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"Filling gaps and removing traps
for sustainable resource management"

Pearl Millet Yield Stability and Susceptibility to Abiotic Stresses in Semiarid; A Modelling Perspective

Festo Richard Silungwe[1], Frieder Graef[1], Marcos Lana[2], Sonoko Dorothea Bellingrath-Kimura[1]

[1] *Leibniz Centre for Agric. Landscape Res. (ZALF), Germany*
[2] *Swedish University of Agricultural Sciences, Crop Production Ecology, Sweden*

Abstract

Over 500 million people depend on pearl millet for their lives worldwide. The crop is reported to be resilient to climate change due to its inherent adaptability to drought and high temperatures. These traits make pearl millet a very important crop in fighting hunger. However, the performance and resilience of pearl millet to different scenarios of future climates have been rarely explored in sub-Saharan Africa. Data from experiments conducted in two consecutive seasons (2015/2016 and 2016/2017) to determine the yield responses to different fertiliser application levels for Okoa pearl millet variety in Dodoma a semi-arid region in Tanzania were used to calibrate and validate the DSSAT model (CERES-Millet). A validated model was evaluated for 49 synthetic scenarios of climate change constructed by incremental method on historical series of observations, with temperature increments ranging from +0.5 up to +3.0°C and precipitation changes from -30 up to +30 %. Nine planting dates from very early planting 5th December to late planting 25th February after every 10 days were used for simulations of pearl millet yields response to the synthetic scenarios. Results show that the model reproduced the phenology and yield of Okoa pearl millet cultivar with relative root mean square error (rrmse) values for calibration (anthesis days (0.0 %), maturity days (0.8 %), tops weight (7.3 %) and grain yield (6.4 %)) and validation (anthesis days (2 %), maturity days (1.2 %), tops weight (3.5 %) and grain yield (11.8 %)). From evaluation, the yield response surfaces indicated that both very early and late planting dates produced lower yields with a higher risk of crop failure. The best planting window with stable yield was between 25th December and 15th January. Our results demonstrate that Okoa pearl millet variety planted before or after best planting window is susceptible to abiotic stresses under the constructed scenarios.

Keywords: Climate change, DSSAT CERES-Millet, pearl millet, planting dates

Contact Address: Festo Richard Silungwe, Leibniz Centre for Agric. Landscape Res. (ZALF), Mücheberg, Germany, e-mail: festo.richard@zalf.de