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The impact of biosolids application on organic carbon and carbon dioxide fluxes in soil

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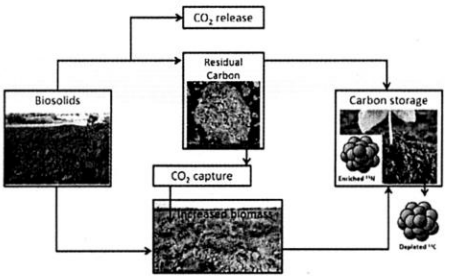
HIGHLIGHTS

- Increased non-labile and labile soil organic carbon under biosolids amended soils.
- Depleted $\delta^{13}C$ in biosolids amended soils showed the residual carbon contribution to soils.
- Application of biosolids caused enriched $\delta^{15}N$ in soils.
- Enhanced CO_2 emission observed under biosolids land application.
- Storing biosolids carbon in soils for a longer period is a challenge.

GRAPHICAL ABSTRACT



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ABSTRACT

A field study was conducted on two texturally different soils to determine the influences of biosolids application on selected soil chemical properties and carbon dioxide fluxes. Two sites, located in Manildra (clay loam) and Grenfell (sandy loam), in Australia, were treated at a single level of 70 Mg ha^{-1} biosolids. Soil samples were analyzed for SOC fractions, including total organic carbon (TOC), labile, and non-labile carbon contents. The natural abundances of soil $\delta^{13}C$ and $\delta^{15}N$ were measured as isotopic tracers to fingerprint carbon derived from biosolids. An automated soil respirometer was used to measure in-situ diurnal CO_2 fluxes, soil moisture, and temperature. Application of biosolids increased the surface (0 −15 cm) soil TOC by > 45% at both sites, which was attributed to the direct contribution from residual carbon in the biosolids and also from the increased biomass production. At both sites application of biosolids increased the non-labile carbon fraction that is stable against microbial decomposition, which indicated the soil carbon sequestration potential of biosolids. Soils amended with biosolids showed depleted $\delta^{13}C$, and enriched $\delta^{15}N$ indicating the accumulation of biosolids residual carbon in soils. The in-

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