A direct determination of N_2O reduction potential in soil using $^{15}N_2O$ tracer

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N_2O reduction is a key biogeochemical process for mitigating N_2O emission from soil. This process is the final step of denitrification and commonly quantified using the acetylene inhibition technique or $^{15}NO_3^-$ amendment. Recently, significant N_2O production from NH_4^+ via nitrification was reported. In addition, recent microbiological studies showed the presence of clade II *nosZ* bacteria, non-denitrifying N_2O reducers catalyzing reduction of N_2O but not NO_2^- nor NO. Thus, quantifying N_2O reduction directly is becoming more critical. Several research groups developed the $^{15}N_2O$ pool dilution technique (Clough et al., 2006; Yang et al., 2011; Wen et al., 2016), which added ^{15}N-labelled N_2O to the soil, determined the gross N_2O production from the decrease in the $^{15}N/^{14}N$ ratio of N_2O, and calculated the gross N_2O reduction from the difference between the gross and net N_2O productions. Here, we tested the applicability of a more direct method by amending the $^{15}N_2O$ tracer and analyzing the $^{15}N/^{14}N$ ratio of N_2 to determine the $^{15}N_2$ production and thereby N_2O reduction potential. First, we validated ^{15}N mass balance in the incubation experiment using pure cultures of denitrifying bacteria. Second, we applied the method to soil samples collected from the upland agricultural field and adjacent forest by the incubation under controlled moisture condition in vials. In this presentation, we will discuss the validity and applicability of this method to determine gross N_2O reduction potential toward mechanistic understanding of N_2O dynamics in soil.

Keywords: gross N2O reduction, nitrogen isotopes, incubation, soil, pure culture

