

CLIMATE AND AGRICULTURE IN AFRICA: A DATA-DRIVEN EXPLORATION (2019-2023)

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2025

AGENDA

- Project Overview
- Introduction
- Insights and Recommendations
- Data Limitations
- Summary and Conclusion



PROJECT OVERVIEW

Over the last few years, climate patterns across Africa have shifted, with rising temperatures, changing rainfall levels, and unpredictable weather events.

This project explores a simple but important question:

How do changes in climate impact agricultural productivity across African countries?

Using five years of data (2019–2023) from 20 African countries, this analysis explores how climate patterns impact agricultural yields. It highlights which product categories are most climate-sensitive, how yields vary across regions, and which countries are more vulnerable or resilient.

The goal? To provide clear insights that can inform climate-smart agricultural decisions and help us adapt to a warming world.

INTRODUCTION

This analysis brings together two key datasets: **agricultural production data** and **climate data across 20 African countries**, selected from all regions – **North, South, East, and West** – to provide a balanced, well-rounded view.

Agricultural **products** were grouped into four main categories:

- Crops & Grains {Cereals, roots & tubers, pulses, tree nuts}
- Fruits & Vegetables {Citrus fruits, fruit, vegetables, sugar crops}
- Oil & Fiber Crops
- Meat & Animal Products {All meat types (beef, chicken, goat, pig, etc.), Eggs}

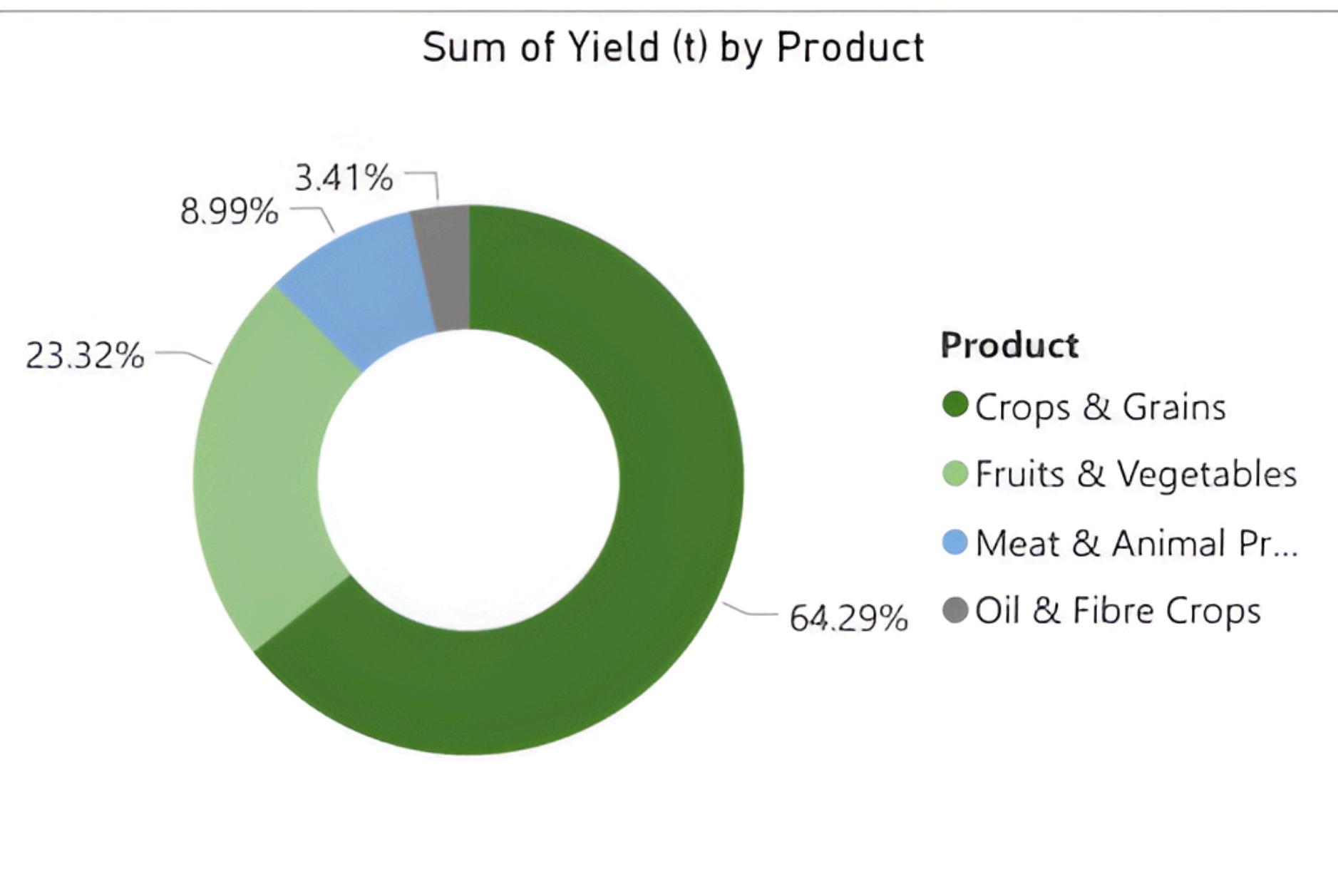
Climate variables included average temperature, precipitation levels, and temperature anomalies.

By connecting these datasets, the analysis offers insights into how different product types and regions respond to changing climate conditions.



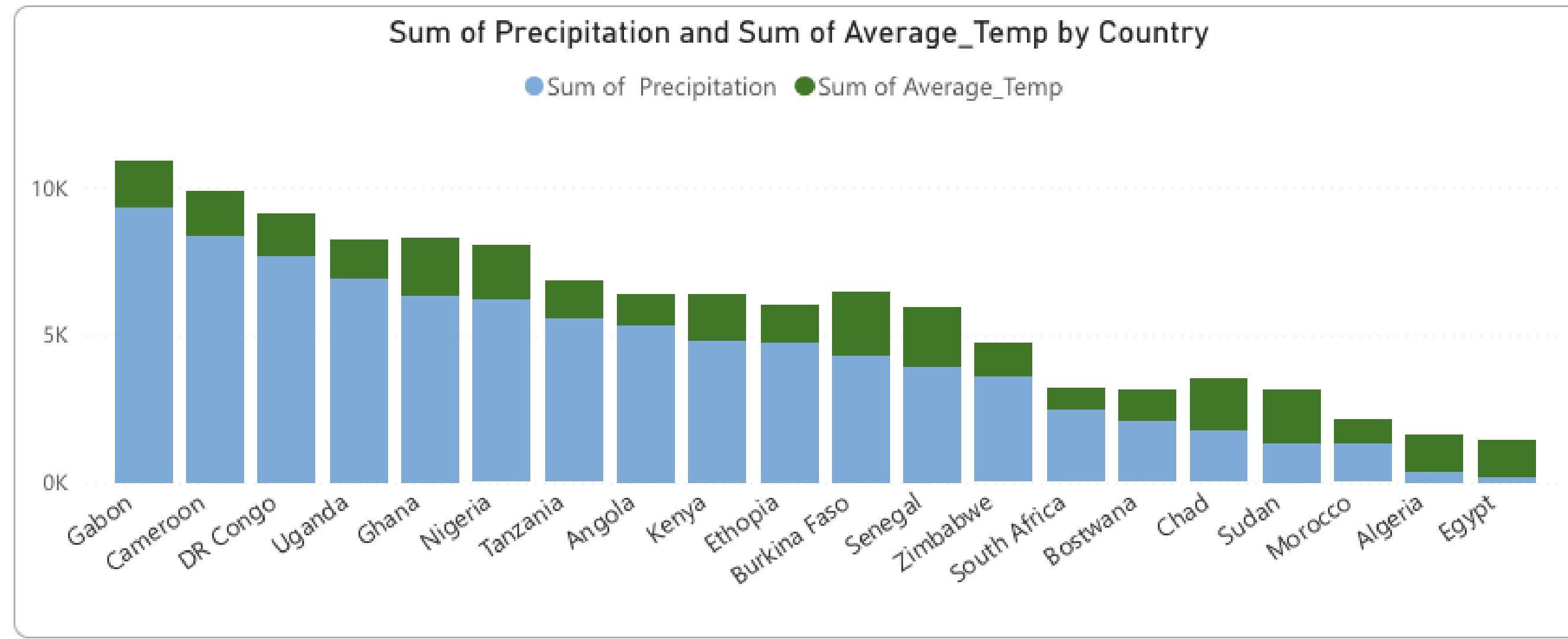
INSIGHTS:





Dominance of Crops and Grains

Across Africa's fields, **Crops & Grains** like maize and cassava dominate. This chart shows their yields soaring above **Fruits & Vegetables, Oil & Fibre Crops, and Meat & Animal Products**. These staples anchor African agriculture, but their lead makes them a prime target for the climate's impact.



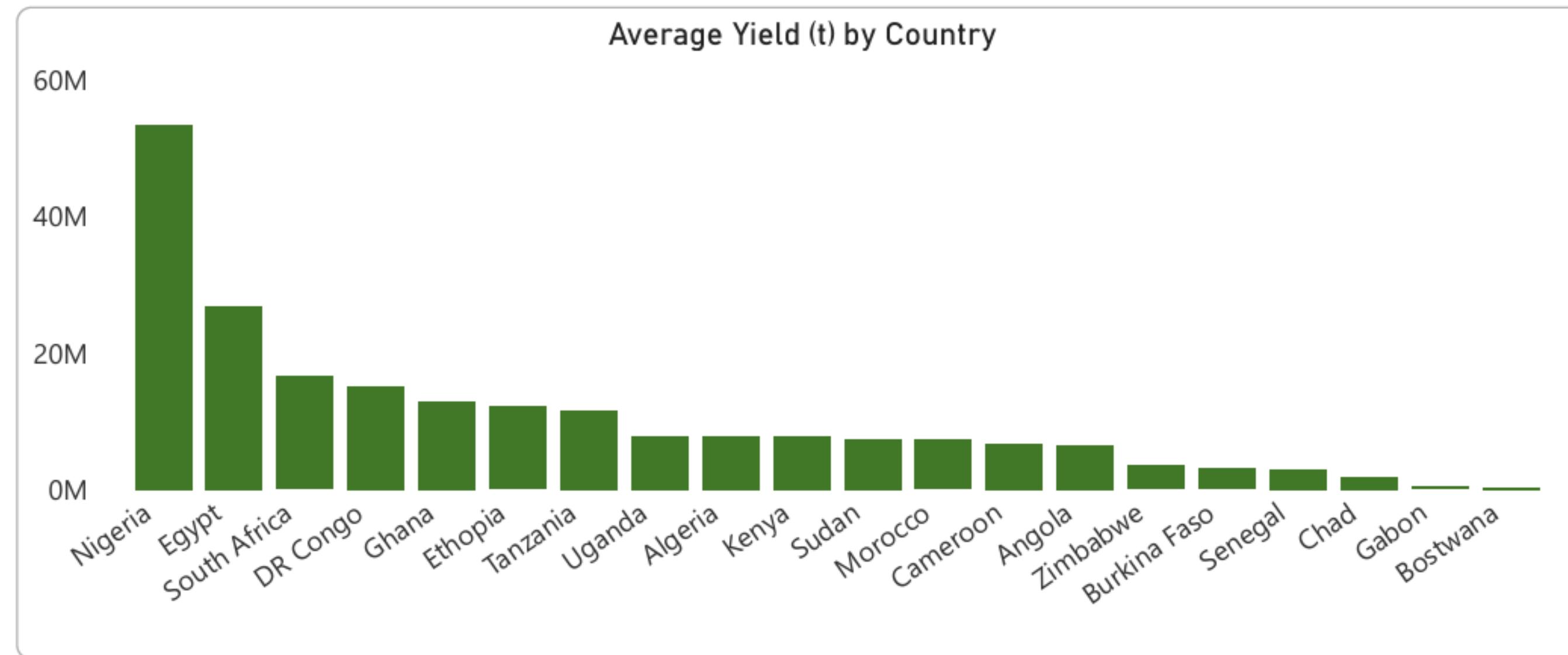
Climate Patterns Across Countries

To understand how climate influences these dominant crops, we next explore climate patterns across the continent.

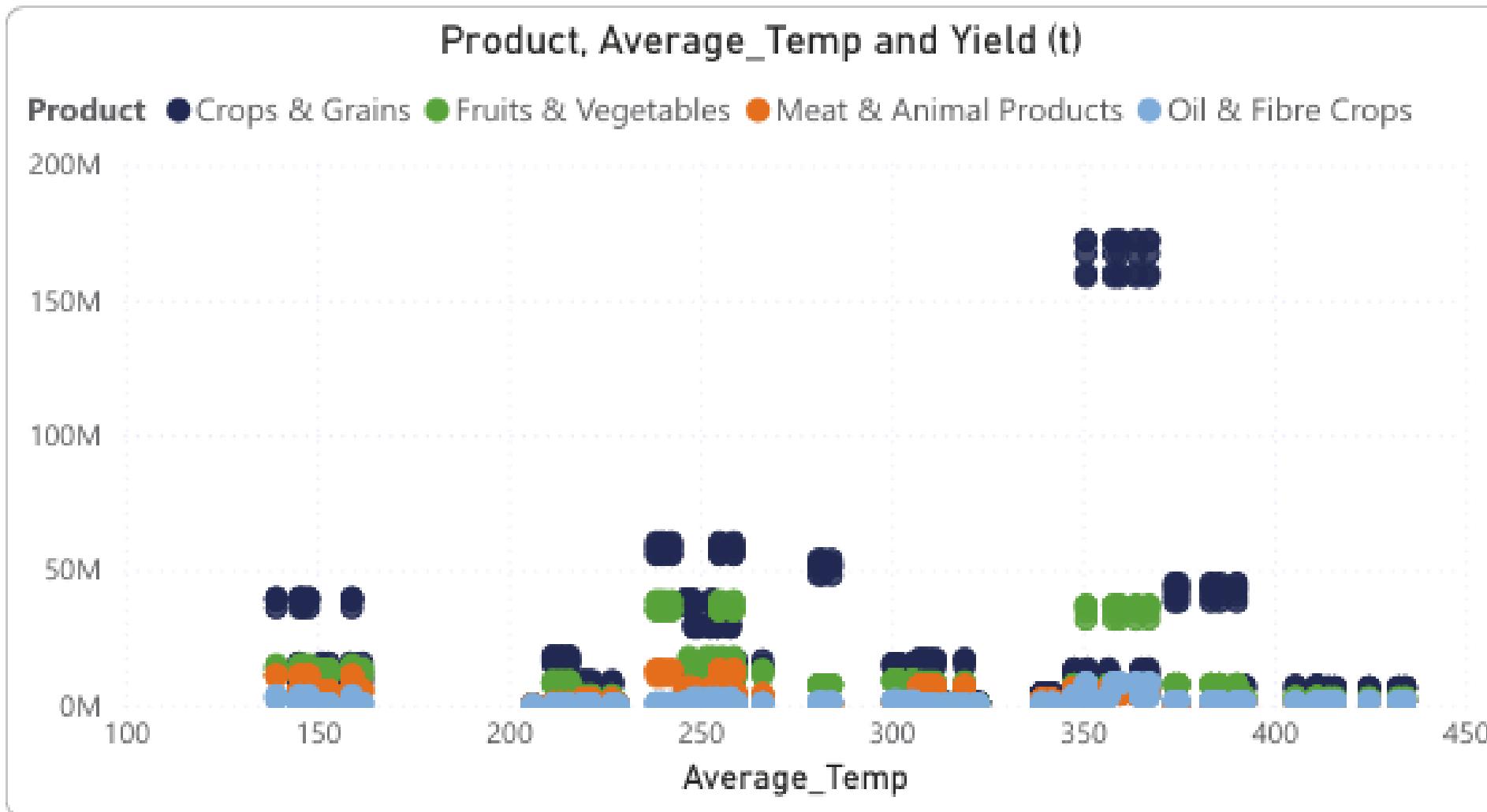
This chart maps precipitation and temperature across 20 African countries, revealing sharp contrasts. High-rainfall nations like **Gabon** and **Cameroon** enjoy abundant water but risk flooding and erosion. **Egypt**, **Algeria**, and **Chad**, with low rainfall, reflect arid climates where temperature plays a bigger role. Low-rainfall countries often rely on irrigation or drought-resistant crops, while hotter nations like **Botswana** and **South Africa** face heat stress, requiring adaptive farming strategies.

Nigeria's Agricultural Leadership

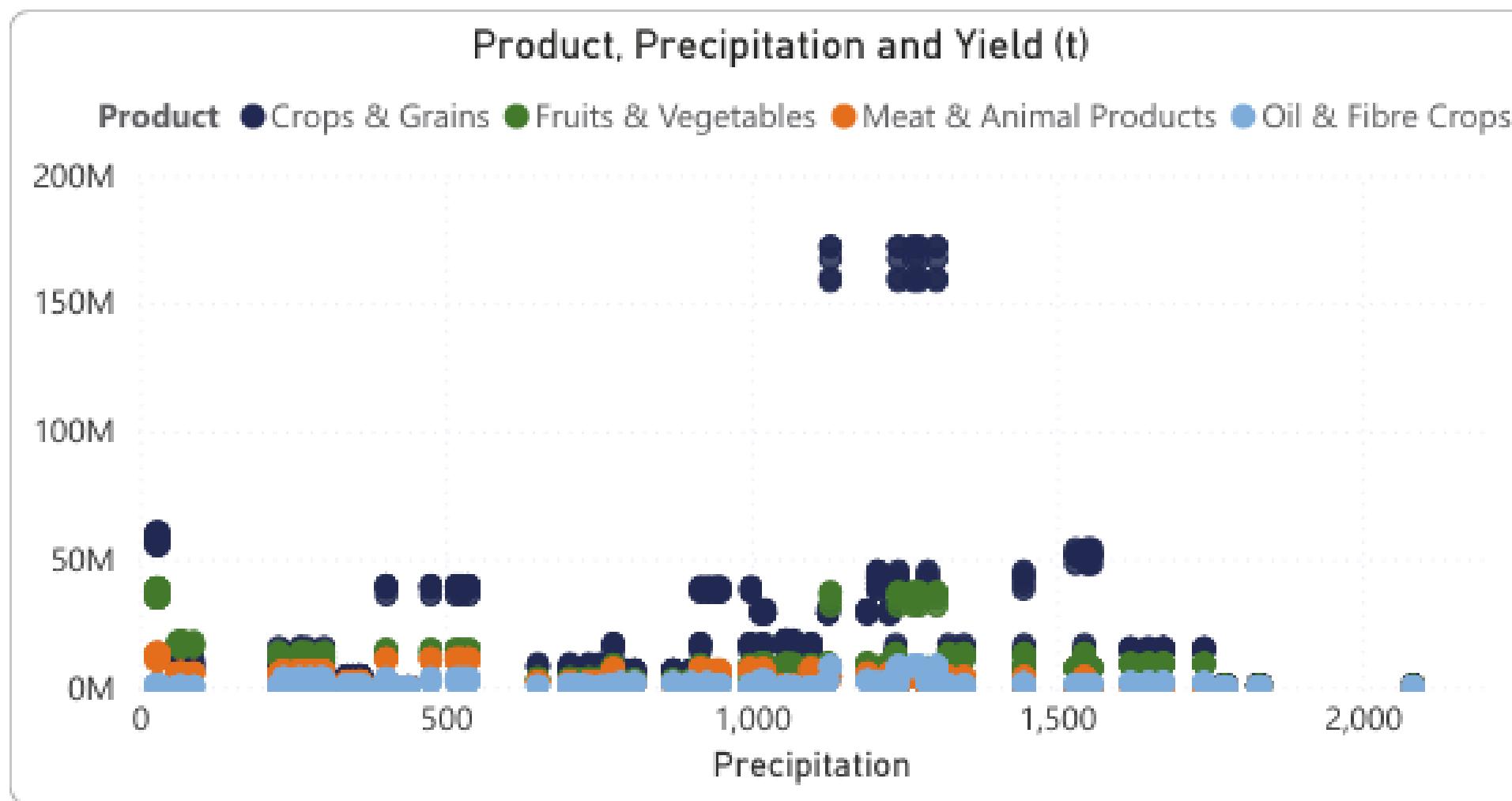
Nigeria leads with 53 million tonnes, nearly double Egypt's 27 million, driven by its dominance in Crops & Grains. **South Africa** and **Ethiopia** follow, while smaller nations like **Botswana** and **Gabon** lag. Despite **Gabon** being a high rainfall nation, the country yields low output, suggesting limited farmland and economic priorities shape agriculture beyond the climate's influence.



Temperature's Complex Role in Yields Over the Years

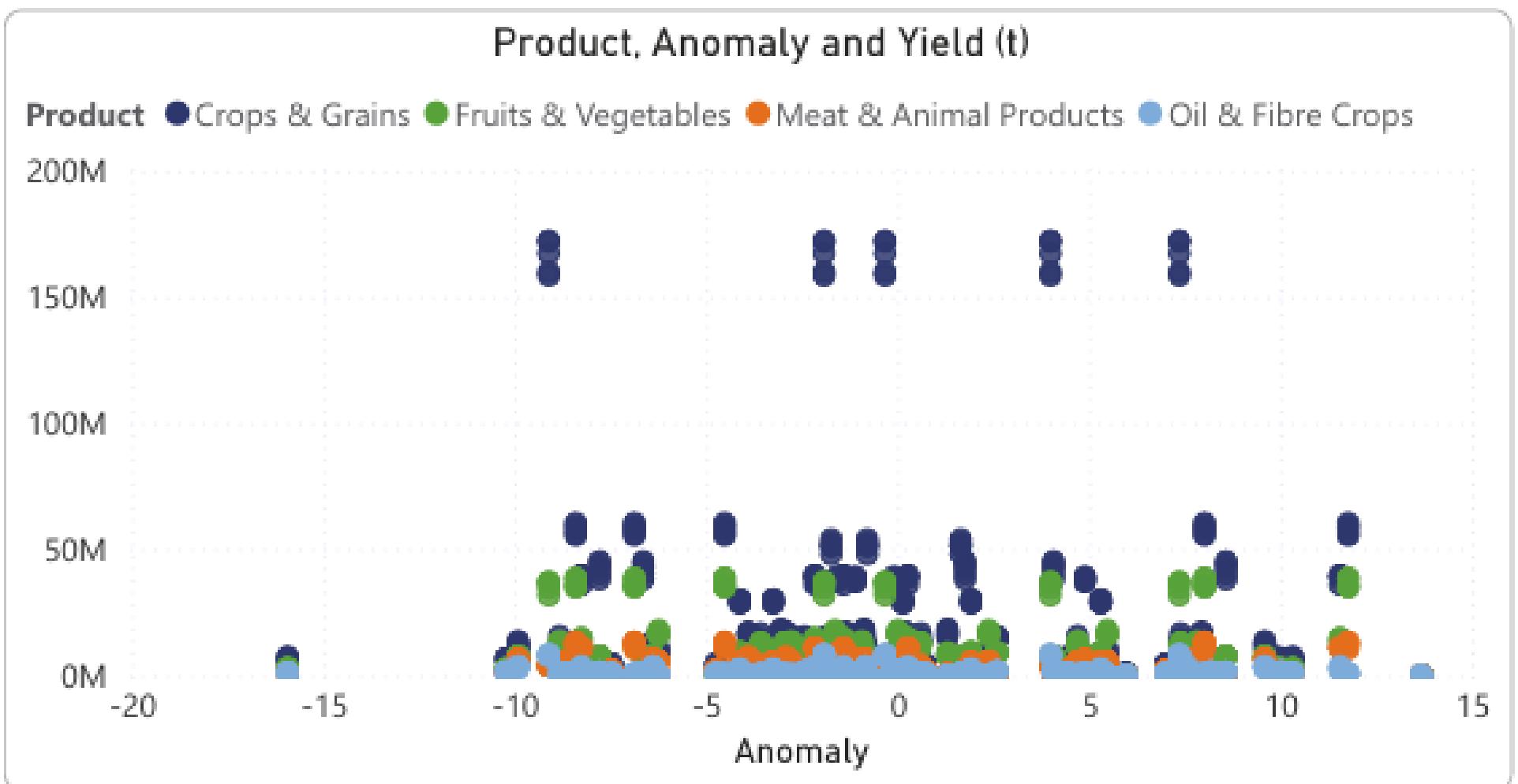


Rainfall's Varied Impact on Yields Over the Years



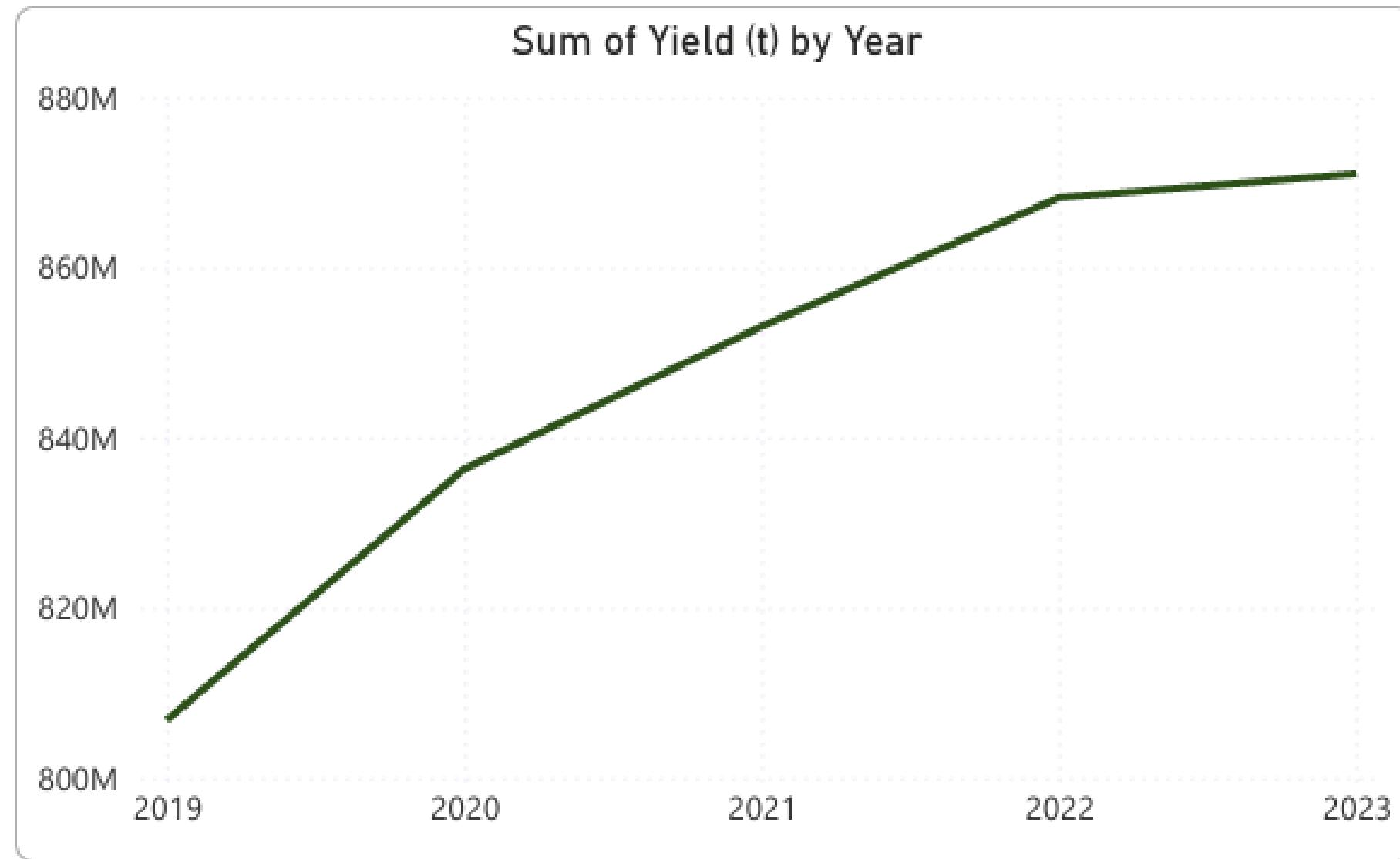
Similar to the temperature scatter plot, this scatter plot maps yields against precipitation. Again, **Crops & Grains** consistently dominate the highest yield values, especially at multiple precipitation levels, including some **outliers** above 150M tonnes (High-Yield Staples). There is no clear linear relationship between precipitation and yield; high yields occur across a range of precipitation values, but the largest yields are mostly Crops & Grains.

Resilience to Climate Anomalies



Crops & Grains maintain the highest yields, with multiple points above 150M tonnes, even at both negative and positive anomaly values. The pattern holds other product categories yield less and are more evenly distributed across the anomaly axis. High yields are not confined to a specific anomaly range, indicating **Crops & Grains** are either more resilient to anomalies or are produced in larger quantities regardless of environmental fluctuations.

Yield Stability Across Years

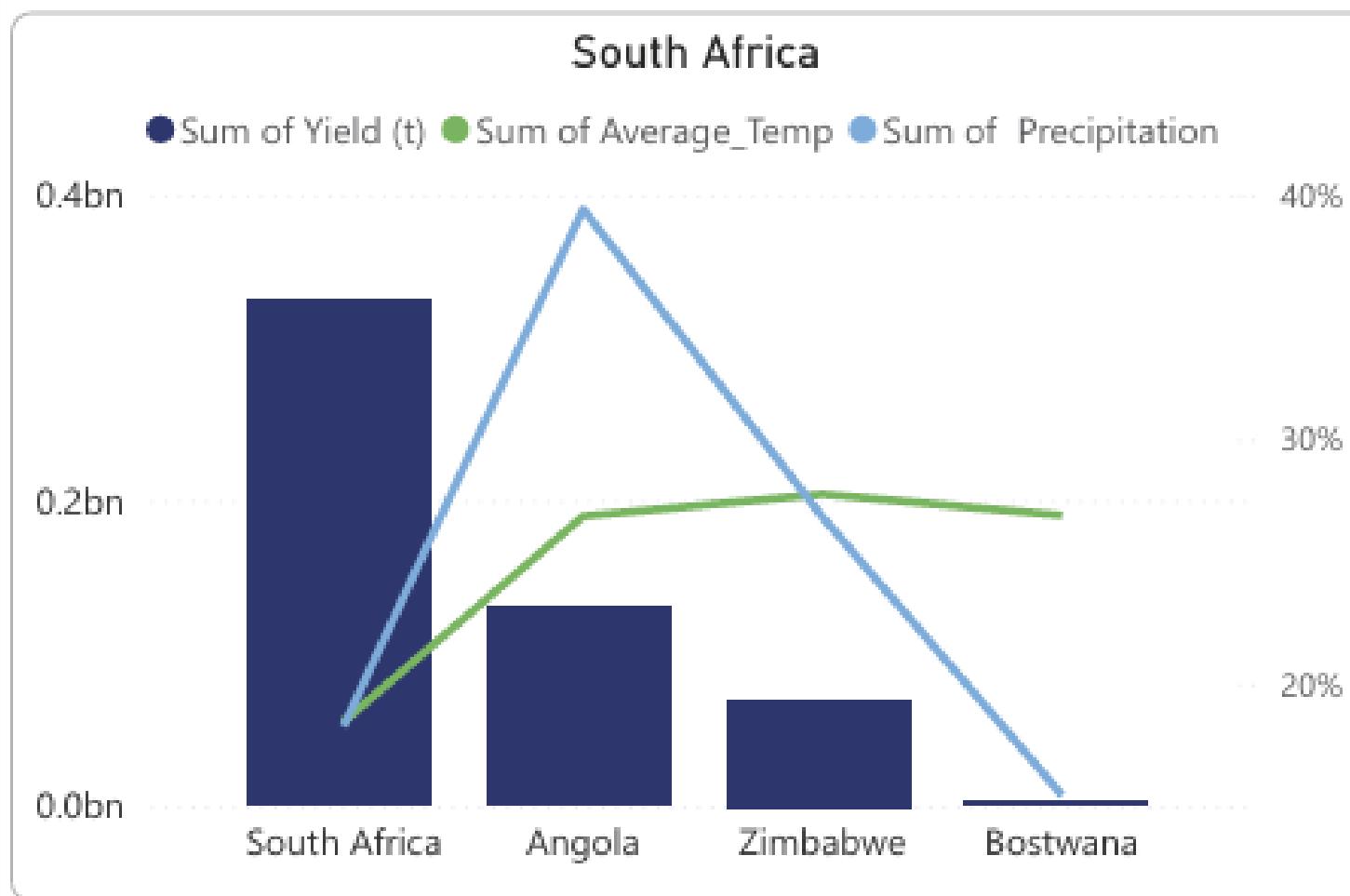
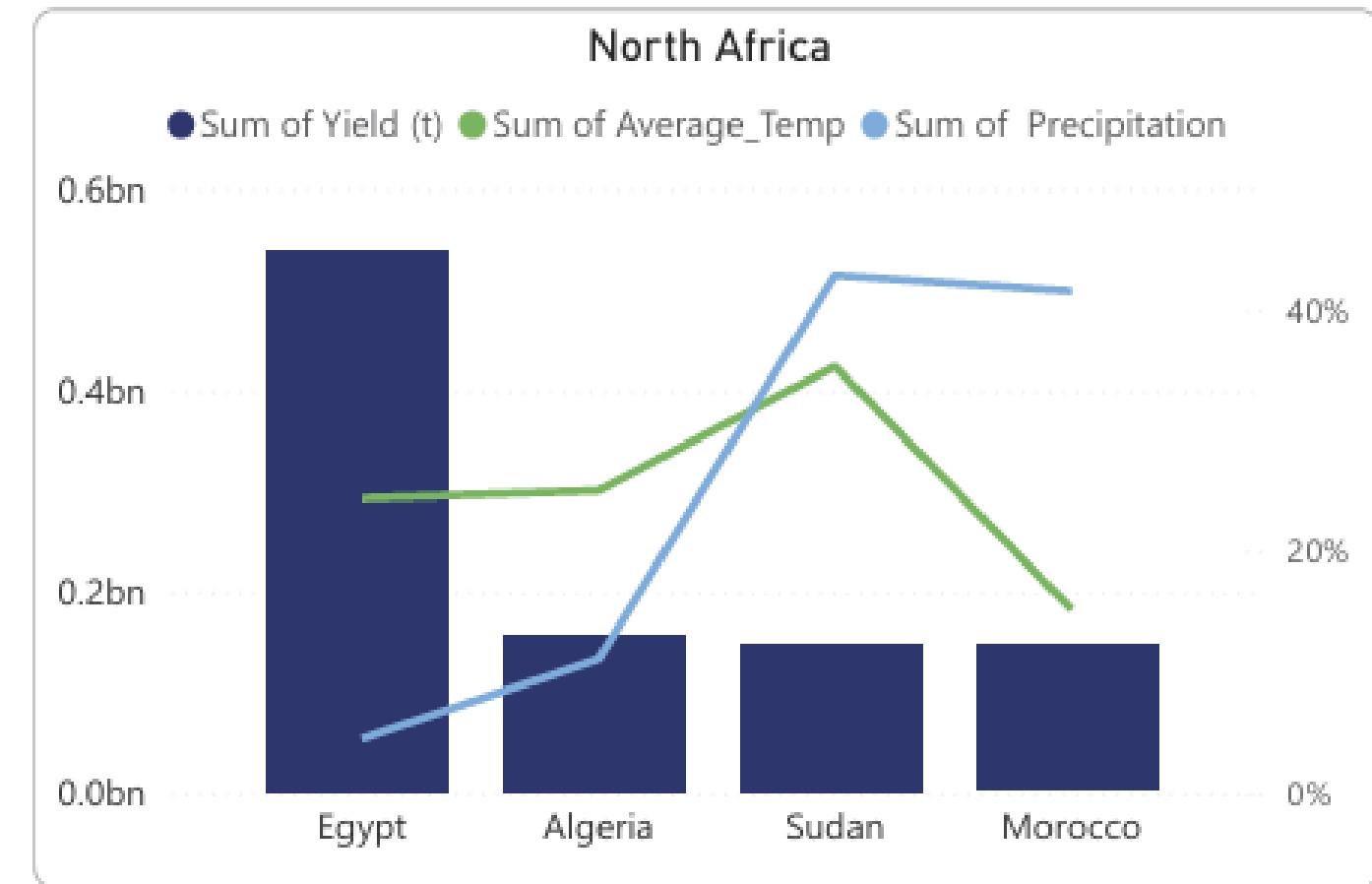


Beyond single-year anomalies, looking at yield trends over time helps us see broader patterns of stability or change

The yield rose sharply from just over **800 million tonnes** to nearly **840 million tonnes**, marking the steepest annual growth in the period. It continued to climb steadily, reaching over **860 million tonnes** by **2022**, though the growth rate was slightly slower. From **2022** to **2023**, the increase was marginal, suggesting a possible plateau where further gains may require significant changes or innovations.

Climate Yield Patterns in North and South Africa

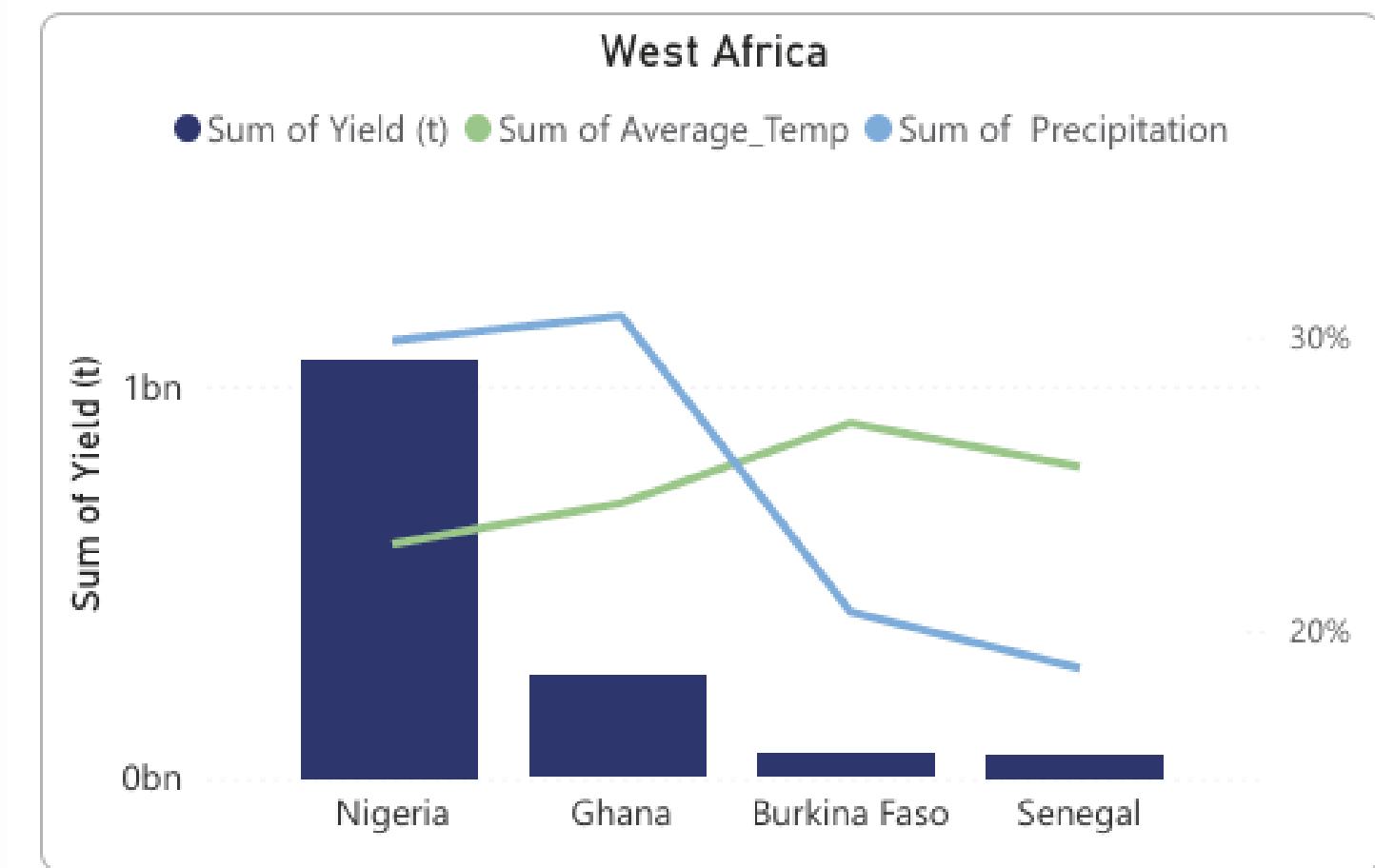
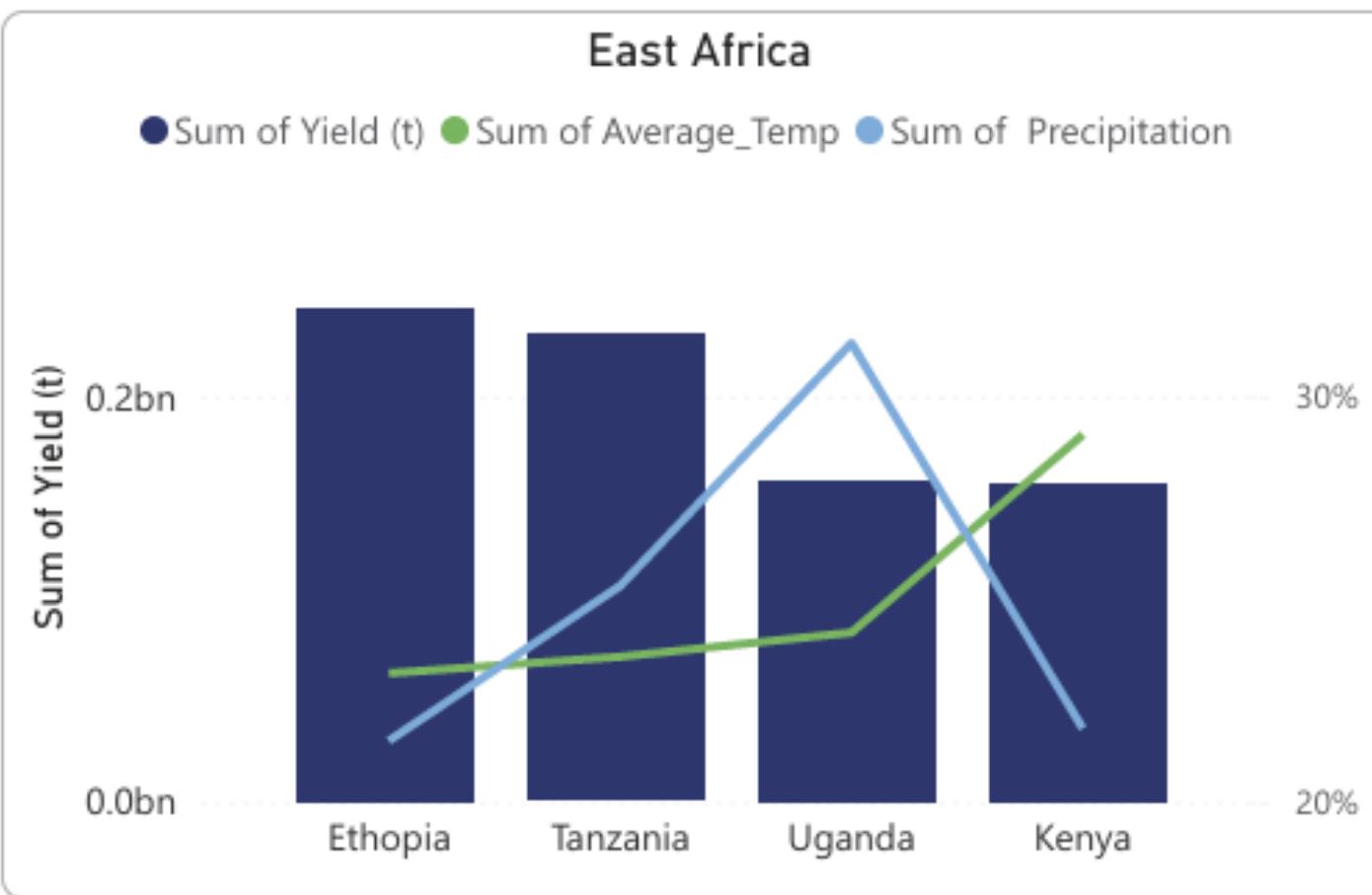
Egypt's high yield despite low precipitation suggests effective irrigation or technological interventions. Sudan's higher precipitation and temperature do not translate into higher yield, possibly due to infrastructure or agricultural practice limitations



South Africa's strong yield with high temperature and moderate precipitation highlights the importance of agricultural efficiency. **Botswana's** negligible yield despite moderate temperature and precipitation suggests possible land suitability or investment issues

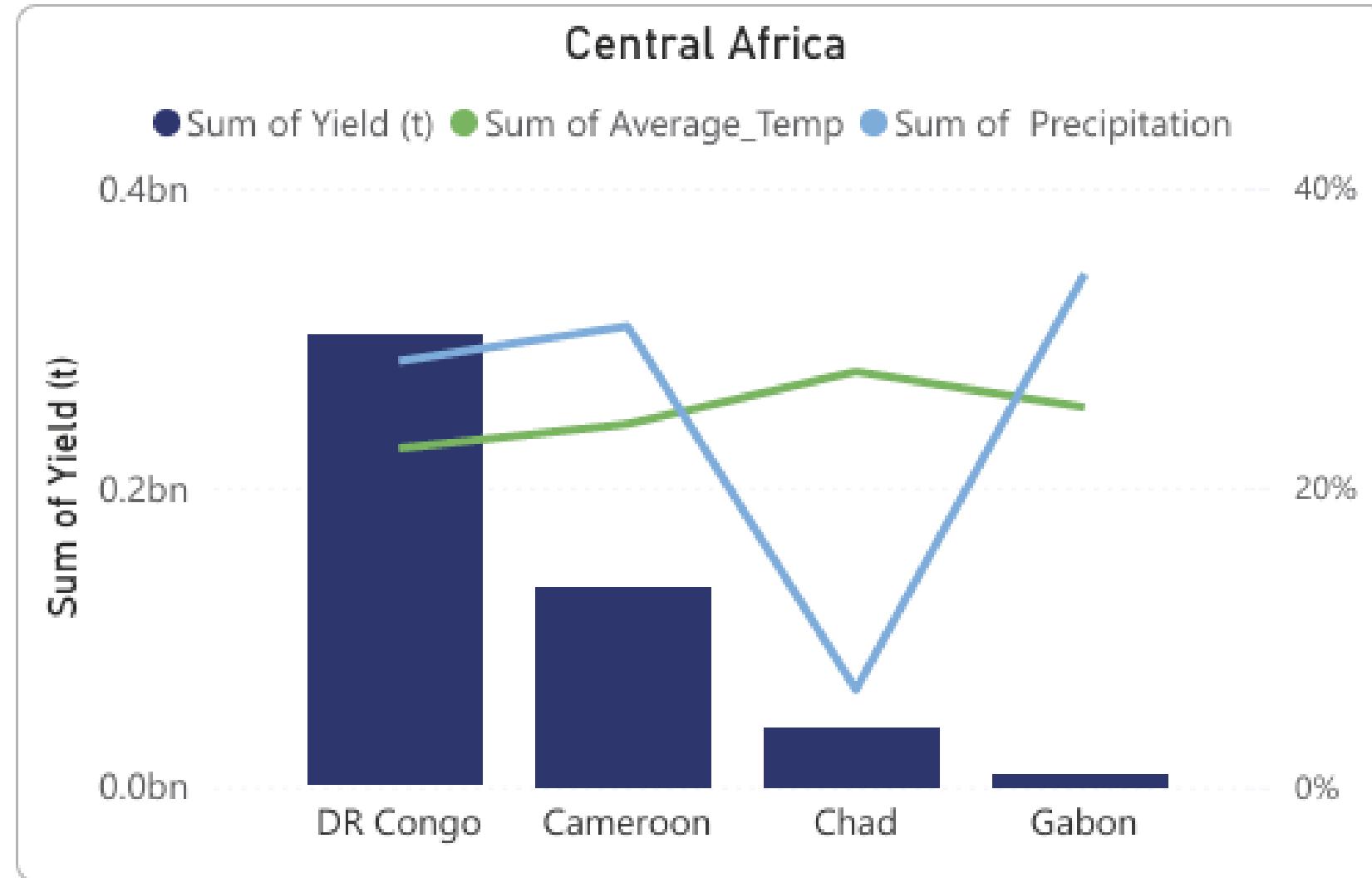
Climate Yield Patterns in East and West Africa

Nigeria's high yield, supported by high rainfall and moderate temperatures, suggests a favorable environment and strong agricultural capacity. The drop in rainfall from **Ghana** to **Burkina Faso** and **Senegal** coincides with lower yields, highlighting rainfall's role. Rising temperatures do not boost yields, suggesting water availability, soil quality, or technology are more critical.



Uganda records the highest rainfall but lower yields than **Ethiopia** and **Tanzania**, showing that rainfall alone doesn't guarantee higher output—soil quality, crop type, and farming practices also matter. **Kenya**, with the highest temperature, has the lowest yield, suggesting higher heat or other factors may limit productivity.

Climate Yield Patterns in Central Africa



DR Congo's high yield aligns with high rainfall, reinforcing the importance of water availability. However, **Cameroon**, despite similar rainfall, records much lower yields, suggesting factors like land size, investment, or infrastructure matter. The sharp drop in rainfall and yield in **Chad** highlights agriculture's vulnerability to water scarcity, while Gabon's low yield despite high rainfall points to limited farmland or a focus on other economic sectors.

Country	Average of Yield (t)	Sum of Yield_Volatility
Algeria	7,839,299.63	0.25
Angola	6,550,179.28	0.14
Botswana	137,212.80	0.00
Burkina Faso	3,057,676.29	0.19
Cameroon	6,652,916.69	0.53
Chad	1,934,919.69	0.00
DR Congo	15,062,985.63	0.14
Egypt	26,900,796.82	0.13
Ethiopia	12,164,072.97	0.01
Gabon	397,161.72	0.01
Ghana	12,954,090.98	0.41
Kenya	7,821,792.06	0.71
Morocco	7,288,850.86	0.30
Nigeria	53,323,631.41	0.49
Senegal	2,911,679.48	0.03
South Africa	16,575,523.17	0.30
Sudan	7,326,921.55	0.25
Tanzania	11,504,894.18	0.54
Uganda	7,892,974.36	0.31
Zimbabwe	3,487,433.28	0.06

Country-Level Yield and Volatility

Kenya records a moderate yield (7.8 million tonnes) but the highest volatility (0.71), indicating unstable agricultural output that could threaten food security and farmer incomes. **Nigeria**, the top producer, shows moderate volatility (0.49), suggesting that while production is high, variability remains a concern. **Botswana** and **Chad** have very low yields but zero volatility, possibly reflecting limited agricultural activity or consistently low production systems. **Ethiopia** and **Gabon** combine relatively high yields with very low volatility, highlighting strong and stable agricultural performance. Meanwhile, **Cameroon** and **Tanzania** have moderate yields but high volatility, pointing to opportunities for improving yield stability.

RECOMMENDATIONS

- **Promote Drought-Resistant Crops:** Especially in low-rainfall and high-temperature regions like Botswana and Chad.
- **Invest in Irrigation Infrastructure:** Support countries with low rainfall but high agricultural potential, such as Egypt and Senegal.
- **Enhance Yield Stability:** Develop programs targeting volatile regions like Kenya and Tanzania to secure farmer incomes.
- **Prioritize Soil and Technology Improvements:** Focus on soil quality, crop selection, and modern farming methods, not just climate factors.
- **Adapt to Heat Stress:** Support research and training on heat-tolerant crop varieties in countries facing rising temperatures.

DATA LIMITATIONS

- **Product Imbalance:** Crops & Grains heavily dominated the dataset, influencing many of the insights and visuals. This may mask trends in lower-volume categories like Fruits & Vegetables.
- **Country Selection:** Only 20 African countries were included – carefully selected but not fully representative of the entire continent.
- **Missing Variables:** Factors like soil quality, farming methods, pests, and policy were not captured but likely impact yields.
- **Climate Data Scope:** The analysis focused only on average temperature, precipitation, and anomalies, excluding variables like humidity, wind, or seasonal rainfall patterns.
- **Time Frame:** A five-year window (2019–2023) limits long-term trend analysis and may not fully capture slower climate impacts.

SUMMARY AND CONCLUSION

- **Key Findings:** Rising temperatures do not guarantee higher yields; rainfall remains a critical factor, but alone is not sufficient. Crops & Grains dominate yields and show greater resilience across climate variations.
- **Regional Insights:** Water availability, agricultural practices, and investment levels heavily shape productivity across Africa's diverse climates.
- **Why It Matters:** Strengthening agricultural resilience is essential to secure food supply, stabilize farmer incomes, and adapt to ongoing climate shifts.
- **Final Thought:** Climate change will reshape African agriculture – proactive, localized strategies can turn challenges into opportunities.

THANK YOU!!