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Food quality influences in vivo emission of N2O from the endogeic earthworm Aporrectodea turgida

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Earthworms contribute to soil N2O emissions indirectly by stimulating soil microbial processes, i.e. nitrification and denitrification, but also directly through in vivo emission of N2O triggered by the earthworm-gut microbiota. The objective of this study was to determine whether the in vivo emission of N2O from the endogeic earthworm A. turgida was influenced by the food quality of ingested organic substrates. This objective was evaluated in a laboratory experiment by first labelling adults of A. turgida with 15N and then tracking the 15N lost from the earthworm body during a 48 h period in microcosms containing soil-plant litter mixtures or soil only. Food quality varied among microcosms, asplant litter (red clover leaves, wheat stems, and corn leaves) contained from 1.4 to 6.1% N and had C:N ratios of 8 to 34, and there was no added substrate in the soil only treatment. The experimental unit was a mason jar (500 ml) and the treatments were 8 factorial combinations of food substrates (4 types) and earthworms (with and without earthworm), with 8 replicates per factorial treatment and 64 mason jars in total. Jars were sealed with a vented lid equipped with a gas-sampling septa to collect headspace gas during a 48 h incubation (16oC, in the dark) for N2O and 15N-N2O analyses. The greatest N2O production was recorded in microcosms with earthworms amended with red clover (1928 $\pm$ 244 μg N2O-N kg-1), while the lowest were observed in microcosms receiving no litter, without earthworms (217 $\pm$ 63 μg N2O-N kg-1). Overall, there was 8 to 12 times more15N-N2O emitted from microcosms with earthworms that were provided with the N-rich red clover than N-poor litters and the control (no litter). These results suggest that the food quality of organic substrates available to earthworm populations may affect their direct contribution to soil N2O emissions from agroecosystems.