

Effects of moisture content on the hardness level measurements of the soil

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Hardness is an important soil strength indicator which is widely discussed in agriculture and engineering. Increased hardness levels used in constructions might retard root penetration detrimentally affecting crop productivity. Moisture content (MC) is a key factor which has been extensively studied in relation with the hardness. However, there is a lack of conclusive measurements regarding the correlation between MC and hardness due to the interpretation problems aroused under varying field conditions. Site specific information of soil hardness and contributing MCs are less available in Sri Lanka as well. Therefore, this study was aimed to assess the effects of MC on the soil hardness in the Faculty of Agriculture, University of Ruhuna in Mapalana area. The hardness and the volumetric and gravimetric MCs were estimated using the standard cone penetrometer (Imants), Time Domain Reflectometry (Field Scout), and the gravimetric methods respectively at 0-5, 5-10, and 10-15 cm depths in triplicates from 25 locations based on selective sampling. Data were statistically analysed using ANOVA. The soil hardness decreased with increasing volumetric and gravimetric MCs showing polynomial relationships which were strongest in the upper depth ($R^2 = 0.6$ and 0.51 respectively). At low MCs the cohesion between soil particles increases enhancing the friction between the penetrometer cone and the soil particles resulting higher hardness values. The increasing MCs replace soil particles reducing the dry density and the hardness. Most of the locations with MCs $< 10\%$ didn't show significantly different hardness values among depths. At higher MCs ($> 30\%$) the hardness was significantly low (1.2 ± 0.11 M Pa) in the top layer and high (2.14 ± 0.12 M Pa) in the bottom layer which might be due to strong clay cementation. The findings signify that MC and hardness correlation might be a good predictor in deciding land use practices within the study site which is characterised with numerous farming and construction activities.

Keywords: Gravimetric, Hardness, Volumetric