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Impact of Climate on the Cassava Yield and Biomass Gap Variability in Sub-Saharan Africa - A Case Study in Nigeria

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Abstract

Cassava (*Manihot esculenta* L.) production is vital to the economy of Nigeria as the country is the world's largest producer of the commodity, contributes almost 19 % of the total world production. We investigated the impact of climatic variables on yield gap variability across the three states in Nigeria using the crop model LINTUL5 embedded into a modelling framework, SIMPLACE (Scientific Impact Assessment and Modelling Platform for Advanced Crop and Ecosystem Management). The simulations were run using a cassava variety (TME 419) and historical weather data (1995–2010). Yield gap was estimated as a difference between simulated water-limited yield and farmer's yield (i.e., observed yield), whereas, biomass gaps were estimated as a difference between a simulated water-limited condition and the simulated actual biomass (i.e., under water and nutrient-limited condition). To examine whether variations in crop yield and biomass were related to variations in a specific climate variable, a multiple linear regression was performed for each district-crop combination with yield as the dependent variable and radiation, mean temperature and precipitation as independent variables. The estimated DM yield gaps were 8.1 Mg ha^{-1}, 6.4 Mg ha^{-1}, and 4.0 Mg ha^{-1} in Edo, Ogun and Kwara states respectively, whereas, DM biomass gap was 10.8 Mg ha^{-1}, 9.7 Mg ha^{-1}, and 3.6 Mg ha^{-1} in the respective states. Average farmer's yield could be increased by 176.4 %, 104.7 % and 80 % respectively in the abovementioned states under water-limited conditions. The spatial and temporal variability in cassava yield gap and biomass gap was not correlated with the climate variables (i.e., precipitation, radiation, minimum and maximum temperature) during the crop growing period. Closing the yield gaps will require in the first place adequate supply of nutrients, and reliable seasonal weather forecasts would be required to allow farmers to manage each seasonal potential, i.e., overcoming season-specific yield limitations.

Keywords: Cassava, LINTUL5, Nigeria, variability, yield gap

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