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WETTING-DRYING CYCLES WITH WASTEWATER AFTER FREEZING-THAWING OF CLAY SOIL CONTAINING SEWAGE SLUDGE IMPROVE HYDRAULIC PROPERTIES

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Abstract

Practical solutions are needed to alleviate possible negative effects of freezing-thawing events on the physical and hydraulic properties of clay soils which are more common with the effect of global warming in medium and high altitudes with cool climates. The deteriorated physical and hydraulic properties can be shortly improved with integrated management of solid and liquid wastes applied as an organic resource. A study was simulated under controlled conditions and conducted with 3 sewage sludge doses (D0: 0 Mg ha^{-1}, D1: 50 Mg ha^{-1}, D2: 100 Mg ha^{-1}), 2 freezing-thawing cycles (FT1: 5 times, FT2: 10 times), 2 water types (FW: freshwater, RWW: recycled wastewater) and 2 wetting-drying cycles (WD1: 4 days, WD2: 8 days) with three replicates. FT2 affected soil properties negatively, while the D2 increased organic matter 32.3%, porosity 8.2%, wet aggregate stability 10.8%, field capacity 16.2%, and hydraulic conductivity 24.7% compared to D0, and a decreased bulk density of 9.0%. RWW contributed to soil organic matter by 6.5% and total porosity by 2.1%. Moreover, WD2 increased organic matter 1.7%, total porosity 4.3%, macro-porosity 8.7% and hydraulic conductivity 17.1%, and decreased bulk density 4.6%. Correlogram analysis indicated the significant relationships between parameters. It was concluded that the high dose application of sewage sludge aiming waste disposal can be a practical way to improve clay soil with increased wetting-drying cycles of wastewater under freezing-thawing conditions.

Keywords: aggregation, domestic wastes, field capacity, hydraulic conductivity, Vertisol

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