SALTGRASS (*DISTICHLIS SPICATA*), A TRUE HALOPHYTIC PLANT SPECIES WITH MINIMUM WATER AND NUTRIENT REQUIREMENTS FOR SUSTAINABLE AGRICULTURE IN DESERT REGIONS

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Abstract

Continuous desertification of arable lands due to urbanization, global warming, and shortage of water mandates use of low quality/saline water for irrigation, especially in the regions experiencing water shortage. Using low quality/saline water for irrigation imposes more stress on plants which are already under stress in these regions characterized with saline soils and shortage of water. Thus, there is an urgent need for finding salt/drought tolerant plant species to survive/sustain under such stressful conditions. Since the native plants are already growing under such conditions and are adapted to these stresses, they are the best and the most suitable candidates to be manipulated under the minimum cultural practices and minimum inputs (water, and fertilizer) for use under these stressful conditions. If stress tolerant species/genotypes of these native plants are successfully identified, there would be a substantial savings in cultural practices and inputs in using them by the growers and will result in substantial savings in the currencies of the countries. My investigations at the University of Arizona on saltgrass (*Distichlis spicata* L.), a euhalophytic plant species, have indicated that this plant has an excellent drought and salinity tolerance with a great potential to be used under harsh and stressful environmental conditions, characterized in arid regions. This grass has multi usages, including animal feed, soil conservation, saline soils reclamation, and use for lawns/parks/recreation areas in desert landscaping and agricultural settings, and combating desertification processes. The objectives of this study were to find the most salinity and drought tolerant of various saltgrass genotypes for use in arid regions, where limited water supplies coupled with saline soils result in drought and salinity stresses, for use in sustainable desert agriculture, urban landscapes, and in biologically reclaiming desert saline soils. Various genotypes of saltgrass were studied in a greenhouse either hydroponically in culture solution for salt tolerance or in large galvanized cans contained fritted clay for drought tolerance. For the salinity stress tolerance, twelve inland saltgrass (*Distichlis spicata* L.) clones were studied in a greenhouse, using hydroponics technique to evaluate their growth responses in terms of shoot and root lengths and DM weights, and general grass quality under salt stress conditions. Grasses were grown vegetatively in Hoagland solution for 90 days prior to exposure to salt stress. Then, 4 treatments [EC of 6 (control), 20, 34, and 48 dSm^{-1} salinity stress] were replicated 3 times in a RCB design experiment. Grasses were grown under these conditions for 10 weeks. During this period, shoots were clipped bi-weekly, clippings were oven dried at 65^{o} C and DM weights were recorded, and shoot and root lengths were also measured. At the last harvest, roots were also harvested, oven dried, and DM weights were determined. General grass quality was weekly evaluated and recorded. Although, all the grasses showed a high level of salinity tolerance, there was a linear reduction in their growth responses as salinity level increased. However, there was a wide range of variations observed in salt tolerance of these saltgrass clones. For the drought tolerance study, 21 clones of Saltgrass were studied to evaluate their growth responses in terms

of shoot dry weights and percentage of plant visual green cover under drought stress conditions. Plants were grown under normal (daily watering and weekly fertilizer application) for 6 months for complete establishment. Then, they were deprived from water for four months. Plant shoots were harvested weekly and oven dried at 65 ^{o}C for DM weight determination. At each harvest, percentages of plant green covers were also estimated and recorded. After the last harvest, plants were re-watered to assess and compare their percent of recovery. Both the shoot dry weights and the percent of plant visual green cover decreased as the drought period progressed. Although, all the grasses exhibited a high level of drought tolerance, there was a wide range of variations observed in various clones responses under the studied conditions. The superior salinity and drought stress tolerant genotypes were identified which could be recommended for sustainable production under arid regions and combating desertification. This grass proved to not only have a satisfactory growth under the harsh desert conditions, but also to substantially reduce salinity level of the rhizosphere, which indicates that saltgrass can effectively be used for biological salinity control or reclamation of desert saline soils and combating desertification processes.

Keywords: Salinity stress, drought, arid regions, saltgrass, sustainable agriculture, saline soil reclamation, combating desertification processes