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长期施肥对土壤微生物生物量碳、氮及矿质态氮含量动态变化的影响

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Changes of soil microbial biomass carbon and nitrogen, and mineral nitrogen after a long-term different fertilization

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摘要 利用位于陕西杨凌的17年长期定位试验研究了长期不施肥（CK）、单施化肥（F）、化肥配施有机肥（F+M）和化肥加秸秆还田（F+S）处理对小麦-玉米轮作体系中作物不同生长时期土壤微生物生物量碳、氮（SMBC、SMBN）和矿质态氮含量的影响。结果表明，0—10 cm土层土壤SMBC、SMBN和矿质态氮含量的变化范围分别为264.8～752.2、37.5～114.8和3.8～38.5 mg/kg。不同处理相比，F+M处理中各采样时期（小麦苗期、拔节期、灌浆期及玉米播种期、大喇叭口期、灌浆期和收获后）土壤SMBC和SMBN含量均为最高，分别为不施肥对照的1.38～2.65和1.89～2.50倍； F+S处理矿质态氮含量最高，SMBC和SMBN也高于F和CK处理，大部分采样时期的差异达显著水平（P<0.05）； 与CK相比，长期单施化肥也使各时期SMBC和SMBN含量提高。在小麦拔节期到灌浆期的旺盛生长阶段各施肥处理土壤SMBN含量均下降，而矿质态氮含量变化不大，处于较低水平； 在玉米大喇叭口期到灌浆期的旺盛生长阶段，F+M、F+S和F处理土壤矿质态氮含量显著下降，而SMBN含量均有所升高。表明在土壤矿质态氮含量较高时，作物首先利用矿质态氮，而在土壤矿质态氮含量处于较低水平时，微生物固持的氮素可能会释放出来供作物吸收利用。

关键词： 小麦-玉米轮作 长期施肥 土壤微生物生物量碳、氮 矿质态氮

Abstract： A 17 year field experiment, located at Yangling, Shaanxi, was conducted to study effects of different fertilizer managements on changes of microbial biomass carbon and nitrogen (SMBC, SMBN) and mineral nitrogen in soils under the winter wheat and summer maize rotation system. There were 4 fertilizer managements, no fertilization (CK), mineral N, P, and K fertilizers (F), mineral N, P, and K fertilizers and manure (F+M), and mineral N, P, and K fertilizers and straw (F+S). The results show that contents of SMBC, SMBN and soil mineral nitrogen are 264.8-752.2, 37.5-114.8 and 3.8-38.5 mg/kg in the 0-10 cm soil layer, respectively. Contents of SMBC and SMBN in the F+M treatment are the highest among the different fertilizer treatments, and contents of SMBC and SMBN in the F+M treatment are 1.38-2.65 and 1.89-2.50 times of those in the no fertilizer treatment, respectively. Contents of soil mineral nitrogen of the F+S treatment are the highest among the different fertilizer treatments, and contents of SMBC, SMBN of the F+S treatment are higher than those of the F and CK treatments at all sampling times. Compared with the CK treatment, long-term application of mineral N, P, and K fertilizers increase SMBC and SMBN contents of0-10 cm soil layer at every sampling time. SMBN contents in each fertilizer treatment from elongation stage to grain filling stage of winter wheat are decreased; however, soil mineral nitrogen contents are very low during this period. Soil mineral nitrogen contents in the F, F+M, and F+S treatments from pre-tasselling to grain filling stages of summer maize are decreased sharply, while, SMBN contents are increased. It is concluded that if there is enough mineral nitrogen in soil, crop would absorb it firstly, while if mineral nitrogen is limited, SMBN would be decomposed for crop uptake.

Keywords： wheat-maize rotation system long-term fertilization soil microbial biomass C, N mineral nitrogen 2

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