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Drought Performance in Millet (*Panicum miliaceum*) and Grain Sorghum (*Sorghum bicolor* L. Moench)

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Abstract

Grain Sorghum (*Sorghum bicolor* L. Moench) and Millet (*Panicum miliaceum*) serve as one of the most important staple cereals in drought-affected areas of our globe, where annual rainfall is at its minimum. Their ability to grow and generate substantial yields under water limiting conditions has been attributed to their drought avoiding and tolerating characteristics.

Three genotypes representing three different maturity groups of each crop were cultivated in sand/nutrient media in a glasshouse. Control plants were maintained at field capacity (soil water potential; SWP at -60 to -80 hPa). Stress was imposed at 50% blooming by withholding water supply from an automatic irrigation system until SWP reached -200 hPa and was maintained for ten consecutive days. This was followed by re-irrigation to field capacity until harvest.

The objectives of this experiment were: (1) To determine if there are any differences in the physiological and morphological response of both crops to water stress; (2) To verify any differences between three maturity groups of each crop in response to water stress; (3) To evaluate the effect of water stress on water use efficiency by looking at Evapo-Transpiration Efficiency (ETE) and harvest indices; And (4) To assess the impact of water stress on yield and its relationship to the “Stay Green” character (if any) in both crop types.

Generally, water stress had a negative effect on the photosynthetic process of both crops. However, this was stronger in grain sorghum than in millet, with the late maturity genotypes of both crops being mostly affected. Also, the yields of sorghum were more drastically reduced by water stress than their millet counterparts. This was also the case for the above ground biomass and tiller production. The harvest indices of millet were relatively stable though not optimal as compared to their sorghum counterparts. The water use efficiency of the various millet maturity groups was significantly higher than their sorghum counterparts both under controlled and water stress conditions.

These results can be used to facilitate crop selection for farmers or breeders in drought affected areas relative to their cultivation or breeding programs respectively.

Keywords: Drought performance, gas exchange, grain sorghum, millet, water use efficiency