Development of Mechanistic Models for Nitrous Oxide Emissions from Two Soil Types Amended with Manure Composts at Different Ammonium Nitrogen Rates

T. D. P. Liyanage[1*], M. Maeda[2], H. Somura[2], M. Mori[3], and T. Fujiwara[4]

[1]*Department of Soil Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

[2]*Graduate School of Environmental and Life Science, Okayama University, Japan*

[3]*Agriculture Unit, Research and Education Faculty, Kochi University, Japan*

[4]*Graduate School of Engineering, Kyoto University, Japan*

**liyanage@soil.ruh.ac.lk*

Abstract

Existing process-based biogeochemical models do not sufficiently assess the impacts of manure composts on nitrous oxide (N_2O) emissions due to a lack of model equations satisfactorily explaining N_2O emission mechanisms in manure compost-amended soils. We aimed to develop mechanistic models for N_2O emissions in nitrification and denitrification processes from two soil types amended with two manure compost types at different initial ammonium N (NH_4^+-N) rates. The data of N_2O emissions and NH_4^+-N and Nitrate N (NO_3^--N) contents from an aerobic incubation experiment, which used cattle manure compost and mixed compost-amended Kochi (K) and Ushimado (U) soils at three different initial NH_4^+-N rates were used for model development. The linear models for N_2O emissions were developed using parameters of soil NH_4^+-N (nitrification) or NO_3^--N (denitrification) contents. In addition, N_2O emissions in nitrification showed a steady state with consumed NH_4^+-N contents. In the linear model, NH_4^+-N contents could satisfactorily evaluate N_2O emissions in nitrification in both manure compost-amended K and U soils regardless of the initial NH_4^+-N rates. The regression coefficient value of the linear model clearly showed the effects of soil and compost properties on N_2O emissions. In the model for N_2O emissions in denitrification, NO_3^--N contents reasonably reflected N_2O emissions only in K soil. In conclusion, N_2O emissions in manure compost-amended soils can be assessed by NH_4^+-N (both K and U soils) and NO_3^-N contents (only K soil).

Keywords: *Cattle Manure, Kochi, Mixed Compost, Nitrification, Ushimado*