Abstract

Sorghum bicolor (L) Moench is an annual crop adapted to a wide range of environmental conditions. It has a number of morphological and physiological characteristics that contribute to its adaptation to arid and semi arid lands (ASALs), including an extensive root system, low osmotic potential, increased cell wall thickness, small cell size and waxy bloom on the leaves that reduces water loss and the ability to survive for years through generations from fresh tillers developing on the old bases. One of the factors that characterize the ASALs is land salinization. The salinization process occurs because of incomplete weathering and intensive soil evaporation hence soil salinity is one of the main problems for world agriculture. The aim of this study was to evaluate the salinity tolerance levels of three selected Sorghum bicolor (L) Moench cultivars. The three cultivars namely; Mtama 1, El-gadam, and Seredo represent the three major categories of cultivated sorghum. They were obtained from Kenya Agricultural Research Institute (K.A.R.I.) - Katumani, in the Eastern province of Kenya; their generated somaclones and their corresponding X-ray treated seeds were also screened for salinity tolerance during seedling growth period in Shive and Robbin's nutrient solution at 5, 10 and 15 dS/m salinity levels against a control (0.22 dS/m) based on morphological aspects. During the hydroponics screening experiment a check cultivar/ standard (Serena) documented as saline tolerant was also used as a control. The inter- and intra-cultivar effect of salinity on root length, root: shoot ratio, root and shoot morphology of seedlings was assessed after seven days growth period in hydroponics system. The ANOVA results for all the cultivars for the seven days growth in Shive and Robbin's nutrient solution as well as treatment × cultivar interaction was significant ($p \leq 0.05$). Cultivar Seredo had higher seedling root length than cultivar Mtama 1 and Elgadam at 10 and 15dS/m. This was attributed to the effect of osmotic stress on salinity sensitive cultivars (Mtama 1 and El-gadam) which led to accelerated leaf senescence thereby inhibiting seedling leaf growth. Better root and shoot growth was however, obtained after X-ray seed treatment of the three cultivars. Further screening of the three sorghum cultivars, their somaclones and X-ray treated seed based on their physiological traits was carried out in the field. Results clearly indicated that basic seed cultivars Elgadam, Mtama 1 and Seredo, had significant differences in physiological traits in comparison with their somaclones and plants obtained via X-ray treatment of the basic seed. Plants obtained via X-ray treatment had significantly better physiological performance, during vegetative growth. Cultivar El-gadam, its somaclone and X-ray treated seeds showed the lowest growth potential when grown both in the hydroponics system and in the field showing the salinity sensitivity characteristics of the white sorghum category. In conclusion, cultivar Seredo representing the red sorghum exhibited optimal efficiency in physiological performance. X-ray seed treatment therefore, has potential in breeding for salinity because it is able to discriminate saline sensitive and Asals sensitive sorghum cultivars at an early stage. However, further research should be undertaken under field conditions to test the physiological and morphological performance of subsequent generations of the X-ray radiated seed.