Soil salinity: a significant factor affecting soil nitrous oxide emissions

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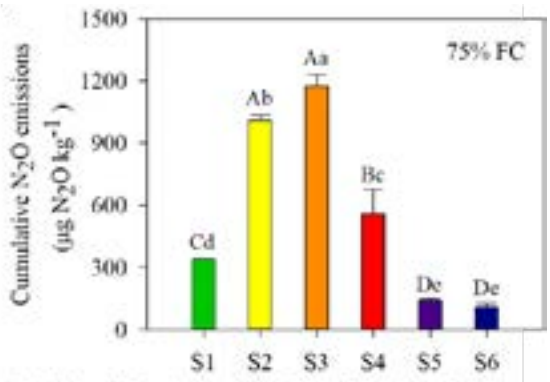
Nitrous oxide (N_2O) as a by-product of various soil nitrogen (N) transformation pathways, its production may be affected by soil salinity which has been proved to have significant negative effect on microbial-driven soil N cycling processes. However, it is little known that the response of N_2O production to different soil salinities from non-saline to heavily saline. We conducted a laboratory incubation experiment using the soils with six different salinity levels from 0.25 to 6.17 dS m^{-1}. With powdered organic fertilizer, rich of ammonium (NH_4^+-N), as N source, the soils were incubated at three soil moisture levels (50%, 75% and 100% of field capacity) for six weeks. N2O fluxes and inorganic N (NH_4^+, NO_2^- and NO_3^-) concentrations were measured throughout the incubation period. Results showed that N_2O fluxes increased first then decreased with the increase of soil salinity at all three soil moisture levels, and N_2O emissions were significantly promoted in soils with EC of 1.01 and 2.02 dS m-1. The rates of NH_4^+ consumption and NO_3^- production decreased with increasing soil salinity, while the accumulation of NO_2^- increased first then decreased. It suggests that soil salinity inhibits both the two steps of nitrification, but the inhibition of salinity on nitrite oxidation was stronger than that on ammonia oxidation. Enhanced N_2O emissions by soil salinity may be mainly derived from nitrifier denitrification promoted by cumulative NO_2^-.



Cumulative N_2O emissions during the incubation period. Different lowercase and uppercase letters indicate significant difference at $p<0.05$ and $p<0.01$ among salinity treatments, respectively.

Recent Publications

1. Y.W., Li., Q., Wei., J.Z., Xu., Y.H., Wang., H.Y., Wang., F., Hameed. (2018). Soil water-air replacement during water infiltration process and its non-neglectable contribution to water-induced CO2 pulse emission. Pakistan journal of agricultural sciences. 56(1):275-281
2. Y.W., Li., J.Z., Xu., Q., Wei., W.H., Bai., K.L., Li., X.Y., Liu. (2018). Soil nitrification process under different soil moisture and salinity conditions. Journal of drainage and irrigation machinery engineering. 36(9):909-913 (in Chinese)

3. Q., Wei., J.Z., Xu., Y.W., Li., L.X., Liao., B.Y., Liu., G.Q., Jin., F., hameed. (2018). Reducing Surface Wetting Proportion of Soils Irrigated by Subsurface Drip Irrigation Can Mitigate Soil N2O Emission. Int. J. Environ. Res. Public Health. 15(12):2747.
4. Q., Wei., J.Z., Xu., L.X., Liao., Y.W., Li., H.Y., Wang., G.Q., S.F., Rahim. (2018). Water Salinity Should Be Reduced for Irrigation to Minimize Its Risk of Increased Soil N2O Emissions, Int. J. Environ. Res. Public Health. 15(10):2114.
5. Q., Wei., J.Z., Xu., S.H., Yang., L.X., Liao., G.Q., Jin., Y.W., Li., F., hameed. (2018). Subsurface watering resulted in reduced soil N2O and CO2 emissions and their global warming potentials than surface watering. Atmospheric Environment 173:248-255.

Biography

Yawei Li, Male, has been studying as a PhD student of Agricultural Water and Soil Engineering since 2016 at Hohai university. His research focuses on saline soil nitrogen cycle and greenhouse gases emissions and 5 papers have been published during the last 3 years.

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