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Two years of gaseous emissions from contrasting soils amended with organic and synthetic nitrogen fertilizers.

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Animal manures are often used as a source of nitrogen (N) for agriculture; however impacts of amendment type on N_2O production may vary. In this study, N_2O emissions from two soil types with contrasting texture and carbon (C) content (a silty clay mixed frigid dystric eutrudept and a sandy loam mixed frigid typic dystrudept) were measured for two years under a cool, humid climate. Treatments consisted of a no N control (CTL), calcium ammonium nitrate (CAN), poultry manure (PM), liquid cattle manure (LCM), or liquid swine manure (LSM). The N sources were surface applied and immediately incorporated at 90 kg N ha^{-1} before seeding of spring wheat (Triticum aestivum L.). Leaching losses of N were also measured using zero-tension lysimeters located at approximately 0.35 m depth. Cumulative growing season N_2O-N emissions from the silty clay ranged from 2.2 to 8.3 kg ha^{-1} yr^{-1} and were slightly lower in CTL plots than in the fertilized plots (P = 0.067). The mean N_2O emission factors ranged from 2.0 to 4.4% of added N with no difference among treatments. Emissions of N2O from the sandy loam soil ranged from 0.3 to 2.2 kg N_2O-N ha^{-1} yr^{-1}, with greatest emissions following PM application (P < 0.001). The N_2O emission factor from sandy loam plots amended with PM was 1.7%, more than double that of the other treatments (0.3 to 0.9%), likely because of the high C content of the PM. On the silty clay the yield-based N2O emissions (g N_2O-N kg^{-1} grain yield N) were similar between treatments; while on the sandy loam, they were greatest when amended with PM. Annual N leaching losses averaged 28.7 kg ha^{-1} for the silty clay and 19.6 kg ha^{-1} for the sandy loam and were similar for all amendment types suggesting that off-site N_2O emissions will also be similar amongst treatments. Preliminary data indicate that overwinter N_2O emissions from sandy loam plots were consistently greater when amended with pig slurry compared with unamended soils, and that these overwinter losses may exceed growing season losses. Our findings suggest that compared to mineral N sources, manure application only increases growing season N_2O flux in soils with low C content.