Chemical Nature of Phosphorus in Cropping Soils from Western Australia Characterised by ^{31}P Nuclear Magnetic Resonance Spectroscopy

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Speciation of soil phosphorus (P) is paramount to understanding the biogeochemical cycle in agroecosystems and key for an efficient P management. Most studies using solution-state ^{31}P nuclear magnetic resonance (NMR) spectroscopy for P speciation were done in soils from eastern Australia. Currently, in-depth knowledge of the P dynamics is limited for the western-Australian region. Only one study has been published using solution-state ^{31}P NMR to characterise P compounds in topsoils (0–2.5 cm) from Western Australia under karri (*Eucalyptus diversicolor* F. Muell.) forests. Therefore, the objective of this research is to improve our knowledge and provide new information on the chemical composition of P in cropping soils from Western Australia. Two contrasting soil types were chosen for this study: a deep structure-less sand (Tenosol) and iron- and aluminium-rich soil with high levels of ironstone nodules present (Ferric Kandosol). The Tenosols of Western Australia are highly weathered soils characterised by low (<100 g kg^{-1}) clay content, low P buffering capacity and low levels of soil organic carbon (5–20 g C kg^{-1}). Kaolinite is the dominant clay mineral in these soils. The Ferric Kandosols of Western Australia have higher levels of soil organic carbon (21–52 g C kg^{-1}) in the surface layer, and higher levels of oxalate extractable iron and aluminium. Kaolinite is often the dominant clay mineral, but gibbsite, goethite and hematite do occur. Ten sites have been selected for this study encompassing five locations for each soil type. Soil profiles (0–30 cm) are being characterised and quantified for their chemical nature and distribution of P using solution-state ^{31}P NMR spectroscopy in 0.25 M NaOH + 0.05 M EDTA extracts. Preliminary data obtained from ^{31}P NMR spectroscopy showed the predominance of inorganic orthophosphate (chemical shift δ = 6.0 ppm) in the alkaline extracts followed by organic P species in the monoester region (δ = 3.5–5.4 ppm) for both soil types. A higher proportion of *myo*-inositol hexakisphosphate was present in Ferric Kandosol than in Tenosol. Additionally, diester phosphate signals (δ = -1.0–1.5 ppm), such as DNA or RNA, and pyrophosphate (inorganic polyphosphate with P-O-P bond) at δ = -4.6 ppm were identified in Ferric Kandosols but not in Tenosols. This is consistent with the contrasting levels of carbon in these soils. These results emphasize the importance of the organic P as a significant pool and differences in the P dynamics in these soils. This study is ongoing.