EGU24-17254, updated on 07 Dec 2024
https://doi.org/10.5194/egusphere-egu24-17254
EGU General Assembly 2024

Impact of urease inhibitor and biofertilizer application on N2O emissions derived from fertilizer using 15N-labelled urea

Maria Heiling[1], **Rayehe Mirkhani**[1,2], Christian Resch[1], Rebecca Hood-Nowotny[3], and Gerd Gerd Dercon[1]

[1]FAO/IAEA, SWMCN, Nuclear Application, Seibersdorf, Austria (m.heiling@iaea.org)
[2]Nuclear Science and Technology Research Institute (NSTRI), Tehran, Iran (rmirkhani@aeoi.org.ir
[3]University of Natural Resources and Life Sciences (BOKU), Vienna, Austria (rebecca.hood@boku.ac.at)

The introduction of nitrogen (N) fertilizers into agricultural soils represents the predominant anthropogenic contributor to the emission of the greenhouse gas N_2O. The impact of N management choices on nitrous oxide (N_2O) fluxes is contingent upon interactions with both soil biotic and abiotic factors. This study, conducted by the Joint FAO/IAEA Centre in the spring of 2022 at the experimental station of the University of Natural Resources and Life Sciences (BOKU) near Vienna, Austria, aims to explore the influence of a urease inhibitor (UI) and biofertilizer (BI) on N_2O emissions arising from fertilizer use in wheat cropping systems. Employing a randomized complete block design with five treatments and four replicates, including a control treatment (T_1), urea-only application (T_2), urea with UI (T_3), urea with BI (T_4), and urea with both UI and BI (T_5). For this study, the application rate was 50 kg N ha^{-1} at the tillering stage (GS 31), except for T_1. N-(n-butyl) thiophosphoric triamide (nBTPT) was used as the UI, and Azotobacter chroococcum as the BI. N_2O gas fluxes were measured using the static chamber method eight times between 3 to 84 days post-fertilizer application, and gas samples were analysed via off-axis integrated cavity output spectroscopy (ICOS, Los Gatos). The highest cumulative N_2O and $^{15}N_2O$ emissions occurred in the T_3 treatment, where urea was combined with UI. The emission factors for N_2O in T_2, T_3, T_4, and T_5 were 0.63%, 0.85%, 0.52%, and 0.68%, respectively. Results from $^{15}N_2O$ emissions and the fraction of N_2O from ^{15}N-urea confirmed that UI increased N_2O release from the added fertilizer source. The fraction of N_2O from ^{15}N-urea reached 26% in the Urea+UI (T_3) treatment, decreasing to 12% in the Urea+BI (T_4) treatment.