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Farmers’ and academia’s views”

Performance of field crops in a semi-arid environment: climate change assessment

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Abstract

Crops yield in semi-arid environments is highly impacted by climatic variables, especially in rainfed sector. In light of global warming, the annual temperature is projected to increase between 2 °C to 6 °C by the end of the 21st century. As consequence, food and nutrition security will be highly affected, particularly in marginal areas where the majority of the populace depend on rainfed agriculture for their livelihood and income generation. Therefore, the objective of this study was to investigate the impact of temperature-based and rainfall-based variables on the yield of four major crops viz., sesame, sorghum, millet and sunflower over 35 years in Gedaref state, Sudan. Firstly, the rainfall and temperature variability over the study period was assessed using the standardised anomaly index. Secondly, the Mann–Kendall trend analysis was employed to assess the existing positive or negative trends in temperature and rainfall over time. Thirdly, the relationships between climatic variables and crops yield was determined using correlation and multiple linear regression. The study shows that the annual minimum temperature (T_{min}) increased by 0.05 °C per year, while maximum temperature (T_{max}) increased by 0.03 °C per year. On the other hand, the annual rainfall fluctuated over time with no significant ($p \geq 0.05$) increase or decrease in the trend. A negative correlation was detected between the yields of all selected crops and T_{min} and T_{max} (correlation coefficient: r ranged between -0.09 and -0.76). However, the annual rainfall had a strong positive correlation with yield of sorghum ($r = 0.64$), sesame ($r = 0.58$), and sunflower ($r = 0.75$). Furthermore, amount of rainfall, T_{max} and T_{min} explained more than 50 % of the variability in the yield of millet ($R^2 = 0.54$), sunflower ($R^2 = 0.61$) and sorghum ($R^2 = 0.70$). The findings of this study could be used to raise awareness among different stakeholders especially, policymakers on the impact of climate change on food and nutrition security.

Keywords: Field crops, food security, global warming, rainfed agriculture, trend analysis