

长期垄作稻田腐殖质稳定碳同位素丰度 ($\delta^{13}\text{C}$) 分布特征唐晓红^{1**}, 罗友进², 任振江², 吕家格², 魏朝富²

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Distribution characteristics of soil humus fractions stable carbon isotope natural abundance ($\delta^{13}\text{C}$) in paddy field under long-term ridge culture.TANG Xiao-hong¹, LUO You-jin², REN Zhen-jiang², LÜ Jia-ke², WEI Chao-fu²

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摘要

研究了四川盆地丘陵区连续16年垄(宽垄)作稻田土壤稳定碳库腐殖质组分的稳定碳同位素($\delta^{13}\text{C}$)分布特征.结果表明: 稻田土壤有机碳含量为宽垄作>垄作>水旱轮作.腐殖质碳以胡敏素为主,占土壤碳含量的21%~30%,提取碳以胡敏酸为主,分别占土壤有机碳和腐殖质的17%~21%和38%~65%.土壤有机碳的 $\delta^{13}\text{C}$ 值介于-27.9‰~-25.6‰,20~40 cm和0~5 cm土壤有机碳 $\delta^{13}\text{C}$ 值之差约为1.9‰.土壤胡敏酸 $\delta^{13}\text{C}$ 值比土壤有机碳低1‰~2‰,更接近于油菜和水稻秸秆及根系的 $\delta^{13}\text{C}$ 值.土壤富里酸 $\delta^{13}\text{C}$ 值分别较土壤有机碳和胡敏酸高2‰和4‰.耕作层和犁底层胡敏素 $\delta^{13}\text{C}$ 值分别介于-23.7‰~-24.9‰和-22.6‰~-24.2‰, $\delta^{13}\text{C}$ 值的变化反映了耕作层中腐殖质的新老混合现象.各有机组分 $\delta^{13}\text{C}$ 值递减顺序为:胡敏素>富里酸>土壤有机碳>稻草(油菜)残体>胡敏酸.长期水稻种植有利于增加土壤有机碳含量,同时,耕作方式影响土壤腐殖质 $\delta^{13}\text{C}$ 在耕作层和犁底层中的分布格局.

关键词: 垄作 有机质 腐殖质 稳定碳同位素丰度 ($\delta^{13}\text{C}$) 稻田

Abstract:

A 16-year field experiment was conducted in a ridge culture paddy field in the hilly region of Sichuan Basin, aimed to investigate the distribution characteristics of stable carbon isotope natural abundance ($\delta^{13}\text{C}$) in soil humus fractions. The soil organic carbon (SOC) content in the paddy field under different cultivation modes ranked in the order of wide ridge culture > ridge culture > paddy and upland rotation. In soil humus substances (HS), humin (HU) was the main composition, occupying 21%-30% of the total SOC. In the extracted soil carbon, humic acid (HA) dominated, occupying 17%-21% of SOC and 38%-65% of HS. The $\delta^{13}\text{C}$ value of SOC ranged from -27.9‰ to -25.6‰, and the difference of the $\delta^{13}\text{C}$ value between 0-5 cm and 20-40 cm soil layers was about 1.9‰. The $\delta^{13}\text{C}$ value of HA under different cultivation modes was 1‰-2‰ lower than that of SOC, and more approached to the $\delta^{13}\text{C}$ value of rapeseed and rice residues. As for fulvic acid (FA), its $\delta^{13}\text{C}$ value was about 2‰ and 4‰ higher than that of SOC and HA, respectively. The $\delta^{13}\text{C}$ value of HU in plough layer (0-20 cm) and plow layer (20-40 cm) ranged from -23.7‰~-24.9‰ and -22.6‰~-24.2‰, respectively, reflecting the admixture of young and old HS. The $\delta^{13}\text{C}$ value in various organic carbon fractions was HU>FA>SOC>rapeseed and rice residues>HA. Long-term rice planting benefited the increase of SOC content, and cultivation mode played an important role in affecting the distribution patterns of soil humus $\delta^{13}\text{C}$ in plough layer and plow layer.

Key words: ridge culture soil organic matter humus substances stable carbon isotope natural abundance ($\delta^{13}\text{C}$) paddy field

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