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Emissions of nitrous acid (HONO), nitric oxide (NO) and nitrous oxide (N2O) from boreal agricultural soil - Effect of N fertilization

Hem Raj Bhattarai (1), Perttu Virkajärvi (2), Pasi - Yli Pirilä (1), and Marja Maljanen (1)

(1) University of Eastern Finland, Kuopio Finland (hemb@uef.fi), (2) Luke Natural Resources Institute Finland, Maaninka Finland

There is no doubt that nitrogen (N) fertilization has crucial role in increasing food production. However, in parallel it can cause severe impact in environment such as eutrophication, surface/groundwater pollution via nitrate (NO_3-) leaching and emissions of N trace gases. Fertilization increases the emissions of nitrous oxide (N2O) which is 260 stronger greenhouse gas than carbon dioxide (CO_2). It also enhances the emissions of nitric oxide (NO); an oxidized and very reactive form of nitrogen which can fluctuate the ozone (O_3) concentration in atmosphere and cause acidification. The effects of N- fertilization on the emission of N2O and NO from agricultural soil are well known. However, the effects of N fertilization on nitrous acid (HONO) emissions are unknown. Few studies have shown that HONO is emitted from soil but they lack to interlink fertilization and HONO emission. HONO accounts for 17-34 % of hydroxyl (OH-) radical production? in the atmosphere, OH- radicals have vital role in atmospheric chemistry; they can cause photochemical smog, form O_3, oxidize volatile organic compounds and also atmospheric methane (CH4). We formulated hypothesis that N fertilization will increase the HONO emissions as it does for N2O and NO. To study this, we took soil samples from agricultural soil receiving different amount of N-fertilizer (0, 250 and 450 kg ha-1) in eastern Finland. HONO emissions were measured by dynamic chamber technique connected with LOPAP (Quma Elektronik & Analytik GmbH), NO by NO_x analyzer (Thermo scientific) and static chamber technique and gas chromatograph was used for N2O gas sampling and analysis. Several soil parameters were also measured to establish the relationship between the soil properties, fertilization rate and HONO emission. This study is important because eventually it will open up more questions regarding the forms of N loss from soils and impact of fertilization on atmospheric chemistry.