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水位调控对崇明东滩围垦区滩涂湿地土壤呼吸的影响

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Effects of water table manipulation on the soil respiration in a reclaimed tidal wetland at Dongtan of Chongming Island, China.

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摘要

以长江口崇明东滩围垦区滩涂湿地3个地下水位梯度(低水位、中水位和高水位)为对象,于2011年1月至2012年1月测定了湿地的土壤呼吸速率及其主要影响因子.结果表明: 围垦区滩涂湿地低水位、中水位和高水位的土壤呼吸速率年变化幅度分别为0.75～11.57、0.70～12.61和 0.83～6.67 μmol·m^{-2}·s^{-1},土壤呼吸速率的最大值出现在7月,最小值出现在1月;在3个梯度下,0～5 cm层土壤温度为驱动围垦区滩涂湿地土壤呼吸季节动态的关键微气象因子,拟合指数模型可以解释其70 %以上的季节变异,而各梯度间土壤呼吸温度敏感性(Q_{10} 值)无显著差异;高水位的土壤呼吸速率最低,可能与土壤温度较低和土壤体积含水量较高有关,中水位的土壤呼吸速率高于低水位,可能是土壤电导率和容重较低,地上生物量和细根密度较高的结果.合理调控围垦区滩涂湿地水位可以降低土壤呼吸速率,增强该类退化湿地的碳汇功能.

关键词: 长江口 崇明东滩 围垦区滩涂湿地 水位调控 土壤呼吸

Abstract:

From January 2011 to January 2012, a monitoring was made on the soil respiration rate and its major affecting environmental factors along a gradient of water table (low, medium and high) in a reclaimed tidal wetland at the Dongtan of Chongming Island in the Yangtze Estuary of China. The annual soil respiration rate in the wetland with low, medium and high water table was 0.75-11.57, 0.70-12.61, and 0.83-6.67 μmol·m^{-2}·s^{-1}, respectively. The soil respiration rate was the maximum in July and the minimum in January. The soil temperature in 0-5 cm layer was the key microclimate factor driving the soil respiration across the three gradients, which could explain more than 70% of the seasonal variation of soil respiration in the reclaimed tidal wetland by fitting an exponential model. No significant difference was observed in the temperature sensitivity of soil respiration (Q_{10} value) among the three gradients. The lowest soil respiration rate in the wetland with high water table was probably due to the lower soil temperature and the higher soil volumetric water content, whereas the higher soil respiration rate in the wetland with medium water table than with low water table could be caused by the lower soil electricity conductivity and bulk density and the higher aboveground biomass and live fine root density. To appropriately manipulate the water table in the reclaimed tidal wetland could decrease soil respiration rate and enhance the carbon sink function of this degraded wetland.

Key words: Yangtze Estuary Dongtan of Chongming Island reclaimed tidal wetland water table manipulation soil respiration.

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