World Academy of Science, Engineering and Technology
International Journal of Agricultural and Biosystems Engineering
Vol:17, No:08, 2023

Sorghum Resilience and Sustainability under Limiting and Non-limiting Conditions of Water and Nitrogen

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Abstract : Food production needs to be almost double by 2050 in order to feed around 9 billion people around the Globe. Plant production mostly relies on fertilizers, which also have one of the main roles in environmental pollution. In addition to this, climatic conditions are unpredictable, and the earth is expected to face severe drought conditions in the future. Therefore, water and fertilizers, especially nitrogen are considered as main constraints for future food security. To face these challenges, developing integrative approaches for germplasm characterization and selecting the resilient genotypes performing under limiting conditions is very crucial for effective breeding to meet the food requirement under climatic change scenarios. This study is part of the European Research Area Network (ERANET) project for the characterization of the diversity panel of 172 sorghum accessions and six hybrids as control cultivars under limiting (+N/-H2O, -N/+H2O) and non-limiting conditions (+N+H2O). This study was planned to characterize the sorghum diversity in relation to resource Use Efficiency (RUE), with special attention on harnessing the interaction between genotype and environment (GxE) from a physiological and agronomic perspective. Experiments were conducted at Adana, a Mediterranean climate, with augmented design, and data on various agronomic and physiological parameters were recorded. Plentiful diversity was observed in the sorghum diversity panel and significant variations were seen among the limiting water and nitrogen conditions in comparison with the control experiment. Potential genotypes with the best performance are identified under limiting conditions. Whole genome resequencing was performed for whole germplasm under investigation for diversity analysis. GWAS analysis will be performed using genotypic and phenotypic data and linked markers will be identified. The results of this study will show the adaptation and improvement of sorghum under climate change conditions for future food security.

Keywords : germplasm, sorghum, drought, nitrogen, resources use efficiency, sequencing
Conference Title : ICAACS 2023 : International Conference on Agriculture, Agronomy and Crop Sciences
Conference Location : Kuala Lumpur, Malaysia
Conference Dates : August 17-18, 2023