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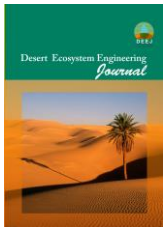

Investigating the Influence of *Calotropis procera* and *Panicum amarum* on the Physical and Chemical Properties of Sandy Hillside Soils: A Case Study of Bashi Region, Bushehr Province

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Extended Abstract

Introduction: Vegetation is of paramount importance for various reasons. Taking restoration and creation of vegetation into account, it can be argued that selecting plant species that are adapted and resilient to arid conditions significantly contributes to the successful establishment of plants and the reduction of desertification effects. Moreover, possessing unique characteristics, such species exert a specific influence on their growth environment. Commonly known as "Malum Sodomiticum", Calotropis procera is a perennial shrub that thrives in arid and semi-arid regions, being considered an important plant due to its medicinal properties and economic uses, including fiber production and soil remediation on the other hand, Panicum amarum, also known as "Salt Grass," is a perennial grass primarily found in coastal areas and sandy soils, serving as a protective ground cover to prevent soil erosion and provide forage for livestock. Such effects could be identified through the investigation of the relationship between soil and plants. Considering the influence of plant species on the physical and chemical properties of the soil, this study sought to investigate the effect of Panicum amarum and Calotropis procera on the physical and chemical properties of sand dunes and their stabilization and reclamation.

Materials and methods: This study used topographic maps, aerial photographs, and satellite imagery to identify the best locations for the growth of Panicum amarum and Calotropis procera. In this regard, the required soil samples were collected from the depths of 0-30 cm and 30-60 cm using systematic random sampling along four 500-meter transects, each of which was 250 meters away from each other. Moreover, soil properties, including texture, pH, salinity, electrical conductivity, organic matter content, phosphorus, potassium, and lime were measured using various laboratory methods. Finally, each soil parameter was assessed in areas with saltbush and millet species and the areas without vegetation cover (control) using an independent t-test in the SPSS software environment.

Results: According to the results of the soil chemical and physical property analyses, the soil samples under millet, saltbush, and control areas showed significant differences, except for pH and potassium which did not display significant differences among the three sites. Moreover, it was found that the changes in organic matter and nitrogen percentages in the soil samples of the three areas were among

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the effective factors involved in improving the physical and structural conditions of the soil, providing a suitable substrate for the activity of microorganisms. This leads to increased water-holding capacity, nutrient availability, organic colloids, specific surface area, cation exchange capacity, and overall improvement of the physical conditions of the soil. These findings suggest a significant influence of the cultivated plant species compared to the control ones. On the other hand, the organic matter content in the surface layer of the saltbush and millet cultivation areas was found to be approximately 23% higher than the subsurface layer, which is due to the aboveground biomass deposition of the plant species in the top horizon, leading to the long-term improvement of soil structure.

The results also showed that the soil pH did not differ significantly among the three areas (saltbush, millet, and control), although it was slightly higher under millet but not statistically significant. The electrical conductivity (EC) of the studied soil samples was higher in the surface layer compared to the subsurface layers, and there was a significant difference among the three areas in this regard. Furthermore, the study found that the soil enjoyed lower salinity under the millet species compared to the other two species, likely due to the plant's ability to absorb the salts. It was also found that the potassium concentration was not significantly different among the three areas; However, the millet site possessed a higher potassium level than the other two areas. The soil texture was also affected by the presence of the plant species. In this regard, it was found that while millet led to increased clay accumulation in the surface layer, Saltbush performed more successfully in accumulating silt, both showing a significant increase compared to the control area. As for the lime content, the plant species caused a significant decrease in the percentage of lime in the surface soil compared to the control area. In summary, the results of the study indicated that the cultivation of saltbush and millet species exerted a significant positive influence on the chemical and physical properties of the sandy soil, with millet showing relatively better performance in improving soil salinity, potassium content, and physical structure compared to the saltbush.

Conclusion: The results of this study proved the positive influence of cultivating saltbush and millet on the chemical and physical properties of the soil. These species significantly increased the nitrogen, organic matter, and phosphorus content of the soil compared to the control area. Overall, it could be argued that the presence of saltbush and millet, along with other diverse species, may exert a positive influence on sandy dunes, indicating the potential of these species for the restoration and diversification of vegetation in sandy areas. Furthermore, this can help reduce the fragility of these ecosystems. Therefore, in the study area, which has light-textured soil and requires biological operations and soil conservation, the millet species can be utilized for such a purpose. Finally, it can be said that the use of these plants along with other sand-loving species can contribute to the rehabilitation and diversification of sandy vegetation and reduce the fragility of such ecosystems.

Keywords: Sand Dune Stabilization, Wind Erosion, Clay Accumulation, Nitrogen, Organic Matter.