Geophysical Research Abstracts
Vol. 16, EGU2014-3546-1, 2014
EGU General Assembly 2014

Mitigating Nitrous Oxide Emissions from Agricultural Landscape: The Role of Isotopic Techniques

Mohammad Zaman and Minh Long Nguyen

Soil and Water Management & Crop Nutrition Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Department of Nuclear Sciences and Applications, International Atomic Energy Agency, Vienna International Centre, PO Box 100, 1400 V

A review of studies from agricultural landscapes indicate that intensification of agricultural activities, inefficient use of reactive nitrogen (N) fertilizers and irrigation water, increasing human population and changes in their diet (more protein demand), high stocking rate (number of grazing livestock per hectare) and intensive cultivation are the major influencing factors for nitrous oxide (N2O) emissions into the atmosphere. Nitrification (both autotrophic and heterotrophic), denitrification and dissimilatory nitrate reduction to ammonium (DNRA) are the three major microbial processes that produce greenhouse N2O and non-greenhouse gas (N2) and can sometimes occur concurrently in a given soil system. The contribution of N2O production from each of these microbial processes is inconclusive because of the complex interactions between various microbial processes and the physical and chemical conditions in soil microsite (s). Nitrous oxide emissions across an agricultural landscape from different N inputs (chemical fertilizers and animal manure) and soil types are also extremely variable both temporally and spatially and range from 1-20% of the applied N and could therefore represent agronomic loss. The available conventional methods such as acetylene (C2H2) inhibition and helium (He) cannot accurately measure both N2O and N2 and their ratio in a given soil. The use of 15N stable isotopic technique offers the best option to measure both N2O and N2 and to identify their source (nitrification and denitrification) with a greater accuracy. Manipulating soil and fertilizer management practices can minimise these gaseous N losses. For example the combined use of urease inhibitor like (N-(n-butyl) thiophosphoric triamide (nBTPT) (trade name Agrotain®) and nitrification inhibitor dicyandiamide (DCD) with urea (100 kg N ha-1) or animal urine (600 kg N ha-1) was shown to reduce N losses by 39-53 % via denitrification-nitrification-DNRA processes. Other farm management practices such as an improved soil C sequestration through conservation agriculture (e.g., retaining crop residues, minimum cultivation and use of organic fertilizers) can improve soil health (soil microbes) and physical fertility (structure) and hence reduce N2O emissions. A maintenance of soil pH above 6 through lime application, the avoidance of soil compaction , withholding grazing animals from grazing land during wet period, and the use of wetland-riparian zones to intercept N are among the best mitigating tools to minimize N2O emissions.