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围海造田长期耕种稻田和旱地土壤氮矿化速率及供氮潜力比较

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Comparison of mineralization rates and nitrogen potentials in foreshore reclamation long-term cultivated paddy soils and adjacent upland soils

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摘要 围海造田是沿海地区拓展土地面积的主要途径。土壤氮矿化参数是揭示围海造田土壤肥力演变和土壤氮供应的重要指标，但是我国沿海造田土壤的相关研究少有报道。本研究以杭州湾南岸海积平原上慈溪市1000年和520年筑塘造田区为对象，选择4个代表性采样点，每个点从低洼稻田采集1个表层混合水稻土，在其相邻高地采集1个表层混合旱地土壤，共8个样品。采用间隙淋洗法研究了土壤样品氮矿化动力学特征。结果如下：119 d培养试验证实水稻土和旱地土壤有机氮矿化动力学符合一级反应动力学方程$N_t=N_0(1-e^{-kt})$；水稻土有机氮矿化势（N_0）为82.7～161.9 mg/kg（平均114 mg/kg），占有机氮的7.3%，旱地土壤N_0为63.9～104.4 mg/kg（平均83.4 mg/kg），占有机氮的7.3%；水稻土有机氮矿化速率（k）为0.033～0.114/d（平均0.064/d），旱地土壤k为0.007～0.023/d（平均0.020/d）。土壤综合供氮指标（$N_0\times k$），水稻土为3.8418.46 mg/(kg·d)［平均8.0 mg/(kg·d)］，旱地土壤为0.54～2.66 mg/(kg·d)［平均1.6 mg/(kg·d)］。水稻土总氮含量为1.4～2.0 g/kg （平均1.6 g/kg），旱地为0.87～2.0 g/kg（平均1.3 g/kg）。可见，水稻土氮库、供氮潜力和速率均大于相邻旱地土壤。因此，从土壤氮肥力来讲，相对于旱地，围海形成的水稻田更具有可持续利用性。

关键词： 围海造田 氮矿化 矿化势 矿化速率 水田 旱地 土地利用

Abstract: Foreshore land reclamation is one major way to expand land area in coastal lines. Soil nitrogen mineralization parameters can reveal the evolution of reclamation lands, which are the indicators for soil fertility and nitrogen supply. However, the knowledge is rarely available in foreshore reclamation soils in China. An intermittent leaching method was used to investigate nitrogen mineralization rates and potentials of four paddy soils, and adjacent another four upland soils originated from foreshore reclamation before 520 years in Cixi city on the plain of marine at the south bank of Hangzhou Bay. A first-order kinetic model derived from curve fitting to laboratory incubation data can be used to predict N mineralization as a function of time [$Nt=N_0(1-e^{-kt})$, where N_t is the cumulative mineralized N at time t, N_0 is the potential mineralizable N pool, k is the first order rate constant, and t is incubation time]. The potentially mineralizable N pool (N_0) ranges from 82.7 to 161.9 mg/kg (av.114 mg/kg) for paddy soils, accounting for 7.3% of SON, and 63.9-104.4 mg/kg (av.83.4 mg/kg) for upland soils, accounting for 7.3% of SON. The k value of paddy soils is 0.033-0.114/d (av. 0.064/d), and 0.007-0.023/d (av. 0.020/d) for upland soils. The $N_0\times k$ ranges from 3.84 to 18.46 mg/(kg·d) [av.8.0 mg/(kg·d)] for paddy soils, and 0.54-2.66 mg/(kg·d) [av. 1.6 mg/(kg·d)] for upland soils. Total N concentration is 1.4-2.0 g/kg (av. 1.6 g/kg) for paddy soils, and 0.87-2.0 g/kg (av. 1.3 g/kg) for upland soil. It can be concluded that soil N pool, potentially mineralizable N pool and mineralizable N rate constant of paddy soils are all greater than those of upland soils. Therefore, paddy soil originated from foreshore reclamation could be highly sustainable land use compared to uplands.

Keywords: foreshore reclamation N mineralization mineralization potential mineralization rate paddy soils upland soils landuse

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