紫色土坡耕地土壤团聚体分形维数与有机碳关系

Relation of soil aggregate fractal dimension and organic carbon in purple-soil slope farmland

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中文摘要：

为深入理解有机碳对土壤团聚体的影响，采用干筛法和重铬酸钾外加热法并基于相关分析研究了不同施肥处理紫色土耕地土壤团聚体分形维数（D）与有机碳（SOC）的关系。结果表明：不同施肥处理和土层间D与SOC均存在差异，变化范围分别为2.376~2.603、3.54~12.07 g/kg，均值都随土层变深呈递减趋势。全样本（n=36，不区分处理和土层）中D与SOC显著相关，但并非简单相关。进一步对D与各粒级有机碳含量（fSOC）的相关分析表明，在全样本中二者相关性显著，且随粒级的减小相关程度变大。不同施肥处理和土层间的相关分析中二者相关性又表现不同：除对照CK，其他处理的呈现多组显著相关，耕作层（0~20 cm）多组的相关性都很微弱，而犁底层（>20~30 cm）的多个组却显著相关。分析认为，这与不同施肥处理所提供的碳源在团聚体形成过程中所起作用的差异有关，该差异将使团聚体形成各自的特点从而表现出各自的分形特征；并且D与fSOC相关性的差异是团聚体中大小颗粒间结构相似程度的反映，体现出各级团聚体在形成过程中的主导因素是否具有一致性，表明该相关关系对形成土壤结构的主导影响因素具有表征作用。该研究结果有助于深入认识和理解土壤团聚体分形维数的影响因素、物理意义以及对土壤结构的表征性。

英文摘要：

Abstract: For better understanding the effect of soil organic carbon on soil aggregate characterization, the relationship between soil aggregate fractal dimension (D) and soil organic carbon (SOC) were studied in purple soil under different fertilization treatments using the dry sieving, potassium dichromate external heating method and correlation analysis. The results showed that the difference existed in both D and SOC in the treatments (CK, NPK, OM, RSD) and in soil layers (0-10, >10-20, >20-30 cm) ranging from 2.376 to 2.603, 3.54-12.07 g/kg, respectively. The average values both declined following the soil layer. Fractal dimension D of all the samples (n=36, no differences for the treatments or soil layers) were significantly correlated with soil organic carbon (SOC) (p=0.01). Further analysis of the correlation of D and the fraction organic carbon content (fSOC) showed that the correlation was significantly for all the samples and the relevant degree increased with smaller grain size. However, the correlation showed distinction in various treatments or soil layers compared with all the samples: there was no significance in CK and weak correlation for almost all groups of the cultivated horizon (0-20 cm). And most groups of the plow pan (>20-30 cm) were significantly correlated. From the results, it was believed that the different effects in the formation of the aggregates caused by carbon source were from various fertilization treatments. Thus would lead the aggregates to own their characteristics and then show their own fractal feature. And the difference of correlation between D and fSOC reflecting the similarity degree of aggregates size structure and whether the primary factors had coherence in the formation of aggregates were also caused by the fertilization. These results signified that the correlation has characterizing function on the dominant factors in soil structure formation. The results are helpful to recognize the affecting factors of the fractal dimension of soil aggregate, physical characterization and the indication factor of soil structure.

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