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华北平原冬小麦－夏玉米轮作体系秋季一次基施牛粪氮素损失与利用研究

岳现录[1,2], 冀宏杰[2], 张认连[2], 林而达[1], 廖上强[2], 张维理[2*]

1中国农业科学院农业环境与可持续发展研究所，北京 100081; 2中国农业科学院农业资源与农业区划研究所，农业部作物营养与施肥重点开放试验室，北京 100081

Nitrogen loss and use efficiency of one-time basal application of cattle manure in autumn to a winter wheat－summer maize cropping system on the North China Plain

YUE Xian-lu[1,2],JI Hong-jie[2],ZHANG Ren-lian[2],LIN Er-da[1],LIAO Shang-qiang[2],ZHANG Wei-li[2*]*

1 Institute of Environment and Sustainable Development in Agriculture, CAAS, Beijing 100081, China; 2 Institute of Agricultural Resources and Regional Planning CAAS/
Ministry of Agriculture Key Laboratory of Crop Nutrition and Fertilization, Beijing 100081, China

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摘要 为对我国华北平原冬小麦-夏玉米轮作体系秋季一次基施有机肥的氮素环境效应提供评估依据，本文分别在山东陵县和天津蓟县以不施肥、分次施用硫酸铵为对照，对秋季一次基施牛粪的产量水平、氮素损失及利用等进行了研究。其中，山东陵县试验采用15N示踪技术。结果表明，秋季一次基施牛粪15N在冬小麦－夏玉米轮作周期的损失率为30%～38%，与硫酸铵15N损失率无显著差异。牛粪氮施用N 300 kg/hm^{2}时，损失量为N 89 kg/hm^2；牛粪氮施用量增加50%，其氮损失量增加91%。冬小麦、夏玉米收获后，施牛粪处理0—80cm土壤硝态氮含量分别为N 38～95、18～28 kg/hm^2，低于分次施用硫酸铵处理。长期施用有机肥农田，秋季一次基施牛粪处理冬小麦、夏玉米子粒产量与分次施硫酸铵处理无显著差异，因此从环境角度分析，秋季一次基施有机肥可继续应用和大力推广，但施用量以不超过N 300 kg /hm^{2}为宜。

关键词： 华北平原 冬小麦－夏玉米轮作 牛粪 基施 氮肥损失

Abstract: Cattle manure was applied to a winter wheat－summer maize cropping system on the North China Plain in autumn as a single basal application (MOAA). In order to provide parameters for evaluation of environmental effects of MOAA, experiments employing no fertilizer application and split application of ammonium sulfate (SAAS) and MOAA as N 300 kg/ha were carried out in Ji County, Tianjin City; as N 300 and 450 kg/ha and was also adopted 15N tracer technology in Ling County, Shandong province, to study nitrogen (N) utilization and 15N loss. In the winter wheat－summer maize cropping system, 30－38% of the total manure 15N was lost, which did not differ significantly from SAAS 15N loss. Manure N loss was N 89 kg/ha following N 300 kg/ha manure N application, and N loss sharply increased by 90% when manure N application increased by 50%. After winter wheat harvest, the amount of soil NO3-N at 0－80 cm depths in MOAA was N 38－95 kg/ha, and decreased to N 18－28 kg/ha after summer maize harvest; in both instances, the values were lower than those of SAAS. In farmland with long-term application of manure, there were no significant differences in winter wheat and summer maize grain yields between MOAA and SAAS. From an environmental point of view, it is concluded that MOAA is an appropriate application but the amount of N should not exceed N 300 kg/ha.

Keywords: North China Plain winter wheat - summer maize rotation cattle slurry, basal application nitrogen loss

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Corresponding Authors: 岳现录 Email: xlyue@caas.ac.cn

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