

MODELLING SLAKING SENSITIVITY TO ASSESS THE DEGRADATION POTENTIAL OF HUMID TROPIC SOILS UNDER INTENSE RAINFALL

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ABSTRACT

In the humid tropics, soil erosion due to the impact of high-intensity tropical rainfall is one of the important environmental problems. A quick assessment of slaking sensitivity of soils that are frequently subjected to the fast wetting of intense rainfall of the humid tropics is necessary for the selection of appropriate soil management practices to avoid soil structure deterioration that results in runoff, seal formation, erosion and eventual degradation. Unfortunately, field and laboratory measurements of slaking sensitivity are tedious, time consuming and expensive. Therefore, a slaking sensitivity ranking framework using readily available soil data, namely, clay content, organic matter content, exchangeable sodium percentage (ESP) and cation exchange capacity (CEC) determined to be important in slaking sensitivity and structural degradation under intense rainfall was developed. The ranking framework was subsequently used to classify 23 agriculturally important Trinidadian soils into slaking sensitivity classes for management recommendation. A simple mathematical model that provides a rapid assessment of slaking sensitivity was also developed using the soil data of 14 out of the 23 soils and subsequently tested on the remaining nine soils. Our results suggest that about 80 per cent or more of the soils are highly sensitive to slaking pressures, highly vulnerable to degradation and require management practices that reduce the rate of wetting and thus degradation of aggregates under intense rainfall. The developed model performed with a high degree of accuracy as the predicted values were in close agreement with measured values ($r = 0.93$). This suggests that the model gives a good indication of the structural degradation vulnerability of the soils studied under the conditions applied and criteria used. The model is, therefore, recommended for use in the tested humid tropical soils. However, more comprehensive testing is required on a broader range of soils prior to its more widespread application in other climatic conditions. Copyright © 2010 John Wiley & Sons, Ltd.

KEY WORDS: slaking sensitivity; soil degradation; intense rainfall; humid tropics; mathematical model; slaking sensitivity ranking framework; slaking pressures; Caribbean; Trinidad