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Abstract

Estimating Soil Organic Carbon Under Different Land-Use Types in Australia's Northern Grains Region Using Mid-Infrared Spectroscopy †

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Abstract: Land-use type is known to affect levels of soil organic carbon (SOC). However, the degree to which SOC is affected by land-use type over the short—(<10-years) and long—(≥10-years) term remains relatively uncertain. Moreover, there is limited data on the distribution of SOC across particulate (POC), humus (HOC) and resistant (ROC) fractions, and the responses of these fractions to land-use. Using mid-infrared spectroscopy (MIR) coupled with partial least squares regression (PLSR) algorithms generated from the Australian Soil Carbon Research Program (SCaRP), soil organic carbon (TOC, POC, HOC and ROC) was estimated across 280 paired samples across Australia's Northern Grains Regions. Our analysis covered five land-use types: remnant native vegetation, long-term pasture (≥10-years), short-term pasture (<10-years), short-term cropping (<10-years) and long-term cropping (≥10-years). All land-use types except long-term pasture generated significant declines across all SOC fractions compared with native vegetation. Long-term cropping resulted in the greatest declines, with an average decrease of 6.25 g TOC/kg soil relative to native vegetation. Long-term cropping also reduced POC (−0.71 g/kg) and HOC (−3.19 g/kg) below that of short-term cropping. In addition, the ROC fraction responded to land-use type, with native vegetation and long-term pasture maintaining greater ROC compared with other land-use types. The results demonstrate substantial reductions across all SOC fractions with long-term cropping. The ability of long-term pastures to maintain levels of SOC similar to that of native vegetation indicates the importance of limiting soil disturbance and maintaining more continuous living plant cover within cropping systems.

Keywords: agriculture; crop production; cropping systems; native vegetation; plant cover; sustainable agriculture; tillage

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