Atriplex nummularia(塩生植物)の塩性ソーダ質土壌の修復能力
The potential of *Atriplex nummularia* (halophytic plant) in the recovery of soils with saline-sodium contamination

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1. Introduction

Population growth and economic pressure for food production have contributed significantly to the expansion degraded by salinity soils[1). The salinization of soils in Mozambique directly affects agricultural production and the environment by reducing the quality of the soil which in turn reduces the production capacity, thereby increasing food insecurity mainly in arid and semi-arid areas.

Phytoremediation is a technology to remediate the environment contaminated with substances and residues, using plants with potential stabilizing substances and structures accumulating them. In addition to being a green method, it does not cause any damage to the environment, has low costs, and achieves excellent results[2). Due to particularity of plants to absorb salt through its physiological system, they are given the name of salt grass, standing out among several other plants[3). This study aimed to evaluate the development of the *Atriplex nummularia* and ability of the plant to extract salts from the soil irrigated with salt water. Parameters of growth, electroconductivity of water and soil, and accumulated salt in parts of the plant were analyzed.

2. Material and methods

The experiment was conducted in a greenhouse of Saga university from November 2022 to January 2023, in a randomized block design with the four treatments (T0, T1, T2 and T3) and three replications. Each pot was filled with 7.135 kg of organic soil to which 200 grams of chemical fertilizer NPK (8:8:8**)** composition were added. The plants used in this study is the *Atriplex nummularia* and were grown from the seed. One seedling was transplanted in each pot and irrigated with normal tap water by the beginning of experiment. For irrigation, which took place once in two days, water from the groundwater with sodium concentration of almost 140 mg/L was used, to which any amounts of sodium chloride were added to guarantee the four treatments with different electrical conductivities, being 50 mS/m for T0, 90 mS/m for T1, 155 mS/m for T2 and 400 mS/m for T3, respectively.

Plant development was evaluated through once in two days measurements of plant height and stem diameter. Soil temperature, permittivity, and salt content parameters were measured using the TDR 315L Soil Moisture Monitor. After harvesting, a plant was divided into three parts (leaves, stems, and roots) to determine the Na^+ concentration of each part. The plants were dried at 60°C for 48hrs and ground, and every 0.1 grams of dried matter was added to 10ml of pure water in a centrifuge tube. The tube was shaken for 30 minutes and extracted water was submitted for Ion

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chromatography to examine ion contents.

3. Results and Discussion

3.1 Plant growth

There was a relatively accentuated growth of plant height during the first 24 days, from which, the speed of development began to decrease (Fig. 1). Total mass of leaves and stems at harvest, treatments T2 and T3 showed better growth performance with averages of 33.7 and 38.6 grams respectively, compared to T0 and T1.

3.2 Na^+ absorbed by plant

The plant's potential to recovery of soil with high sodium contents was evaluated by determining the mass of Na^+ existing in the parts. For the leaf part, there is an increasing trend in sodium content levels as the electroconductivity of irrigation water is increased, that is, T2 with an average of 56.17 (mg-Na^+/g-DM) and T3 56.79 (mg-Na^+/g-DM) showed better results respectively. For the stem part, the treatments T2 and T3 with higher electroconductivity of the irrigation water showed to have higher means of sodium content, and the T2 treatment with 7.44 (mg-Na^+/g-DM) surpassed the treatment T3 with 6.36 (mg-Na^+/g-DM). For the root part, T3 with 6.00 (mg-Na^+/g-DM) had the highest mean sodium concentration, followed by T2 with 5.12 (mg-Na^+/g-DM), T1 with 4.45(mg-Na^+/g-DM) and T0 with 3.49(mg-Na^+/g-DM).

Figure 2 shows the total Na^+ content in a plant for each treatment. The treatment T3 with highest level of electroconductivity of irrigation water showed better results in the extraction and accumulation of Na^+, with an average of 69.15(mg-Na/g- DM), followed by T2 with 68.73 (mg-Na/g-DM). Treatments T0 and T1 present low levels of

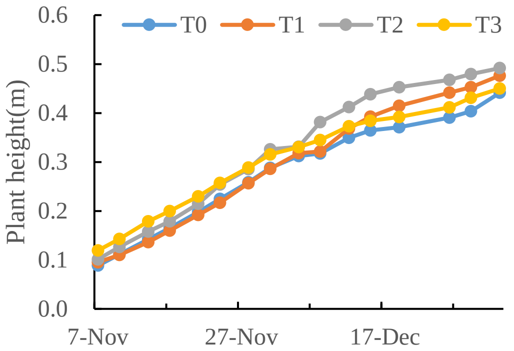

Fig.1 Change of plant height.

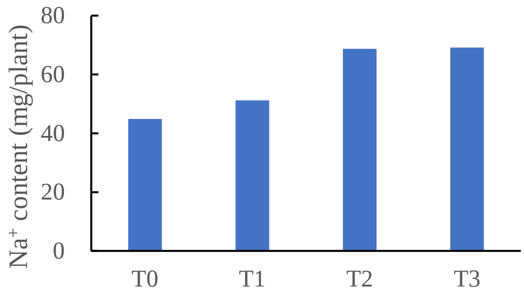

Fig.2 Total Na^+ content per plant.

Na^+ extraction in relation to the others, 44.91 and 51.24 (mg-Na^+/g-DM), respectively.

4. Conclusion

This study showed that *Atriplex nummularia* really might recover soils with salinity problems as it was possible to grow larger and to accumulate more sodium in situations of exposure to high levels of salinity and sodium content soil compared to low levels of them.

Reference

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