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Effects of Land Use Change in the Hydrophysical Properties in Vertisols in Northeastern Mexico

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Abstract

The impact of the use of natural resources associated with anthropogenic activities has increased evidently, mainly through land use changes which have altered hydrophysical properties of soils. We hypothesised that, in the same soil type (Vertisol), four types of land use system (grassland, agriculture, Eucalyptus plantation and thornscrub) and seasonal variation can modify the soil hydrophysical properties. Results showed significant differences between land use systems and seasons for hydraulic conductivity (K), infiltration capacity (fp), and cumulative infiltration (fc). There were no seasonal differences in soil penetration resistance (SPR), bulk density (ρd) and total porosity (φP). Grassland presented higher values for ρd (1.2 g cm^{-3}) and SPR (5.3 kg cm^{-2}) and lower for K (0.8×10–5 cm s^{-1}) and φP (53 %), unlike thornscrub. Agriculture presented lower SPR (0.4 kg cm^{-2}), while plantation showed similar values when compared to the thornscrub. Kostiakov infiltration model was fitted to land use infiltration curves, showing differences between land use and season. The values for fp oscillated between 53.6 and 548.8 mm h^{-1} and fc ranged from 105.3 to 1061 mm. The order of the infiltration values goes as follows: agriculture > plantation > thornscrub > grassland. Land use changes in Vertisols induced modification of soil physical properties affecting processes like permeability, soil compaction, and water availability. It can be concluded that although the edaphic factor is dominated by the characteristics of the interaction of factors at the time of its formation, the anthropogenic activities will determine the functioning of the soil-system, contributing to changes that modify the physical properties, affecting ecological stability and economic continuity.

Keywords: Bulk density, hydraulic conductivity, infiltration, land use system, porosity, soil penetration resistance, Vertisol

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