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"Solidarity in a competing world — fair use of resources"

Turnover of Soil Nitrogen in a Semi-Arid Tropical Soil: From Basic Research to Knowledge Application in Organic Agriculture

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Abstract

In the arid tropics, year-round high temperatures lead to fast mineralisation in irrigated agriculture which need quantification to develop management systems with enhanced nitrogen(N) use efficiency. In this context, the objective of this experiment was to investigate the loss of N_2O-N from ^{15}N labelled, soil incorporated manure in a laboratory incubation experiment. To this end male goats were fed ^{15}N incorporated (0.675 at %) or normal (0.369 at %) Rhodes grass (*Chloris gayana*) to produce labelled (M) and unlabelled (m) manure. This manure was subsequently applied at a rate of 210 kg N ha^{-1} in experimental plots for two cropping seasons in 2013/14 and 2014/15. Soil samples labelled only in the first year (Mm), labelled in both the years (MM) and control soils (C) were collected at the end of the 2014/15 cropping season for the laboratory experiments. Four treatments, control (C), Mm + unlabeled manure (Mmm), MM + unlabeled manure (MMm) and MM + labelled manure (MMM) were replicated 4 times. 150 g soil was placed in air-tight 1.6-liter glass jars inside a thermostat chamber at 25°C for 31 days. The soil was reconditioned for 10 days (pre-incubation) at 50 % water holding capacity before manure (equivalent to 100 kg N ha^{-1}) was applied. Gas samples were taken 15 times during the incubation period before and after flushing the jars with fresh air. N_2O and CO_2 were analysed by gas chromatograph (GC) and isotopic N was determined by mass spectrometry (MS). Cumulative N_2O-N emissions were 3.2, 12.1, 23.1 and 24.7 μg kg^{-1} soil for C, MMM, MMm and Mmm, respectively, for the total period. N derived from labelled manure (N_2O-Nman) was lower in Mmm and higher in MMm and MMM. On the day of highest N_2O emissions Nman was 9 % for Mmm, 16 % for MMm and 61 % for MMM. During pre-incubation 7–15 % of N_2O -N emission was derived from manure applied two years ago and 9–10 % was derived from manure applied 1 year ago. Our study showed that even after two years, soil applied goat manure contributed to N_2O emissions.

Keywords: ^{15}N, N_2O, Oman

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