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Biogenic nitric oxide emission from saline sodic soil

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Saline soils cover about 380–995Mha of the Earth's land surface and of these, 62% are saline-sodic or sodic. There are about 3.73Mha of saline sodic land in the semi-arid region of Northeastern China, one of the three major contiguous regions of saline sodic soil worldwide. The changes of land use in saline-sodic soil are accompanied by changes in biogeochemical cycles of nutrients, particularly of the air-surface exchange of trace gases like nitric oxide. Our study, based on results obtained by a laboratory incubation technique, focusses on (a) NO production and consumption in saline sodic soils from four types of land use as function of soil temperature and soil moisture, and (b) seasonal variation of biogenic NO emission from saline sodic soil in arid region.

At 25°C, average NO production (in terms of mass of N) was 0.043±0.001, 0.055±0.003, 0.093±0.009, and 0.101±0.010 ng $kg^{-1}s^{-1}$ in saline sodic soil, natural pasture soil (NP), man-made pasture soil (MP), paddy field soils (pure sodic soil,(PP) and sodic soil mixed with sandy soil (SP)), respectively. NO consumption rate constant ranged from 1.07×10^6 to 7.44×10^6 $^{m3kg-1s-1.}$At 25°C and under optimum soil moisture conditions for NO production, the NO compensation point mixing ratio was about 60, 60, 115, and 74 ug m^{-3} (105, 106, 201, 129 ppb) for NP, MP, PP, and SP, respectively. Statistically sound relationships have been observed between NO fluxes and soil moisture (optimum curves). NO fluxes also increased exponentially with soil temperature at any given soil moisture. The optimum soil moisture for which maximum NO flux was observed was independent of soil temperature. The maximum of NO fluxes for NP, MP, PP, and SP soils (at 25°C) were 16, 20, 31, and 24 ng $m^{-2}s^{-1}$ at water-filled pore space (čěWFPS) of 14.0, 9.0, 9.5, and 18, respectively. The NO flux was about 1.2-2 times larger for paddy field soils than fore pasture soils, most likely

due to fertilizer application to the paddy field soils. For an entire growth period, we estimated the NO flux from these saline sodic soils, based on (a) our laboratory NO flux parameterizations, (b) on field data (soil temperature and soil moisture monitoring data), (c) sodic soil properties, and (d) information of the individual agricultural management practices. NO emission mainly occurred in October for SP and PP, early July for NP and June for MP, and another small peak was observed in October for NP and MP. The peaks of NO fluxes from saline sodic NP, MP, PP, and SP soils were 12.6, 15.2, 14.9 and 8.3 ng $m^{-2}s^{-1}$.