Soil Physics: Linking the Impacts of Soil Physical Condition & N Cycling on Plant Growth

There is an urgent need to better understand the extent to which the soil physical environment that roots explore limits the ability of crops to exploit and utilise N, either by direct capture from root proliferation, plant physiological responses (Gregory et al., 2013), abiotic limitations that affect N cycling by microorganisms or losses to the wider environment (Nawaz et al., 2013). Soil physical degradation exacerbates these stresses, with Brazil providing various examples (e.g. Cerrado) where the judicious choice of tillage has produced favourable and stable physical conditions for crop production (Corbeels et al. 2006). Here we aim to disentangle the underlying plant physiological and environmental processes influencing N capture. It is well known that large differences exists in soil physical conditions in the UK (George et al. 2011) and Brazil (Calonego and Rosolem, 2011) depending on cultivation practices. Significant variation exists in the adoption of no-till between Brazil and the UK, with the latter some distance behind (both in terms of % area and time since conversion; Mangalassery et al. 2015) e.g. some Brazilian soils have been under no-till for >50 years, whereas 10 years no-till is considered a long time by UK standards. UK studies have shown no-till soils behave very differently in terms of water transport and GHG movement (Mangalassery et al. 2014) however less is known about the effect of soil structure on N availability/transport e.g. to what extent do new root systems exploit old root channels/biopores and what effect do they have on N leaching.

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