

长期不同施肥条件下土壤微生物量及土壤酶活性的季节变化特征

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Seasonal variation of soil microbial biomass and soil enzyme activities in different long-term fertilizer regimes

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摘要

研究长期不同施肥条件下褐潮土微生物量碳 (SMBC)、微生物量氮 (SMBN) 和土壤酶活性随季节的变化特征。结果表明, 长期施肥条件下土壤 SMBC、SMBN 含量及土壤酶活性均表现出一定的季节变化。SMBC、SMBN 含量在各施肥处理中的顺序为: 化肥与猪厩肥配施处理 (NPKM) > 化肥配施玉米秸秆处理 (NPKS) > 单施化肥处理 (NPK) > 不施肥处理 (CK), 各处理之间差异显著 ($P < 0.05$); 施肥还显著提高了土壤脲酶、转化酶、碱性磷酸酶活性, 有机无机配施的高于单施化肥的。除过氧化氢酶活性随季节变化显著下降外, SMBC、SMBN、酶活性的值一般在夏季 (6 月到 8 月) 较高。通过双因素单变量方差分析表明, 不同施肥制度与季节变化对 SMBC、SMBN 与酶活性的影响分别达极显著水平 ($P < 0.01$), 不同施肥制度的 SMBC、SMBN 与酶活性的季节波动有极显著不同 ($P < 0.01$)。

关键词: 长期施肥 土壤微生物量 土壤酶 季节变化 长期施肥 土壤微生物量 土壤酶 季节变化

Abstract:

The long-term impact of fertilizer regimes on soil microbial biomass carbon (SMBC), soil microbial biomass nitrogen (SMBN) and soil enzyme activities were studied over the growing season in a fluvo-aquic soil in Changping County, Beijing, China. Four different fertilization treatments were established in 1991. They were in a wheat-maize rotation receiving either no fertilizer (CK), mineral fertilizers (NPK), mineral fertilizers plus swine manure (NPKM) or mineral fertilizers with maize straw incorporated (NPKS). Results indicated that long-term fertilizer regimes had considerable effects on SMBC, SMBN and enzyme activities compared to CK. The order of SMBC and SMBN in all fertilization treatments was NPKM > NPKS > NPK > CK, and they were significantly different among these treatments ($P < 0.05$). Studies on soil enzyme activities showed that soil urease, invertase, alkaline phosphatase activities were significantly enhanced in the treatments applied with fertilizers, and were much higher in the treatments applied of mineral fertilizers with organic manure or maize straw (NPKM, NPKS) than in NPK treatment. Catalase activity was markedly decreased in these treatments throughout the season from April to September. Further analysis indicated that treatment and sampling date had obvious influence on the SMBC, SMBN and soil enzyme activities separately and there were significant interactions between treatment and sampling date.

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