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不同轮作和管理措施下根系呼吸对土壤呼吸的贡献

The contribution of root respiration to soil respiration under different crop rotations and managements

关键词: [根系排除法](#) [根区](#) [非根区](#) [土壤呼吸](#) [根系呼吸贡献](#)

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摘要: 根系呼吸对土壤呼吸的贡献是研究土壤碳排放和土壤碳平衡的重点和难点.本研究采用根系排除法联合运用Li-8100土壤碳通量系统测定了华北平原冬小麦-夏玉米一年两熟传统管理体系(Con.W/M)、冬小麦-夏玉米一年两熟优化管理体系(Opt.W/M)、冬小麦-夏玉米(或夏大豆)-春玉米两年三熟优化管理体系(W/M-M、W/S-M)和春玉米一年一熟优化管理体系(M)作物根区土壤呼吸和非根区土壤呼吸,以根区和非根区土壤呼吸差异除以根区土壤呼吸计算根系呼吸的贡献.结果表明,根区土壤呼吸和非根区土壤呼吸具有明显的季节变化特征,二者具有显著的拟合关系.Con.W/M和Opt.W/M处理小麦季非根区土壤呼吸可分别解释根区土壤呼吸变异的65%和87%,玉米季非根区土壤呼吸的分别解释根区土壤呼吸变异的48%和65%.W/M-M、W/S-M和M处理春玉米非根区土壤呼吸可分别解释根区土壤呼吸变异的68%、76%和58%.Con.W/M处理小麦和玉米季根系呼吸对土壤呼吸贡献分别为25.0%和29.6%,Opt.W/M处理则分别为31.1%和35.0%.不同轮作和管理措施对春玉米根系呼吸的贡献无显著影响,W/M-M、W/S-M和M处理春玉米季根系呼吸贡献分别为23.7%、24.8%和24.9%.5 cm土壤温度对根区土壤呼吸的影响程度大于非根区土壤呼吸.

Abstract. It is important and difficult for quantifying the contribution of root respiration to soil respiration when study soil carbon balance. The root-and no root-zone respiration from the conventional and optimized winter wheat-summer maize double-cropping system (Con.W/M, Opt.W/M), optimized winter wheat-summer maize or summer soybean-spring maize three harvests over two years (W/M-M, W/S-M) and single spring maize system per year (M) were measured by combining soil CO₂ fluxes system (LI-8100) with the method of root exclusion on the North China Plain, and the difference between root-and no root-zone respiration was calculated as the contribution of root respiration to soil respiration. The results showed that root-and no root-zone respiration had an obviously seasonal variation and had significant correlation each other. No root-zone respiration explained for 65% and 87% of root-zone respiration in winter wheat season in treatments Con.W/M and Opt.W/M, respectively, and they were 48% and 65% in summer maize season. No root-zone respiration explained 68%, 76% and 58% of root-zone respiration in spring maize season in treatments W/M-M, W/S-M and M, respectively. The contributions of root respiration to soil respiration were 25.0% and 29.6% for winter wheat and summer maize in Con.W/M, respectively, and they were 31.1% and 35.0% in Opt.W/M. The ratio of root respiration to soil respiration in spring maize season was not significantly affected by cropping rotations and managements, and they were 23.7%, 24.8% and 24.9% for W/M-M, W/S-M and M, respectively. The root-and no root-zone soil respiration showed positive correlation with 5 cm depth soil temperature, and the root respiration significantly increased this kind of relationship.

Key words: [root exclusion method](#) [root-zone](#) [no root-zone](#) [soil respiration](#) [contribution of root respiration](#)

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