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硫酸铵施用量和温度对红壤稻田土硝化作用及微生物特性的影响

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Effects of Application Rate of Ammonium Sulfate and Temperature on Nitrification in and Microbial Properties of Paddy Red Soil

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摘要 以红壤稻田土为供试土壤，设置不同硫酸铵（简称硫铵）施用量，分别在15、25、35℃条件下培养，研究短期内土壤硝化作用、微生物生物量和微生物功能多样性的变化。结果表明，在相同硫铵施用量下，不同温度处理土壤NH_4^+含量差异不显著；温度变化对于对照和常规硫铵用量（折纯N 120 mg · kg^{-1}）处理土壤NO_3^-含量有显著影响，但对中、高量（折纯N 600和1200 mg · kg^{-1}）处理无显著影响。对照和常规硫铵用量处理土壤硝化速率均随温度升高而显著增加；中、高量硫铵处理土壤硝化速率普遍较低，且不同温度之间差异不显著；相同温度条件下，硝化速率随硫铵施用量的升高而降低。中、高量硫铵处理对土壤微生物生物量碳有显著影响，且土壤微生物生物量碳随硫铵施用量的增加而显著降低；相同硫铵施用量下，不同温度处理土壤微生物生物量碳由高到低大致为25、15和35℃。BIOLOG分析显示，中、高量硫铵处理平均吸光值和多样性指数均较低，各处理中以25℃时对照处理的平均吸光值和Shannon、Simpson、McIntosh指数最大，其次为25℃时常规硫铵用量处理。过量施用硫铵有可能造成土壤生物结构和功能衰变。

关键词： 温度 硝化作用 BIOLOG 微生物生物量 硫酸铵

Abstract： Soil samples were collected from a paddy field of red soil, treated with different rates of ammonium sulfate and incubated indoors at 15, 25 and 35℃, separately, for exploration of short-term effects of the treatments on nitrification, microbial biomass and microbial community diversity in the paddy red soil. Results show that NH_4^+ content was not a significant factor of temperature in treatments the with same in ammonium sulfate application rate, while NO_3^- content was a significant factor of temperature in CK (control) and the Treatment Conventional with ammonium sulfate application rate (pure N 120 mg · kg^{-1}), but not either in the Treatments Moderate (N 600 mg · kg^{-1}) and high (1200 mg · kg^{-1}) in ammonium sulfate application rate. Nitrification rate increased significantly with rising temperature in CK and Treatment Conventional, while it was generally low in Treatments Moderate and High, and did not vary much with temperature. In the treatments incubated under the same temperature, nitrification rate declined with increasing ammonium sulfate application rate. In Treatments Moderate and High, soil microbial biomass carbon was a significant factor of ammonium sulfate application rate, and decreased with increasing of application rate (P<0.05), and in the treatments the with same in ammonium sulfate application rate, it varied with temperature, showing a decreasing order of 25℃ > 15℃ > 35℃. BIOLOG analysis showed that the AWCD, Shannon, Simpson and McIntosh indices were low in Treatments Moderate and High. Under 25℃, CK, among all the treatments, was the highest in AWCD, Shannon, Simpson and McIntosh indices, and Treatment Conventional followed. Overuse of ammonium sulfate may possibly undermine soil biological structure and function.

Keywords： temperature nitrification BIOLOG microbial biomass ammonium sulfate

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