

Soil - water relationships in the Weatherley catchment, South Africa

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Abstract

Soil water content is influenced by soil and terrain factors, but studies on the predictive value of diagnostic horizon type for the degree and duration of wetness seem to be lacking. The aim of this paper is therefore to describe selected hydro-pedological soil-water relationships for important soils and diagnostic horizons in the Weatherley catchment. Daily soil water content was determined for 3 horizons in 28 profiles of the Weatherley catchment. These data were used to calculate annual duration of water saturation above 0.7 of porosity ($AD_{s>0.7}$), which was correlated against other soil properties. Significant correlations ($\alpha = 0.05$) were obtained between average degree of water saturation per profile and slope ($R^2 = 0.24$), coarse sand content ($R^2 = 0.22$), medium sand content ($R^2 = 0.23$), fine silt content ($R^2 = 0.19$), and clay content ($R^2 = 0.38$). $AD_{s>0.7}$ per diagnostic horizon ranged from 21 to 29 $d \cdot yr^{-1}$ for the red apedal B, yellow brown apedal B, and neocutanic B horizons; 103 $d \cdot yr^{-1}$ for the orthic A horizons; and from 239 to 357 $d \cdot yr^{-1}$ for the soft plinthic B, unspecified material with signs of wetness, E, and G horizons. A regression equation to predict $AD_{s>0.7}$ from diagnostic horizon type (DH), clay to sand ratio ($Cl:Sa$), and underlying horizon type (DH_u) gave: $AD_{s>0.7} = -26.31 + 41.64 \ln(Cl:Sa) + 35.43 DH + 13.73 DH_u$ ($R^2 = 0.78$). Results presented here emphasise the value of soil classification in the prediction of duration of water saturation.

Keywords: diagnostic horizon, model, slope, soil texture, water saturation