

研究论文

侵蚀环境生态恢复过程中人工刺槐林 (*Robinia pseudoacacia*) 土壤微生物量演变特征

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摘要

采用时空互代法, 以典型侵蚀环境纸坊沟流域生态恢复过程中不同年限的人工刺槐林为研究对象, 选取坡耕地和天然侧柏林为参照, 分析了植被恢复过程中土壤微生物量、呼吸强度、代谢商及理化性质的演变特征。结果表明, 生态恢复过程中刺槐林土壤理化性质得到明显改善, 微生物量随恢复年限的增加变化显著, 10~15a后达到显著水平; 并随年限逐渐增加, 在近熟林和成熟林期基本达到稳定, 成熟林后期又开始上升, 恢复50a的刺槐林微生物量碳、氮、磷较坡耕地增加幅度分别为213%、201%和83%, 但仅为天然侧柏林的50.98%、55.17%和61.48%。呼吸强度随恢复年限增加先升高后降低, 与有机碳变化规律不同步; qCO_2 在恢复初期较坡耕地显著升高, 随后迅速降低, 25a后开始回落到坡耕地以下, 50a后达到最低值, 与天然侧柏林没有显著差异。相关性分析显示微生物量碳、氮、磷、 qCO_2 与土壤养分和恢复年限相关性最为密切, 达到显著($P<0.05$)或极显著水平($P<0.01$)。人工刺槐林促进生态恢复可以依靠生物的自肥作用恢复土壤肥力和增加微生物量, 但要恢复到破坏前该地区顶级群落时的土壤微生物量和理化性状, 还需要一个漫长的阶段, 这个阶段可能需要上百年的时间。

关键词 [侵蚀环境](#); [人工刺槐林](#); [生态恢复](#); [微生物量](#); [土壤质量](#)

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Evolution of soil microbial biomass in the restoration process of artificial *Robinia pseudoacacia* under erosion environment

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Abstract Vegetation recovery is a key measure to improve ecosystems in the Loess Plateau of China. In order to understand the soil micro-organism and evolution in artificial woodland in loess hilly area of the Loess Plateau, the soil microbial biomass, microbial respiration and physico-chemical properties in *Robinia pseudoacacia* soils were studied. In this study, eight woodland soils with different ages were used to study the evolution, and a farmland, a native forest communities (*Platycladus orientalis* L.) were chosen as the references. The results showed that soil quality were steadily improved on soil microbial biomass, metabolic quotient and physical and chemical properties after plantation. Soil microbial biomass C,N,P increased significantly after 10-15 years of de-farming and vegetation recovery, and a relatively stable state was kept in near matured o

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r matured forest, then a rise appeared again at the end of mature stage. After 50 years of de-farming and vegetation recovery, soil microbial biomass C,N,P (SMBC SMBN SMBP), respectively, are increased by 213%,201% and 83% compared with the farmland, however, they are only 50.98%,55.17%and 61.48% of that in *Platycladus orientalis*'s soil, respectively. Soil microbial respiration was enhanced in the early stage and then weakened in the late stage after plant restoration. This is different from the change of soil organic carbon. Metabolic quotient (qCO_2) was significantly higher in *Platycladus orientalis*'s soil than that in farmland at the early restoration stage, and then decreased rapidly. After 25 years of de-farming and vegetation recovery, qCO_2 is lower than that in the farmland's, and reach the minium after 50 years which is close to *Platycladus orientalis*'s. A significant relationship was found between soil microbial biomass, qCO_2 and physico-chemical properties and restoration duration. The results suggested that it is possible to improve eco-environments and soil quality in the loess hilly area of Loess Plateau by artificial vegetation recovery, but a long time, maybe more than 100 years, is required to reach to the climax before vegetation destruction.

Key words erosion environment Robinia pseudoacacia ecological restoration soil microbial biomass soil quality

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