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Climate change impact on mixed-crop livestock systems in sub-Saharan Africa

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Abstract

Sub-Saharan Africa (SSA) is particularly exposed and vulnerable to climate risks and therefore warrants a profound estimate of the effects of current and future climate on crop and livestock production to inform policies that may counteract the adverse effects. Therefore, the current study attempts to develop an integrated modelling framework at a farm-scale (IFM-FARM) for simulating the impact of climate change scenarios on the potential productivity of the mixed crop-livestock production systems in SSA. Dominant crops such as millet, sorghum, and maize and total livestock units (TLUs) based on one Representative Concentration Pathways (i.e., RCP 4.5) from the four General Circulation Models (GCMs) namely mbc-cclm-mpiesm, mbc-wrf-gfdlesm, mbc-wrf-hadgem2, and mbc-wrf-mpiesm in Sudan and Savannah zone of SSA were chosen in the study. The time-horizon 1981–2005 and 2020–2050 were considered to represent the baseline and near-future climate conditions respectively.

There was an average decline in the yield of millet, maize, and sorghum by 33.9 %, 28.7 %, and 26.3 % respectively across all the GCMs in 2050 compared to the baseline period. The highest yield loss was estimated for millet and Sorghum to the tune of 65.5 % and 53.2 % respectively under mbc-cclm-mpiesm in the Sahelian savannah zone.

Total livestock Units (TLUs) per hectare increased on average by 81 % in time horizon 2050 compared to the baseline across the two zones and GCMs which could be attributed to the more availability of grass biomass for feed. The results indicate the necessity of tailored management options and agricultural policies promoting the development of short cycled, heat, and drought-tolerant crop varieties and promoting the irrigation schemes in the affected areas.

Keywords: Climate change, integrated modelling framework, livestock, sub-saharan africa

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