Tapping large genetic variation in water use, grain yield related traits in sorghum minicore collection: New opportunities for enhancing grain yield and drought adaptation

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Abstract

Sorghum (Sorghum bicolor (L.) Moench) is the fifth most important cereal crop globally and serves the most food-insecure regions in the semi-arid tropics. Although sorghum is considered resilient in semi-arid tropics, they do suffer significant terminal drought due to cessation of rain towards the end of the rainy season for which breeding efforts are needed. Addressing the genetic variation is foremost pre-requisite to exploit in any breeding programs. Therefore, present study was taken to assess the genetic variation in the sorghum minicore collection for traits related to plant water use and was hypothesized to be closely related to crop adaptation under water limited environments i.e., transpiration efficiency (TE; amount of biomass produced by per unit of water utilized), water use efficiency (WUE; amount of grains produced by per unit of water utilized) as well as agronomically important traits. These traits were assessed in 242 genotypes of sorghum minicore collection (Bicolor, Durra, Caudatum, Guinea, Kafir) along with 20 elite cultivars under well-watered (WW) and water stressed (WS) conditions. Grain yield was not related to flowering and was found to be tightly correlated to water-use (TE and post flowering water use) and yield related traits under WW conditions. Significant variations was found for all traits measured. Most importantly, some of the minicore entries showed higher TE and water extraction capacity under WS than the existing elite cultivars. In addition, mapping of minicore entries for geo-locations showed that most of the high TE lines preferentially originate from the semi-arid regions of India and Africa. Among the different races, Durra race had high TE (WW and WS) and GY (WW). In summary, high genetic variation for TE and GY was found that offer substantial breeding opportunities with Durra race being a critical source for key drought adaptive traits in sorghum diversity panel.