

In-vitro induced drought and heat stress on seed germination of diverse African sorghum germplasm

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Abstract

One of the critical growth and development stages that is vulnerable to drought and heat stress even in hardy staple crops is germination. Sorghum is a critically essential, resilient, and diverse crop that displays genotypic variations in its ability to withstand such harsh conditions, limiting crop stand and ultimately leading to yield losses. Therefore, the goal of this study was to evaluate the performance of 50 high potential genotypes of African sorghum, including landraces, breeding lines and check varieties to simulated drought and heat stress at germination stage. The study used a split plot arrangement for temperature treatments, laid in a completely randomized design with three replications. Final germination percentage, mean germination time, germination index and coefficient variation of germination time (CVt) were determined. Data was subjected to generalized linear model, principal component analysis, hierarchical agglomerative cluster analysis and principal coordinate analysis to determine statistical differences in genotypes and visualize groups of genotypes according to their overall performance in assessed germination parameters. Drought stress and supra-optimal temperatures suppressed and delayed germination. The genotypes were grouped into six distinct clusters based on their performance. Genotypes NPGRC1593, NPGRC1782, NPGRC1476 and IS224426 performed exceptionally well under both stressors and outperformed check varieties in almost all parameters assessed. To improve crop establishment and increase agricultural yields, breeding and crop improvement programs should focus on genotypes that can withstand both stresses.

Keywords: drought stress, genotypes, germination index, heat stress, polyethylene glycol