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Navigating the drought's grip: Cocoa yield dynamics in agroforestry systems in Ghana and Togo

AFI AMEN CHRISTÈLE ATTIOGBE¹, EMMANUEL QUANSAH², UDO NEHREN³, ENOCH BESSAH⁴,
AGODZO SAMPSON⁴

¹*West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), College of Engineering, Ghana*

²*Kwame Nkrumah University of Science and Technology (KNUST), Dept. of Meteorology and Climate Science, Ghana*

³*TH Köln - University of Applied Sciences, Inst. for Technology and Resources Management in the Tropics and Subtropics (ITT), Germany*

⁴*Kwame Nkrumah University of Sciences and Technology (KNUST), Dept. of Agricultural and Biosystems Engineering, Ghana*

Abstract

Cocoa is an important agricultural commodity and holds significant economic and cultural value for the livelihoods of millions of households around the world, especially in West Africa, which accounts for around 70% of the global production. Production is influenced by both on-farm management and agronomic factors (nutrients, pests, shade coverage, and diseases), as well as environmental factors including climate, soil conditions, and water availability. In the green landscapes of Ghana and Togo, Drought is having a devastating effect on cocoa yields, challenging the vitality and sustainability of cocoa production. This work focuses on assessing the effect of drought on cocoa yields in the bordering region of Ghana and Togo over forty years (1981–2020). We extracted cocoa yield data from the FAO, UTCC, and COCOBOD databases, while climate variables, including minimum temperature, maximum temperature, and rainfall, were obtained from meteorological data sources. They were used to explain the variation observed in the data. We used the Standardized Precipitation Evapotranspiration Index on a 12-month scale (SPEI12) as a proxy for agricultural drought quantification. We further used an autoregressive distributed lag (ARDL) to account for the dynamic impact of drought on cocoa yields. The study revealed only a short-term relationship between climate variables and cocoa yield. The study showed that drought reduced cocoa yield by 0.6% and 0.08% in Togo and Ghana respectively. While rainfall and minimum temperature have a positive impact on the cocoa yield, the maximum temperature has a negative effect and positive effects in Togo, and Ghana respectively. The effect climatic variables and drought index were not statistically significant. Only the first lag (the previous year value) of the cocoa yield was significantly affecting the actual cocoa yield. This could relate to the impact of the previous years' agronomic practices, such as pruning and fertilizer application, on the current year, since cocoa is a perennial species and exhibits interannual behaviour. Notwithstanding the non-statistical significance of climate variables, the study suggests developing appropriate drought risk reduction strategies in cocoa systems to avoid harsh and undesirable consequences of drought disasters.

Keywords: Cacao, climate change, Ghana, Togo, yield gap