How climate change influences paddy soil nitrogen pool in northeastern China

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Plant nitrogen (N) acquisition is essential to crop growth and yield. However, how plant N uptake and N origin (soil-derived N or fertilizer-derived N) respond to elevated atmospheric CO_2 and warming remains largely unknown.

Recently, researchers from the Northeast Institute of Geography and Agroecology (IGA) of the Chinese Academy of Sciences investigated the soil- or fertilizer-derived N uptake and yield of different cultivars of rice in response to climate change in northeast China.

Related findings were published in *Agricultural and Forest Meteorology*.

The researchers found that elevated CO_2 and warming significantly increased plant N uptake, and soil-N rather than fertilizer-N was the source of the increased N uptake.

The increased soil-N uptake resulted in the enhancement of rice yield under climate change. Urea application did not alter the yield response to elevated CO_2 and warming compared to the non-N supply, but did stimulate plant uptake of the soil-derived N.

The researchers also examined the impacts of climate change on N mineralization and relevant microbial mechanisms in the rhizosphere of rice plants. The study was published in *Biology and Fertility of Soils*.

They found that co-elevation of CO_2 and temperature increased microbial biomass C and N, as well as N mineralization. The absolute abundances of the N-mineralization genes chi, pea, pan, and urea hydrolysis gene ureC in the rhizosphere also increased under elevated CO_2 and warming, corresponding to the additional N mineralization and photosynthetic C allocation into the soil.

These studies suggested that climate change may lead to the depletion of the recalcitrant soil N pool in paddy soils, and that fertilizer-N-use efficiency may need to be factored into future breeding for rice genotypes adapting well to climate change. Co-elevation of CO_2 and temperature stimulated microbially mediated soil N mineralization in the rhizosphere of rice, posing a risk on the acceleration of soil organic matter decomposition.

More information: Jinyuan Zhang et al, Co–elevation of CO2 and

temperature enhances nitrogen mineralization in the rhizosphere of rice, *Biology and Fertility of Soils* (2022). DOI: 10.1007/s00374-022-01667-4

Jinyuan Zhang et al, Elevated atmospheric CO2 and warming enhance the acquisition of soil-derived nitrogen rather than urea fertilizer by rice cultivars, *Agricultural and Forest Meteorology* (2022). DOI: 10.1016/j.agrformet.2022.109117

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