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Understanding Soil Interfacial Reactions for Sustainable Soil Management and Climatic Change Mitigation

Organic Matter content and composition in a sandy loam Amazonian Acrisol as affected by soil management

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The agricultural production in the State of Acre (Brazilian Amazon Southwest) is still very incipient and, so far, none investigation about the effect of soil management systems on organic matter (OM) is reported. The main goal of this work was to investigate the impact of conservation soil management systems after 10 years on the C content and SOM composition in an Acrisol, Acre State. The experiment was conducted in split-plot design in a randomized complete block design with three repetitions for NT and CT (main parcels), employing the succession manioc/green manure/maize. For each system, three treatments (subparcels) were established: Control: slash and burn; green manures (*Mucuna aterrima, Canavalia ensiformes, Sorghum bicolor*) as cover crop; cover crop with addition of P-fertilizer and liming. Soil N and C contents were determined in samples collected in 6 layers within 100 cm depth and the OM composition was evaluated by ^{13}C NMR-CP/MAS spectroscopy and n-alkanes determination (GC-MS). C content in the 0-5 cm layer ranged from 13.9 to 16.5 g kg^{-1} and did not differ between treatments. As expected, it decreased with depth reaching values between 3.9 and 5.1 g kg^{-1}. The NMR spectra showed the same pattern regardless the treatment and, on average, OM contained 34 to 40% O-alkyl, 21 to 29% alkyl, 19 to 26% aromatic 11 to 17% carbonyl. In comparison to OM of an agriculture subtropical Acrisol, this OM composition is poorer in O-alkyl and richer in aromatic structures. The OM n-alkanes showed a unimodal and asymmetric distribution with a predominance of short chain n-alkanes ($1.1 \leq R_{S/L} \leq 3$), maximizing at n-C_{18-22} in all analyzed layers. The average chain length was around 21.5, pointing to a predominance of microbial derived lipids. The carbon preference index (CPI) values for both short ($C_n \leq 22$) and long chain n-alkanes ($C_n \geq 23$) indicated a strong OM degradation and a possible contribution of fossil-fuel derived OM. Our results showed that soil conservation management systems did not affect SOM content and composition in Amazonian Acrisol. The high temperature and precipitation, associated to low protection of OM via organo-mineral interactions lead to a more recalcitrant and degraded OM in comparison to subtropical Acrisols.

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