

Comparative Analysis of Genetic Variability, Water stress Tolerance and Nutritional Properties
of Selected Sorghum (*Sorghum bicolor* (L) Moench) Cultivars in Kenya

Emmanuel Otunga Omondi

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ABSTRACT

Water stress is the most common adverse environmental condition that seriously reduces crop productivity. Increasing crop tolerance to water stress may be the most economical approach to improve agricultural productivity and to reduce agricultural use of fresh water resource in arid and semi-arid lands (ASALs). The study was undertaken from 2008 to 2010 to evaluate tissue culture (TC) regenerates of sorghum cultivars with respect to nutritional value and safety, water stress tolerance and to establish the genetic diversity among the sorghum bicolor cultivars. The parent plants were used as controls in the study. The study involved Seredo, El Gardam and Mtama 1 cultivars. Selection of these cultivars was based on tannin content. The genetic variability was investigated using five simple sequence repeats (SSR) markers. Parameters associated with water stress tolerance were measured in the field and in hydroponics experiment and the data were recorded for all the cultivars and subjected to principal component analysis (PCA) and analysis of variance (ANOVA). The nutritional and safety analysis experiment were also done and data recorded and subjected to ANOVA. Simple sequence repeats (SSRs) marker used in the analysis showed a significant amount of polymorphism with an average of 0.675 similarity coefficient. Phylogenetic analysis clustered the 3 cultivars into two main clusters. The TC regenerates compared to their parental controls showed no significant variations ($p < 0.05$) for physiological and morphological traits except for water potential under field and hydroponics experiments. The TC regenerates for all the cultivars showed better tolerance ($p < 0.05$) to water stress than the parents except for Seredo. No significant variations were observed for proximate composition, B vitamins and mineral composition between the TC regenerates and their parental plants. Significant variations ($p < 0.05$) were however noted in the anti-nutrient content

specifically the phytates between the TC regenerates and their respective parental controls. The phytates content ranged between 124.3 – 351.4 mg/100g with Mtama 1 TC regenerates having the lowest (124.3 mg/100g) and Seredo parent having the highest (351.4 mg/100g). The anti-nutrient amounts were observed to be elevated in the Seredo cultivar (Red sorghum) compared to Mtama 1 and El Gardam cultivars (White sorghum). Protein digestibility percentages were higher ($p < 0.05$) for the TC regenerates than the parental plants. The outcome of this study has shown that tissue culture technique as a method of hardening the sorghum to introduce any somaclonal variation in the regenerated plants is not effective. The outcome of the food analysis would also be useful in determining the varieties suited for particular industrial use and as animal and human food according to the nutritional properties.