农田土壤呼吸特征及根呼吸贡献的模拟分析

Characterization of farmland soil respiration and modeling analysis of contribution of root respiration

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中文摘要：

采用静态箱法研究了黄淮海平原典型农田土壤CO2排放通量的日变化、季节变化特征，分析了土壤温度、水分对土壤呼吸的影响；并利用反硝化－分解（DNDC）模型定量化研究了根呼吸对土壤总呼吸的贡献。结果表明，在作物生长季节内棉花地、休闲地和冬小麦/夏玉米地土壤CO2排放均表现出明显的季节变化规律。土壤CO2排放季节变化的总体趋势是夏季高、其他季节低，与对应气温的动态变化基本一致。冬小麦/夏玉米地土壤CO2排放通量高峰值为2324 mg?m-2?h-1，棉花地为1111.9 mg?m-2?h-1，休闲地为436.07 mg?m-2?h-1。土壤CO2季节性排放受温度的影响最大，其中与5 cm地温的相关性最好，与土壤湿度的相关性不太明显。同一种种植模式施氮量高的处理CO2平均排放通量大于低的处理。同时根据DNDC模型型估算，玉米根际呼吸对土壤呼吸的贡献最大，为91%～95%，棉花和冬小麦根际呼吸比例分别约为70%和80%。施氮不仅影响土壤微生物的呼吸而且还影响到根系呼吸。

英文摘要：

Daily and seasonal variation of soil CO2 emission fluxes were measured using close chamber method in typical crop fields in Huang-huai-hai Plain, the impacts of soil temperature and moisture on soil CO2 emission flux were analyzed respectively, and the contribution of root respiration by using the DNDC (DeNitrification - DeComposition) model was also discussed. The results indicate that seasonal variations of CO2 emissions from cotton, fallow and winter wheat－summer corn rotation field are all remarkable. The emission of CO2 is relatively higher in summer and lower in other seasons, and it is consistent with the variation of air temperature. The maximum values of CO2 emission fluxes are 2324 mg?m-2?h-1 in winter wheat－summer corn rotation fields, 1111.9 mg?m-2?h-1 in cotton fields and 436.07 mg?m-2?h-1 in fallow fields. Analyses show that the CO2 emission is exponentially correlated with the soil temperature at 5 cm, but there is no significant correlation between soil respiration and soil moisture. The fields under the same crop with higher soil organic matter content can emit more CO2. According to the DNDC simulated results, the contribution of maize root respiration to soil respiration at the whole growth stage varied from 91% to 93%, while the contributions of cotton and wheat root respiration were 70% and 80%, respectively. Soil N-application did not only influence the soil microbial respiration but also the root respiration.

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