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Effect of Intensification of Crop Management on Cereal Crop Yields under 1.5°C and 2.0°C Global Warming in the West African Sudan Savannah

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Abstract

Rainfed cereals are the main staple food crops in the West African Sudan Savannah. While current yield levels are low due in large part to the limited use of fertilisers, sustainable intensification of cropping systems is widely promoted in the region to improve food security and drive regional economic development. However, an important consideration is increased internannual yield variability and possible interactions with climate change, as this represents an important source of risk for farmers. This study assessed the effect of intensification on maize, pearl millet and sorghum yields under 1.5°C and 2.0°C global warming in the West African Sudan Savannah. Simulations were conducted with two crop models (DSSAT and Lintul5 embedded into the SIMPLACE modelling framework) at a spatial resolution of 0.25° under both current fertiliser use and optimum fertiliser application (intensification case). The models were calibrated with local varieties from field experiments in the region with management reflecting a range of typical sowing windows. Results indicated that yields simulated under intensification were two to three times higher than yields simulated under current fertiliser use, irrespective of the warming scenario. However, yield losses under climate change were slightly higher with intensification: 2 % units higher for maize and sorghum with 2.0°C compared to 1.5°C warming, with no change in millet yields for either scenario. As expected, interannual variability increased with intensification compared to current fertiliser use, though there was no interaction with

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climate change scenario. In summary, it is suggested that intensification would much more than offset the negative impacts of climate change, though economics analysis is required to understand the implications for risk and constraints on market development needed to support intensification.

Keywords: 1.5°C, climate change, intensification, West Africa