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研究论文

不同农业土地利用方式和管理对土壤有机碳的影响——以北京市延庆盆地为例

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摘要 自20世纪80年代以来，我国农业土地利用方式和农田管理发生了巨大变化，由此引起的土壤有机碳(SOC)含量、密度及其垂直分布发生了相应的变化，研究不同土地利用方式和管理对土壤有机碳的影响对于探讨农田生态系统的固碳作用具有重要的意义。以北京市延怀盆地为典型研究地区，选择6种农业土地利用和管理模式，共计42块样地，在1m深土体内分层采集197个土壤样品。研究结果表明：(1) 不同农业土地利用和管理方式对SOC含量的影响主要发生在0～25 cm土层中，剖面中SOC含量自上向下明显降低。(2) 通过对6种土地利用和管理方式下土壤SOC含量进行比较，结果发现果园和高投入的玉米地土壤在0～100 cm土层中SOC含量均较高，变化范围分别为4.16～10.00 g kg-1和4.73～9.31 g kg^{-1}； 菜地土壤在0～40 cm土层中SOC含量较高，变化范围为6.42～9.67 g kg^{-1}；大豆地、中、低投入玉米地土壤在0～100 cm土层中SOC含量较低，变化范围分别为3.27～7.73 g kg^{-1}、3.14～8.33 g kg^{-1} 和1.83～7.67 g kg^{-1}。 (3) 不同农业土地利用方式对SOC密度影响的趋势与对SOC含量影响的趋势基本一致，在0～100 cm土壤中，SOC密度的顺序为果园＞菜地＞高投入玉米地＞中投入玉米地＞大豆地＞低投入玉米地，变化范围为4.15～8.22 kg m^{-2}。

关键词 农业土地利用方式；管理；土壤有机碳；土层深度

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Soil organic carbon changes as influenced by different agricultural land use types and management practices: A case study in Yanqing Basin, Beijing

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Abstract Soil organic carbon (SOC) content play a crucial role in sustaining soil quality, crop production, and environmental quality. It is strongly affected by land use types and management practices. Changes in state land use policy in China in the last two decades have resulted in intense changes in agricultural land use types and farm management. The effect of such changes on SOC content, SOC density and vertical distribution is of great concern. This study investigated changes in SOC in sandy loam soils (Ustochrepts) under orchard, vegetable, corn (Zea maize L.) and soybean (Glycine max L.) cultivation in northern China. The corn fields were further classified into three categories based on its inputs, i.e. high-input corn fields, mid-input corn fields and low-input corn fields. In April of 2005, a total of 197 soil samples were collected in Yanqing Basin, Beijing. The soil samples were taken from 42 soil profiles within 100 cm soil depth which represents the six land use types and management practices. SOC contents were determined via rapid dichromate oxidation and ANOVA statistical analysis was used to test for significant differences among land use types at $p<0.05$.

The results showed: (1) the effects of land use type on SOC occurred primarily within 25 cm soil depth, and below this it was not significant. SOC contents of each land use type and management practice decreased sharply with increasing soil depth. (2) SOC contents under orchard and high-input corn fields fluctuated from 4.16 g kg^{-1} to 10.00 g kg^{-1}, and 4.73 g kg^{-1} to 9.3

1 g kg^{-1}, respectively. Under vegetable cultivation to a depth of 40 cm, SOC varied from 6.42 g kg^{-1} to 9.67 g kg^{-1}; however, it was lower under soybean fields (3.27 g kg^{-1} to 7.73 g kg^{-1}), low-input corn fields (1.83 g kg^{-1} to 7.67 g kg^{-1}), and mid-input corn fields (3.14 g kg^{-1} to 8.33 g kg^{-1}), respectively, for up to 100 cm depth. (3) The variation patterns of SOC density were similar to those of SOC content for all land use types. SOC densities can be ranked as: orchard>vegetable fields>high-input corn fields>mid-input corn fields>soybean fields>low-input corn fields(4.15 kg m-2 to 8.22 kg m^{-2}).
This investigation revealed that SOC contents and densities of orchard fields, vegetable fields and high-input corn fields are higher than those of soybean fields, mid-input and low-input corn fields. This is indicative of applied fertilizer, irrigation, tillage practices, and farm management. Increasing SOC content through intensive management practices in orchard and vegetable fields is a valuable option for improving soil quality and soil carbon sequestration.

Key words agricultural land use type _ management practice _ soil organic carbon _ soil depth

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