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Anoxia and nitrous oxide production after slurry injection into soil

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Injection of liquid manure into soil reduces ammonia (NH_3) volatilization and odor emission compared to band spreading but increases nitrous oxide (N_2O) emission. To understand the conditions governing the emission of N_2O, micro scale distribution of O_2 and N_2O in soil was measured in the soil. Raw liquid pig manure was injected into closed slots 5 cm below ground at 0.9 L m^{-1}. Vertical microsensor profiles of N_2O and O_2 revealed a circular zone of anoxia around the slit with a cross section diameter up to 6 cm and a peak of N_2O up to 125 μM in the middle of the anoxic zone. Emission rates of N_2O were calculated from concentration gradients of N_2O in the manure slit, and they matched the rate directly measured at the surface. Results showed that N_2O emission rate peaked 2 days after injection (between 600-700 μmol m^{-2} day^{-1}). After 4 days the emission of N_2O was undetectable from profile calculations and $<$30 μmol m^{-2} day^{-1} from measured emissions, although anoxic conditions in the slit persisted, suggesting that N_2O reductase was fully induced a few days after injection.