Mechanisms of Soil Respiration Under Warming and Nitrogen Enrichment

Abstract

This study investigates the individual and interactive effects of soil warming and nitrogen (N) fertilization on soil respiration and it's drivers within a bioenergy cropping system. The experiment employed a split-plot design with warming and N fertilization as fixed factors and two levels for each factor (W: ambient and heated; N: no and high fertilizer). Hourly soil respiration rate (Rs), biweekly soil organic carbon (SOC), total nitrogen (TN), microbial biomass carbon (MBC), microbial biomass nitrogen (MBN), and extracellular enzymes activities (EEAs) were quantified consecutively for 1 year in soil samples (0-10 cm). Results showed that warming significantly increased soil respiration rate by 16.7%, while N addition alone did not significantly change R_s. However, nitrogen fertilization significantly reduced warming effect on R_s. Soil respiration is most strongly influenced by soil temperature, while MBC and enzyme activities appear to have little direct impact ($R^2 < 0.06$) despite having a significant relationship. Nonparametric analyses validated the strong influence of soil temperature on the stimulated soil respiration of combined treatment. This one-year results suggested that the interaction between warming and N fertilization escalated the respiration rate resulting in the reduction of carbon pool.

Key words: Warming, Nitrogen, Soil respiration, Mechanism