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Abstract

Climate change, anthropogenic activities and ageing-related deterioration often trigger the failure of man-made and natural slopes. Compared to conventional stabilisation methods, bioengineering techniques provide a cost-effective and sustainable alternative for stabilising slopes.

This study investigates the effects of tall fescue (*Festuca Arundinacea*), with and without symbiosis with mycorrhizal fungi, on the stabilisation of slopes. The research is conducted into three phases: growth, measurement and modelling. Two distinct soils were selected and classified through the Unified Soil Classification System (USCS) as silty clay and silty sand. Eighteen growth columns were prepared for both soils.

Three experimental treatments were applied: grass treatment, grass-mycorrhizal fungi treatment and control. Each treatment was replicated three times per soil type. The growth columns were placed in the greenhouse for a growth period of 12 weeks. Saturated hydraulic conductivity (k_s) and mechanical reinforcement parameters, effective cohesion (c') and the angle of internal friction (ϕ'), were measured on soil samples retrieved from growth columns at three depths.

Results indicated that c' significantly increased for silty clay with both grass-only and grass-fungi symbiosis treatments. In contrast, c' only increased under the grass-fungi symbiosis treatment for the silty sand. Changes in ϕ' were negligible for both soil types. Limit Equilibrium analysis using the GEO5 2024 'Slope Stability' module showed that the factor of safety (FOS) for a model slope increased by 23% for silty clay and 12% for silty sand with grass-fungi symbiosis. These findings demonstrate the potential of tall fescue roots, in association with mycorrhizal fungi, as a sustainable and effective approach for slope stabilisation at shallow depths

Keywords

mycorrhizal fungi, slope stabilisation, tall fescue