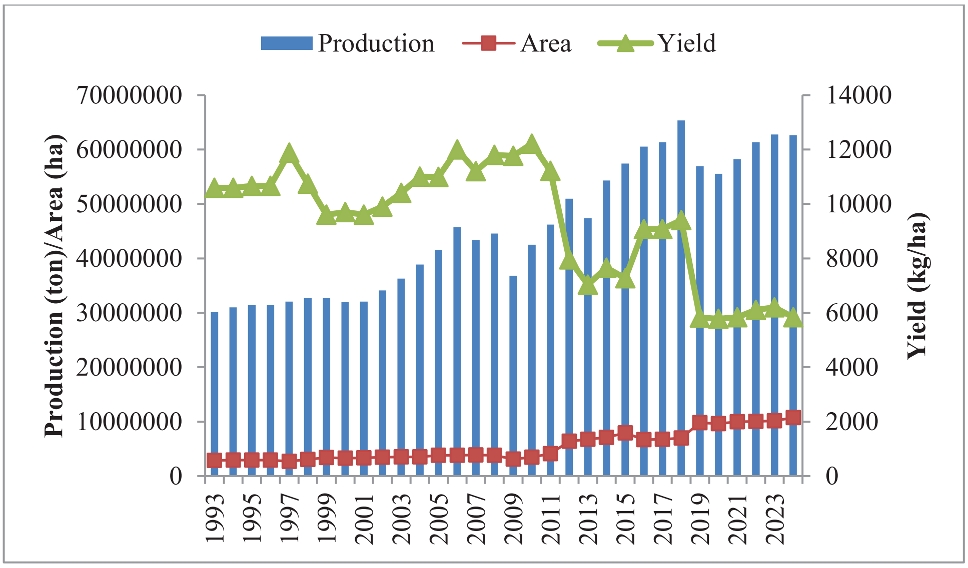

Fig. 2d. Production trend of cassava in Nigeria

Source: FAO, 2026.

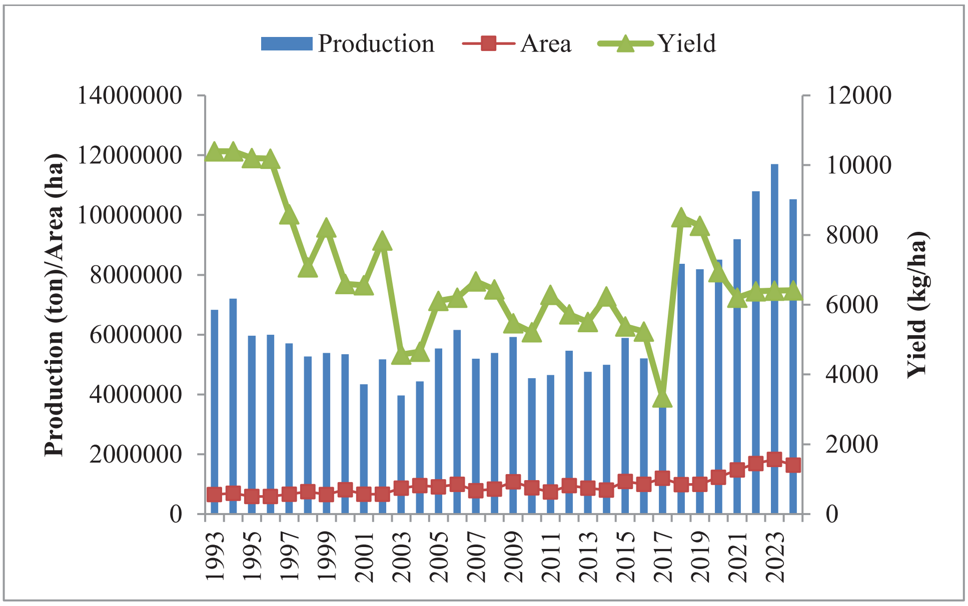

Fig. 2e. Production trend of cassava in Tanzania

Source: FAO, 2026.

Table 1a. Causes of changes between period I (1993-2008) versus period II (2009-2024) for cassava in Angola

Items	Period	Area	Yield	Area-Yield interaction
Mean	I	602371.4	8540.181	5.45E+09
	II	991998.4	10816.57	1.07E+10
Change		389627	2276.388	5.24E+09
Variance	I	1.12E+10	9533489	7.73E+18
	II	1.14E+09	1734107	8.87E+17
Change		-1E+10	-7799382	-6.8E+18
Covariance	I	2.02E+08		
	II	-4.2E+07		
Change		-2.4E+08		

Source: FAO, 2026.

Table 1b. Causes of changes between period I (1993-2008) versus period II (2009-2024) for cassava in Congo

Items	Period	Area	Yield	Area-Yield interaction
Mean	I	100064.8	8675.594	8.7E+08
	II	144544.4	10261.52	1.49E+09
Change		44479.56	1585.925	6.15E+08
Variance	I	8899899	648079.7	1.13E+16
	II	1.45E+08	28788.79	2.19E+16
Change		1.36E+08	-619291	1.06E+16
Covariance	I	1483362		
	II	1915372		
Change		432009.9		

Source: FAO, 2026.

Table 1c. Causes of changes between period I (1993-2008) versus period II (2009-2024) for cassava in Ghana

Items	Period	Area	Yield	Area-Yield interaction
Mean	I	687871.4	12223.48	8.45E+09
	II	959630	20280.52	1.97E+10
Change		271758.6	8057.038	1.12E+10
Variance	I	1.22E+10	201718.9	2.75E+18
	II	5.06E+09	11450554	2.2E+19
Change		-7.1E+09	11248835	1.93E+19
Covariance	I	30587678		
	II	2.26E+08		
Change		1.95E+08		

Source: FAO, 2026.

Table 1d. Causes of changes between period I (1993-2008) versus period II (2009-2024) for cassava in Nigeria

Items	Period	Area	Yield	Area-Yield interaction
Mean	I	3322431	10709.07	3.55E+10
	II	7469700	8015.519	5.65E+10
Change		4147269	-2693.55	2.1E+10
Variance	I	1.12E+11	11989.96	1.04E+19
	II	4.65E+12	2777070	3.29E+19
Change		4.53E+12	2765080	2.25E+19
Covariance	I	-2.3E+07		
	II	-3.4E+09		
Change		-3.3E+09		

Source: FAO, 2026.

Table 1e. Causes of changes between period I (1993-2008) versus period II (2009-2024) for cassava in Tanzania

Items	Period	Area	Yield	Area-Yield interaction
Mean	I	753441.3	7545.875	5.48E+09
	II	1152834	6093.863	7.13E+09
Change		399392.4	-1452.01	1.64E+09
Variance	I	1.03E+10	4575475	7.51E+17
	II	6.68E+10	170326.5	4.21E+18
Change		5.65E+10	-4405148	3.46E+18
Covariance	I	-1.3E+08		
	II	99967754		
Change		2.34E+08		

Source: FAO, 2026.

Table 2a. Sources of change in average production of cassava in Angola

Components of change in average production			
S/No.	Source of change	Components of change	Percent
1	Change in mean yield	1.37E+09	26.18365
2	Change in mean area	3.33E+09	63.53833
3	Interaction between changes in mean area and mean yield	8.87E+08	16.93616
4	Change in yield and area covariance	-2.4E+08	-4.65820
	Total Change in mean production	5.24E+09	100

Source: FAO, 2026.

Table 2b. Sources of change in average production of cassava in Congo

Components of change in average production			
S/No.	Source of change	Components of change	Percent
1	Change in mean yield	1.59E+08	25.81305
2	Change in mean area	3.86E+08	62.76753
3	Interaction between changes in mean area and mean yield	70541250	11.47410
4	Change in yield and area covariance	432009.9	0.07027
	Total Change in mean production	6.15E+08	100

Source: FAO, 2026.

Table 2c. Sources of change in average production of cassava in Ghana

Components of change in average production			
S/No.	**Source of change**	**Components of change**	**Percent**
1	Change in mean yield	5.54E+09	49.33932
2	Change in mean area	3.32E+09	29.57255
3	Interaction between changes in mean area and mean yield	2.19E+09	19.49258
4	Change in yield and area covariance	1.95E+08	1.736563
	Total Change in mean production	1.12E+10	100

Source: FAO, 2026.

Table 2d. Sources of change in average production of cassava in Nigeria

Components of change in average production			
S/No.	**Source of change**	**Components of change**	**Percent**
1	Change in mean yield	-8.9E+09	-42.696
2	Change in mean area	4.44E+10	211.8949
3	Interaction between changes in mean area and mean yield	-1.1E+10	-53.2959
4	Change in yield and area covariance	-3.3E+09	-15.9589
	Total Change in mean production	2.1E+10	100

Source: FAO, 2026.

Table 2e. Sources of change in average production of cassava in Tanzania

Components of change in average production			
S/No.	**Source of change**	**Components of change**	**Percent**
1	Change in mean yield	-1.1E+09	-66.5781
2	Change in mean area	3.01E+09	183.4091
3	Interaction between changes in mean area and mean yield	-5.8E+08	-35.2924
4	Change in yield and area covariance	2.34E+08	14.23845
	Total Change in mean production	1.64E+09	100

Source: FAO, 2026.

Table 3a. Sources of instability in the production of cassava in Angola

Components of change in variance of production		
S/No.	**Source of change**	**Components of change**
1	Change in mean yield	-37.6613
2	Change in mean area	-106.243
3	Change in yield variance	41.36734
4	Change in area variance	10.77443
5	Interaction between changes in mean yield and mean area	-5.24423
6	Change in area and yield covariance	36.11586
7	Interaction between changes in mean area and yield variance	70.82182
8	Interaction between changes in mean yield and area variance	6.509367
9	Interaction between changes in mean area and yield and change in area and yield covariance	39.83559
10	Change in residual	43.72381
	Total change in variance of production	-6.8E+18

Source: FAO, 2026.

Table 3b. Sources of instability in the production of cassava in Congo

Components of change in variance of production		
S/No.	**Source of change**	**Components of change**
1	Change in mean yield	26.81982
2	Change in mean area	77.3244
3	Change in yield variance	-58.5022
4	Change in area variance	96.63669
5	Interaction between changes in mean yield and mean area	1.974399
6	Change in area and yield covariance	7.062657
7	Interaction between changes in mean area and yield variance	-63.5686
8	Interaction between changes in mean yield and area variance	38.56027
9	Interaction between changes in mean area and yield and change in area and yield covariance	5.014187
10	Change in residual	-31.3216
	Total change in variance of production	1.06E+16

Source: FAO, 2026.

Table 3c. Sources of instability in the production of cassava in Ghana

Components of change in variance of production		
S/No.	**Source of change**	**Components of change**
1	Change in mean yield	19.17192
2	Change in mean area	1.521602
3	Change in yield variance	27.59134
4	Change in area variance	-5.49806
5	Interaction between changes in mean yield and mean area	0.694362
6	Change in area and yield covariance	16.74535
7	Interaction between changes in mean area and yield variance	26.10763
8	Interaction between changes in mean yield and area variance	-9.63678
9	Interaction between changes in mean area and yield and change in area and yield covariance	22.35449
10	Change in residual	0.948148
	Total change in variance of production	1.93E+19

Source: FAO, 2026.

Table 3d. Sources of instability in the production of cassava in Nigeria

Components of change in variance of production		
S/No.	**Source of change**	**Components of change**
1	Change in mean yield	-32.3283
2	Change in mean area	-6.5605
3	Change in yield variance	135.6615
4	Change in area variance	2311.259
5	Interaction between changes in mean yield and mean area	2.250025
6	Change in area and yield covariance	-1108.37
7	Interaction between changes in mean area and yield variance	550.0651
8	Interaction between changes in mean yield and area variance	-1016.44
9	Interaction between changes in mean area and yield and change in area and yield covariance	-722.357
10	Change in residual	-13.1777
	Total change in variance of production	2.25E+19

Source: FAO, 2026.

Table 3e. Sources of instability in the production of cassava in Tanzania

Components of change in variance of production		
S/No.	**Source of change**	**Components of change**
1	Change in mean yield	-49.9110
2	Change in mean area	77.3167
3	Change in yield variance	-72.2549
4	Change in area variance	92.9064
5	Interaction between changes in mean yield and mean area	4.4906
6	Change in area and yield covariance	77.0986
7	Interaction between changes in mean area and yield variance	-96.9068
8	Interaction between changes in mean yield and area variance	-32.3149
9	Interaction between changes in mean area and yield and change in area and yield covariance	18.1151
10	Change in residual	81.4602
	Total change in variance of production	3.46E+18

Source: FAO, 2026.

For citation:

Sadiq M.S., Singh I.P., Ahmad M.M., Isah M.A., Sani B.S. (2026). Understanding Drivers and Risks for Policy: A Comparative Assessment of Cassava Production Systems in Africa. *Problems of World Agriculture*, 26(1), 35-54; DOI: 10.22630/PRS.2026.26.1.3