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研究论文

侵蚀退化红壤自然恢复下土壤生物学质量演变特征

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摘要 为了探讨严重侵蚀退化红壤区自然植被恢复过程中土壤生物学质量演变特征，对南方严重侵蚀退化红壤自然植被恢复的4个演替阶段 (裸地， 地衣地， 苔藓地 和草地)，以及该地区人工马尾松林地的土壤微生物量、酶活性和线虫数量进行了比较研究。结果表明：在侵蚀红壤自然恢复过程中土壤生物学性质演变特征明显。在恢复初期，地衣和苔藓对土壤生物学性质的改善主要体现在土壤表层。在0~2cm土层地衣地土壤微生物量碳、氮、蔗糖酶和脲酶活性高于裸地，但差异不显著；苔藓地表层微生物量氮、脲酶和酸性磷酸酶活与人工马尾松林地已无显著差异，表明苔藓地是严重侵蚀退化红壤自然恢复过程中土壤质量改善的重要阶段。裸地、地衣地和苔藓地土壤线虫恢复程度低于微生物量和酶活性。草地土壤微生物量碳、氮和3种酶活性以及线虫数量则显著高于自然恢复初期各阶段。与人工恢复林相比较，自然恢复草地表层土壤生物学质量优于人工马尾松林地，但对深层土壤的改善效果不如林地。相关分析表明自然恢复过程中土壤微生物与酶活性的改善程度比较一致，而土壤线虫对自然植被恢复响应与微生物和酶活性不尽相同。

关键词 侵蚀退化红壤；自然恢复；土壤微生物量；土壤酶；土壤线虫

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Characteristics of biological property of erosive degraded red soil under nature restoration

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Abstract Hilly red soil region of Southern China is a main producing area for agriculture, pasture and forestry in China. Due to improper land utilization this region is suffering serious soil erosion. This problem has resulted in emergence of large naked lands called “red desert” and hindrances to local agriculture sustainable development. For this reason, restoring vegetation and improving soil quality become urgently needed in this region. During recent decades, man-made forest restoration was taken as the dominating method to reconstruct the destroyed ecosystem. However, the most effective solution to these naked lands should be nature restoring, on condition that human disturbance stopped. Therefore, exploring the effects of nature restoration on soil quality is very important for reconstruction and management of degraded ecosystems in the hilly red soil region of Southern China.

This study was carried out at the Ecological Experiment Station of Red Soil, Institute of Soil Science, Chinese Academic of Science, which was located in Yujiang County, Jiangxi Province. Four types of erosive degraded red soil (bare land, lichen land, mosses land, grass land), which represent different stages of natural restoring, and an artificially restored woodland (Pinus massonina land) were selected. Soil′s biological properties of these five types of land were determined. Results showed that soil′s biological properties varied during the process of nature restoration on erosive degraded red soil. At the initial stages of restoration, improvement on the soil biological properti

es by lichen and moss were represented mainly on surface layer soil. Contents of soil microbial bi omass C, N, activities of Sucrase and Urease in lichen land were higher than that in bare land in s urface soil layer (0-2 cm), without significant difference between them. Moss land presented signif icantly higher soil microbial biomass C, N and activities of Sucrase, Urease and Acid Phosphatas e compared to bare land and lichen land in surface soil layer. There was no significant difference o f soil microbial biomass N and activities of Urease and Acid Phosphatase between moss lan an d Pinus massonina land. This indicated that moss land was a very important stage for the improve ment of degraded red soil quality during nature vegetation restoration process. Resumption of ne matode abundances in the bare land, lichen land and mosses land lagged largely to that of soil mic robial biomass and enzymes′ activities. Grass land illustrated the highest soil microbial biomass, en zymes′ activities and nematode abundance among the four stages of nature restoration. Biologica l properties in surface and sub-surface soil layers of grass land were better than pinus massonina l and, while in deeper layer the latter presented more effective improvement on soil biological qualit y. Correlation analysis suggested that resumption of soil microbial biomass was consistent with en zymes′ activities in the process of nature restoration, whereas nematode abundance was discrepa nt.

Key words erosive degraded red soil _ nature restoration _ soil microbial biom ass _ enzymes activities _ nematode abundances

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