Short-term turnover of stable organic carbon and CO2 evolution of soils applied with fresh organic matter

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As deduced from the literature, the soil organic carbon (SOC) of particle size is less than 53 micrometer is mineral-associated organic carbon (MAOC), a measurable fraction of a passive soil organic matter (SOM) pool described by the CENTURY terrestrial SOM model.

The effect of fresh organic matters (FOM): no OM (control); chicken manure (CM): 2.12 g CM carbon kg^{-1}; and leaf litter (LL): 1.81 g LL carbon kg^{-1} on short-term dynamics of MAOC and CO_2 evolution of two soils: Bagabag, Nueva Vizcaya, Philippines (121.25E, 16.583N) and Tsumagoi, Gunma Prefecture, Japan (138.5E, 36.5N) were studied in a 110-day constant temperature laboratory incubation experiment.

Cumulative CO_2 evolution and CO_2 evolution rate were significantly higher in CM-applied soils than in LL-applied, and control soils. Bagabag soil had higher cumulative CO_2 evolution and CO_2 evolution rate than Tsumagoi soil despite the former having lower initial SOC content. This is contrary to conventional knowledge that soils that has higher initial SOC content have higher rate of SOC loss than soils with lower SOC levels.

Significant MAOC decrease in 50-cm depth of Tsumagoi soil suggest short-term stable C turnover even with FOM application. Greater MAOC decline in CM-applied Bagabag soil suggest that manure application may result to bigger stable C turnover in this soil than when manure was not applied.

Our results provide evidence of significant short-term stable SOC turnover, and challenge the convention that only labile SOC is involved in short-term CO_2 evolution from soils applied with organic matters.