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STRESS RELAXATION BEHAVIOUR OF A HIGHLY CALCAREOUS SOIL AMENDED WITH LONG-TERM APPLICATION OF THREE ORGANIC MANURES

ABBAS HEMMAT¹, N. AGHILINATEGH², M. SADEGHI³

¹Professor, Department of Farm machinery, Isfahan University of Technology, Isfahan 84156-83111, Iran, ahemmat@cc.iut.ac.ir

²Former Graduate Student, Department of Farm machinery, Isfahan University of Technology, Isfahan 84156-83111, Iran, nahidaghili_85@yahoo.com

³Assistant Professor, Department of Farm machinery, Isfahan University of Technology, Isfahan 84156-83111, Iran, sadeghimor@cc.iut.ac.ir

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ABSTRACT When soil strain occurs under external force the strain-stress relation is not linear and strains are composed of elastic and plastic or viscose components. Various combinations of rheological elements have been used to develop models for assessing the viscoelastic behaviour of soils. The viscoelastic properties of a soil can be determined by a uniaxial compression device using two kinds of transient test: creep and stress relaxation. In the present work, a uniaxial confined compression test was conducted on the remoulded samples collected from the topsoil of experiment plots in which organic manures (municipal solid waste compost; fresh air-dry sewage sludge; farmyard manure) were added to a silty clay loam soil at three rates (25, 50 and 100 Mg ha⁻¹) for 7 years successively under annual wheat-corn rotation. Large remoulded specimens were prepared at two gravimetric water contents (17.1 and 20.9%) and axial load was applied. When the applied stress reached 100 kPa, the strain was kept constant and the decay of the stress with time was recorded for 30 min. The stress relaxation behaviour was represented by the generalized Maxwell model with 2 elements. The strain induced in the soils after having subjected them to 100-kPa stress decreased with increasing organic carbon, whereas the residual modulus of elasticity increased linearly indicating higher elasticity with higher organic matter. The residual stress increased linearly with increasing organic carbon. The stress relaxation rate of the soils was not influenced by the long-term incorporation of organic manures tested at two moisture contents.

Keyword: Viscoelastic properties, Maxwell model, municipal solid waste compost, sewage sludge, farmyard manure