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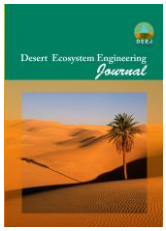

Effects of Biological Soil Crusts on Some Soil Physico-Chemical Propertices (Case Study: Hilslopes of Agi-Gol Wetland, Golestan Province)

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Extended abstract

Introduction: The expansion of deserts in Iran poses a significant challenge, with 75% of the population in arid and semi-arid regions facing issues related to desertification. Within this ecosystem, biotic and abiotic environmental components and their interactions are of paramount importance. The soil biota in these areas plays a crucial role in improving soil properties and restoring degraded lands. Therefore, biological soil crusts (BSCs), as communities of living organisms on the uppermost few millimeters of the soil surface in dryland regions, perform various invaluable ecological functions and are highly susceptible to erosion. They can enhance soil physico-chemical characteristics, aid in natural resource management, and play an essential role in protecting wetlands, as well as in soil and water conservation. Hence, this study aims to assess the impact of biocrusts on the soil properties of the Ajigol wetland in the Inche Burun region of Gonbad Kavous, North of Golestan province, a hotspot of wind erosion during warm days and months north of Gorgan.

Materials and Methods: In this research, the physicochemical properties of both topsoil and subsurface samples were measured, including soil organic carbon (SOC), electrical conductivity (EC), pH, sodium adsorption ratio (SAR), exchangeable sodium percentage (ESP), and the concentrations of Sodium (Na), Calcium (Ca), Potassium (K), and Magnesium (Mg). Additionally, soil particle size distribution (SPSD) was determined using laser diffraction analysis. Finally, data analysis was conducted to investigate the impact of biological soil crusts on the physical and chemical properties of the soil using the t-test and Wilcoxon test within the R programming environment.

Here's an edited English version of the Results section:

Results: The analysis of soil chemical properties revealed notable differences between the two depths examined: 0-1 cm and 1-5 cm. The electrical conductivity (EC) measured 199.87 dS/m at 0-1 cm and 194.51 dS/m at 1-5 cm. Potassium (K) content was higher in the surface layer, recorded at 78.29 ppm compared to 71.48 ppm in the subsurface layer. Magnesium (Mg) levels also showed a similar trend, with 1.75 ppm at 0-1 cm and 1.12 ppm at

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1-5 cm. The soil organic carbon (SOC) content was significantly higher at 1.58% for the 0-1 cm depth, compared to 0.77% at 1-5 cm. However, pH levels were slightly elevated in the deeper layer, measuring 7.41 at 0-1 cm and 7.48 at 1-5 cm. Sodium (Na) content increased with depth, with values of 132.73 ppm at 0-1 cm and 137.63 ppm at 1-5 cm. Calcium (Ca) levels were comparable at 3.42 ppm for the surface layer and 3.5 ppm for the subsurface layer. The sodium adsorption ratio (SAR) showed higher values at greater depth, with 83.67 ((mmol/L)0.5) at 0-1 cm and 96.61 ((mmol/L)0.5) at 1-5 cm. Similarly, exchangeable sodium percentage (ESP) values were also higher, recorded at 128.38 ((mmol/L)0.5) at the surface layer and 142.65 ((mmol/L)0.5) at the subsurface layer. The findings indicated that biological soil crusts in the studied area significantly influenced organic carbon levels at both depths, leading to an increase in organic matter. Furthermore, potassium and magnesium concentrations were greater in the surface layer of the biological soil crusts, while sodium, calcium, SAR, and ESP concentrations increased with soil depth. For all study depths, the predominant soil particle size was silt (2-50 microns), but in the subsurface layer, the particle size was generally larger than in the surface layer.

Discussion and Conclusion: Analysis of the soil's physicochemical properties at different depths did not reveal statistically significant differences across the various parameters studied. However, it was observed that biological soil crusts have a positive impact on increasing organic matter in the topsoil, with a subsequent decrease at greater depths. Soil particle size distribution was also influenced by the presence of BSCs. In general, biological soil crusts can directly and indirectly affect the physicochemical properties of the soil and play a significant role in sediment processes and the distribution of dust particles in the environment. These communities can stabilize the soil by increasing organic matter and overall soil stability, thereby contributing to soil conservation and erosion prevention. This research enhances our understanding of soil properties and sediment processes influenced by biological soil crusts in the Ajigol wetland area in Golestan province, highlighting the ecological value of this wetland ecosystem. Raising awareness among local residents regarding the importance of BSCs is crucial, and their degradation due to various factors, particularly overgrazing, should be carefully considered and mitigated.

Keywords: Biological Soil Crusts, Soil Physicochemical Properties, Soil Organic Carbon, Ajigol Wetland, Golestan Province.