University of Zabol

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Thesis for obtaining a master's degree in watershed management

Study of the Effect of Plant Growth-Promoting Rhizobacteria and Humic Substances on the Stability of Soils Sensitive to Wind Erosion in Zabol City (Case Study: Taghazi Region)

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The Sistan region has become a critical wind erosion area and dust storms have caused economic, social and environmental problems. Thus, finding the most efficient approaches to controlling wind erosion is essensial.The aim of this study was to investigate the effect of rhizobacteria that stimulate plant growth and humic substances on the stability of sensitive soils to wind erosion in Taghazi area of Sistan. The study was performed as a factorial study in a completely randomized design (with 3 replications). The first factor of soil type was in 3 levels including: low sensitivity to wind erosion (S1), medium sensitivity (S2) and high sensitivity (S3); The second factor of PGPR and humic substances treatments were in 5 levels including: 1-: H0B0 control (no use of PGPR and humic substances), 2-: NB Nutrition Broth, 3-: H0B1 PGPR combination (Pseudomonas R38N3 + Pseudomonas R31N1 + Staphylococcus R38N2), 4- H1B0 was a combination of humic substances (combination of humic acid and folic acid) and H1B1 was a combination of PGPR and humic substances. Treatments were added to the soil with irrigation water. After three months, the effect of the treatments on acidity, percentage of lime, organic matter, organic carbon, percentage of nitrogen, calcium / magnesium, phosphorus, potassium, microbial respiration, electrical conductivity (EC), sodium, sodium adsorption ratio, mass Specificity, soil erodibility coefficient, surface sediment factor, percentage of dry aggregates stability, weight percentage of aggregates in wet and dry sieves, mechanical resistance of dry and wet soils and microbial population were measured. Data was analyzed using Statistix10 software and the means were compared by LSD test. The results showed that nitrate broth treatment increased calcium / magnesium content, dry aggregate stability percentage and decreased bulk density in highly sensitive soil (S3) as well as decreased surface tuber factor and erodibility coefficient in sensitive soil, respectively. Low sensitivity soil (S1) and medium sensitivity soil (S2). Inoculation had a significant effect only on soil nitrogen percentage ($p < 0.01$). However, in addition to increasing the percentage of nitrogen, humic substances increased the percentage of lime, microbial respiration and microbial population and decreased the pH in high-sensitivity soil (S3) and also increased the mechanical strength of wet soil in medium-sensitive soil (S2). Humic substances also increased the amount of organic matter, organic carbon and weight percentage of aggregates and decreased the ratio of sodium uptake in S3 soil. This combination also increased the amount of potassium and weight percentage of aggregates in wet sieve and decreased sodium in soil S2 and the amount of phosphorus, mechanical strength of dry soil and decreased EC in S1 soil. The results also showed that between the size of aggregates and the stability of aggregates with the weight percentage of aggregates in dry and wet sieve, erodibility coefficient, percentage of dry aggregate stability, mechanical strength of dry and wet soil, percentage of lime, sodium was a negative and significant correlation between sodium uptake ratio, droplet test, organic carbon and microbial population. In general, the results of this study showed that the use of plant growth-promoting rhizobacteria and humic substances improved the physical, chemical and biological properties of sensitive soils to wind erosion in the Taghiz area. It seems that in erosion-sensitive surface soils, the use of humic substances along with PGPR It can be used as a solution to improve soil properties and reduce wind erosion, environmentally friendly, economical as well as affordable.

Keywords: Soil erosion, Fulvic and humic acid, *Pseudomonas*, *Staphylococcus*, Soil fertility, Sistan.