

夏玉米根系密集区与行间N₂O浓度及与氨氧化细菌和反硝化细菌数量的关系

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The N₂O concentration and the relationships with ammonia-oxidizing bacteria and denitrifiers abundance in root zone and row of summer maize

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摘要

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摘要 采用硅胶管法和微生物分子生态学方法对华北平原典型旱地土壤夏玉米根系密集区与行间土壤产生的N₂O及与氨氧化细菌和反硝化细菌数量的关系进行了研究。结果表明:夏玉米三叶期和十叶期的施肥灌水措施以及超过15 mm左右的降雨均显著促进了土壤N₂O的产生。夏玉米行间产生的N₂O略高于根系密集区,但二者未达显著差异。相关分析表明影响土壤N₂O产生的主要环境因子为土壤空隙含水量(WFPS)及土壤NO₃⁻-N含量,二者决定系数分别为0.79和0.51。N₂O浓度与氨氧化细菌amoA基因拷贝数及反硝化细菌nirS基因拷贝数之间的显著正相关关系(决定系数分别达0.55和0.62)表明土壤中N₂O的产生与氨氧化细菌和nirS基因反硝化细菌数量的增加亦有关。表明在该试验条件下,夏玉米根系生长对根系密集区土壤中氮和水的消耗以及氨氧化细菌和反硝化细菌数量的变化并未引起根系密集区和玉米行间N₂O浓度的显著差异,即在田间布设N₂O观测箱时,采样箱是否覆盖作物根系或采样箱覆盖作物根系的多少对N₂O排放量的测定结果没有显著性影响。

关键词: 夏玉米 根系密集区 N₂O amoA基因拷贝数 nirK/nirS基因拷贝数

Abstract: The N₂O concentration in the root dense zone and the row of summer maize and the relationships with bacteria abundance (ammonia-oxidizing bacteria (AOB) and denitrifiers) were measured using silicon tube method and microbial molecular technology in a typical dry land agricultural soil in the North China Plain. The results showed that the great amount of N₂O was produced after fertilization and irrigation measures and above 15 mm precipitation. N₂O concentration in the row is higher than in root dense zone of summer maize slightly, but not reached significant difference. The correlation analysis showed that the significant positive relationship were observed between N₂O concentration and water-filled porespace (WFPS) and the content of NO₃⁻-N, the determination coefficient reached 0.79 and 0.51, respectively; and the significant positive relationship were observed between N₂O concentration and the copy numbers of amoA and nirS also, the determination coefficient reached 0.55 and 0.62, respectively, it indicated that environment factors (WFPS and the content of NO₃⁻-N) and the changes of AOB and denitrifiers abundance influenced N₂O production significantly. In conclusion, in our experiment conditions, the consume of N and water due to maize root growth and the changes of AOB and denitrifiers in the root dense zone not caused N₂O production significant difference between the root dense zone and row of summer maize. Thus, when we install the closed chamber in the field, whether included plant root or not have no significant influence to the results of N₂O emission.

Keywords: summer maize root dense zone N₂O the copy numbers of amoA

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