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REGULAR ARTICLE

Soil biochemical parameters in the rhizosphere contribute more to changes in soil respiration and its components than those in the bulk soil under nitrogen application in croplands

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Abstract

Aims Soil respiration (RS), which is the second largest carbon flux between the atmosphere and terrestrial ecosystems, has significant impact on atmospheric CO_2 concentration and climatic dynamics. Nitrogen (N) fertilizer has been heavily applied in agroecosystems at the global scale for high crop yields, and plays a major role in regulating RS. Although the respective response of soil biochemical property and RS to N addition has been widely studied, the contributions of soil biochemical parameters especially in the rhizosphere to changes in RS and its components (soil heterotrophic (RH) and autotrophic (RA) respiration) under N application remain poorly understood. The present study aimed to examine whether the rhizosphere effect alters the relationship between soil biochemical properties and RS under N addition in croplands.

Methods We conducted N application experiment in a wheat-maize rotation system in the North China Plain. N fertilizer was applied at four different levels during both wheat and maize growing seasons: 0, 120, 180 and 240 kg N ha^{-1}. Soil biochemical parameters (e.g. soil enzyme activities, available N, and glomalin contents), RS and its components were measured under all N treatments.

Results First, N addition only significantly enhanced RA in 2014 (the fifth year of N application) but increased both RA and RH in 2015 (the sixth year of N application) because RH had lower N sensitivity than RA or lower soil moisture in 2014 which weakened the

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