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Z. spina-christi and *G. tenax* as Promising Fruit Trees for Afforestation in Northern Sudan

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Abstract

The northern two-thirds of Sudan are in the arid, semi-arid and low rainfall savanna with an annual maximum rainfall of 500 mm. The majority of population in this area depends on subsistence-agriculture and pastoralism. Studies showed that due to the ongoing land degradation per capita food production has declined significantly over the last decades and there is on-going debate on how to reverse this trend.

Indigenous plant species can play a vital role in land reclamation and enhanced food production. *Ziziphus spina-christi* and *Grewia tenax* are two multipurpose fruit species which are not only adapted to high temperatures and dry conditions, but also produce edible fruits and have deep roots which stabilize sand dunes. However, little is known about how to increase their propagation and early seedling establishment under the harsh conditions of northern Sudan.

Due to their hard seed coats *Z. spina-christi* seeds have a strong mechanical dormancy. In this study, besides untreated seeds, two mechanical and three acid scarification methods were used namely, scratching with sand paper at the hilum, cracking of the seedcoat and immersion in sulphuric acid for 30, 60 and 120 min to enhance germination. Final emergence was highest after immersing seeds in acid for 120 minutes. Mechanical and acid scarification, with the exception of the 30 min acid treatment, improved germination of Z. spina-christi by decreasing days to first emergence (E_{1st}) by 4 to 2 days, days to 50% emergence (E_{50}) by 12 to 10 days, and mean days to germination (MDG) by 4 to 2 days. Cracking of the seedcoat resulted in lowest E_{1st}, E_{50} and MDG.

To study the salt tolerance of *G. tenax*, seedlings (6 weeks old) were grown in a sand culture and supplied with nutrient solution to which 0, 20, 40 and 80 mM NaCl was added. As after 4 weeks of salt stress treatment no visible symptoms were observed, salt levels were doubled to 0, 40, 80 and 160 mM NaCl. Weekly measurements of leaf number showed significant reductions for the 80 and 160 mM NaCl treatments as compared to the salt-free control, however the reduction of plant height was only significant for the 160 mM salt level. The highest salt treatment reduced leaf chlorophyll content by 21%. Measurements of leaf gas exchange showed that stomatal conductance was most sensitive to salt stress. After 3 weeks of salt application, this parameter was reduced by 29% for the 80 mM salt treatment. Net photosynthesis was reduced by 29% and 42% at the 80 and 160 mM NaCl, respectively, while leaf internal CO_2 was increased by 72% at the 160 mM salt level.

Keywords: Afforestation, *Grewia tenax*, indigenous fruit trees, salinity, seed germination, *Ziziphus spina-christi*

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