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Mineralization and release of inorganic nitrogen in soils amended with animal manure

S D Wanniarachchi*, B C Walpola and A P Senanayake
Department of Soil Science, Faculty of Agriculture, University of Ruhuna, Kamburupitiya

Animal manures are generally assumed to provide a readily available source of nitrogen to crops. Information on the release of nitrogen and other nutrients from animal manure is vital to adopt crop nutrient management systems that minimize the use of chemical fertilizers and increase the productivity of soil. Mineralization and release of inorganic nitrogen was determined for three different animal manures in a laboratory incubation experiment. The soil used for the incubation was an Ultisol (Hapludults) with a loamy sand texture. Dried and ground manure of cattle, goat and poultry were allowed to decompose in soil for 12 weeks at the rate of 5 MT/ha (dry matter). A control soil treatment with no amendments was also included in the experiment for comparison. Soil was analyzed periodically for inorganic/available nitrogen (NH_4^+-N and NO_3^--N).

Application of animal manure influenced the amount of inorganic/available N in soil. The release of NH_4^+-N was high at the start of the incubation in all treatments and gradually decreased with the incubation period. The highest NH_4^+-N content, on average, was observed in the soil amended with poultry manure followed by goat and cattle manure/dung, respectively. Amount of NH_4^+-N in poultry manure amended soil ranged from 4 – 25 mg/kg soil while ranges for cattle and goat manure were 2 – 17 and 3 – 22 mg/kg soil, respectively. As expected, the control soil recorded a low level of NH_4^+-N (a range of 2 – 13 mg/kg soil) compared to manure amended soils.

In general, poultry manure amended soil recorded the highest NO_3^--N content while the control soil recorded the lowest NO_3^--N content at the end of the incubation period. Mineralization and release of nitrogen varied among animal manure used in the incubation and poultry manure had the highest and rapid release of nitrogen followed by goat and cattle manure/dung. The amount of NO_3^--N in poultry manure amended soil ranged from 26 – 72 mg/kg soil while ranges for cattle and goat manure were 12 – 35 and 18 – 49 mg/kg soil, respectively. The control soil had a NO_3^--N range of 13 – 17 mg/kg soil during the incubation. Results of this study indicate that animal manure is a good provider of N for crop growth and the release of nitrogen from different types of animal manure could be synchronized with crop growth to minimize the usage of chemical fertilizers and N losses from soil. NO_3^--N in soil amended with animal manure increased up to 12 weeks of incubation indicating the continued mineralization and accumulation of NO_3^--N in soil.

*sdwanni@soil ruh.ac.lk Tel: 041-2294378