

Sub-soil microbial activity under rotational cotton crops in Australia

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Soil microbial communities contribute significantly to soil organic matter formation, stabilisation and destabilisation, through nutrient cycling and biodegradation. The majority of soil microbial research examines the processes occurring in the top 0 cm to 30 cm of the soil, where organic nutrients are easily accessible. In soils such as Vertosols, the high clay content causes swelling and cracking. When soil cracking is coupled with rain or an irrigation event, a flush of organic nutrients can move down the soil profile, becoming available for subsoil microbial community use and potentially making a significant contribution to nutrient cycling and biodegradation in soils. At present, the mechanisms and rates of soil nutrient turnover (such as carbon and nitrogen) at depth under cotton rotations are mostly speculative and the process-response relationships remain unclear, although they are undoubtedly underpinned by microbial activity.

Our research aims to determine the contribution and role of soil microbiota to the accumulation, cycling and mineralisation of carbon and nitrogen through the whole root profile under continuous cotton (*Gossypium hirsutum*) and cotton-maize rotations in regional New South Wales, Australia. Through seasonal work, we have established both baseline and potential microbial activity rates from 0 cm to 100 cm down the Vertosol profile, using respiration and colourimetric methods. Further whole soil profile analyses will include determination of microbial biomass and isotopic carbon signatures using phospholipid fatty acid (PLFA) methodology, identification of microbial communities (sequencing) and novel experiments to investigate potential rates of nitrogen mineralisation and quantification of associated genes. Our preliminary observations and the hypotheses tested in this three-year study will be presented.