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稻麦轮作农田氮素循环的DNDC模型分析

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Evaluating the validity and sensitivity of the DNDC model to estimate nitrogen cycling in rice-wheat rotation system

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摘要 基于长江中下游稻麦轮作体系的氮肥施用田间试验，采用Denitrification- Decomposition model (DNDC) 模型研究了气候条件、土壤属性、农业管理等输入因素的不确定性对子粒产量、作物氮吸收、氨挥发、N2O排放等预测结果的影响。结果显示：采用DNDC模型模拟的土壤氨挥发速率和N2O排放通量与田间实测结果较为吻合，氨挥发通量模拟值与实测值相关系数为0.688，N2O排放通量模拟值与实测值相关系数为0.528，均达极显著水平，表明DNDC模型预测农田土壤氮素具有较高可信度。模拟结果显示，气温和氮肥用量是影响作物产量和吸氮量的关键因素；土壤氨挥发主要受氮肥品种影响，并随氮肥用量增加而增加；土壤N2O排放主要受温度、土壤pH值、土壤有机碳含量的影响。为使DNDC能更有效地估算氨挥发和N2O排放，有必要获取更翔实的资料以减少输入数据的不确定性。

关键词： 稻麦轮作 氮循环 DNDC模型 敏感性分析

Abstract： Based on in situ measurements of ammonia volatilization and nitrous oxide (N2O) emission from a wheat-rice rotation field, as a representative of cropping system in Yangtze Plain, the reliability and sensitivity of Denitrification-Decomposition model (DNDC) for forecasting nitrogen cycling and balance were tested in field scale, and influencing factors of various N cycling pathways were identified. A higher reliability was found between soil ammonia volatilization and N2O emission simulated by DNDC model and field results, suggesting that the DNDC model could be used for describing nitrogen loss under different nitrogen fertilizer managements. According to sensitivity test on the DNDC model, both grain yield and crop N uptake were significantly affected by temperature and nitrogen application rate, ammonia volatilization was significantly influenced by fertilizer N type and nitrogen application rate, N2O emission significantly affected by temperature, soil pH and soil organic carbon. More work is needed to improve the validition of DNDC model to estimate ammonia volatilization and N2O emission.

Keywords： rice-wheat rotation system nitrogen cycling DNDC model sensitivity analysis

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