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Effect of increasing soil bulk density and organic amendment on soil hydrological properties, structural stability and selected growth parameters of cowpea

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Abstract

Agricultural intensification whether in terms of crop production or animal production (ranching) involve constant traffic load on the soil. With heavy machineries or large animals, deteriorative soil compaction may result. In response to this emerging challenge in Nigeria, a study was instituted in the nursery pavilion of the Department of Agronomy, University of Ilorin, Nigeria to determine the response of soil moisture holding capacity (MHC), saturated hydraulic conductivity (Ksat), mean weight diameter (MWD), soil organic carbon (SOC) leaf area (LA) and root biomass (RB) of cowpea to increasing bulk density (BD) and organic amendment. The study was designed as a two factorial experiment in Randomised Complete Block Design (RCBD) with six levels of BD (1.0 gcm^{-3}, 1.20 gcm^{-3}, 1.40 gcm^{-3}, 1.60 gcm^{-3}, 1.80 gcm^{-3} and 2.0 gcm^{-3}) and two types of organic amendments (poultry droppings and cattle dung), applied at 10 % per pot, with an un-amended treatment (control), replicated three times and conducted twice during 2023 planting season. The result showed that for every 0.2 gcm^{-3} increase (1.4–1.8 gcm^{-3}) in BD, MHC reduced by at least 14 % whereas on soils subjected to organic amendment, it increased by at least 65 % compared with un-amended soils. For every 0.2 gcm^{-3} increase in BD, there was a minimum of about 21 % reduction in Ksat whereas the application of organic amendment to the soil led to about 1.7 fold increase with soils under poultry droppings exhibiting higher performance than those under cattle dung. There was about 49 % loss of RB when BD was increased from 1.0 – 2.0 gcm^{-3}. Increase in BD from 1.4–2.0 gcm^{-3} reduced LA by at least 10 %. However, plants on organic amended soils showed 35 – 56 % increase in LA relative to control.

Keywords: Bulk density, cowpea root biomass, leaf area, soil compaction, soil physical properties

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