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Adapting the CROPGRO model to simulate biomass production and soil organic carbon of *Brachiaia* cv. hybrid Cayman and *Panicum maximum* in East Africa

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Abstract

Biophysical models are key to inform management activities that can restore degraded soils and ultimately improve biomass production and soil organic carbon (SOC) sequestration. Within East Africa several studies have been conducted to evaluate models in annual cropping systems, and to quantify the impacts of different agronomic management options on soil organic carbon and yields. However, no modelling studies exist on perennial forage grasses, which are important for mixed-crop livestock systems within the region. We evaluate the CROPGRO-Perennial Forage model (CROPGRO-PFM) using harvested biomass and SOC data from several sites across Kenya and Tanzania. The model version initially parametrized for *Brachiaria* cv. Marandu and *Panicum maximum* in Brazil is applied to simulate *Brachiaria* cv. hybrid Cayman and *Panicum maximum* in the two countries. We modify model parameters to improve d-statistic and root mean square error (RMSE) for biomass and SOC. Our results show that the CROPRO-PFM model can simulate biomass of *Brachiaria* cv. Cayman under different soils and weather conditions with an acceptable adjustment of parameters including soil water (lower limit, drained upper limit, saturated water content) and stable soil organic carbon. The d-statistic for harvested biomass across the Tanzania sites ranged between 0.78 to 0.97, while the root means square error ranged between 0.6 to2 t ha^{-1}. Sensitivity simulations with increased manure application rates of 5 t ha^{-1} show an increase in SOC of up 0.833 t ha^{-1} yr^{-1}. These results suggest that the CROPGRO-PFM can be used to simulate growth of *Brachiaria* cv. Cayman adequately under rainfed conditions in the East African highlands.

Keywords: Biomass, *Brachiaria*, Kenya, perennial forage model, soil organic carbon, Tanzania

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