Deciphering the effects of long-term fertilization practices on the Nitrite-oxidizing bacterial community in a Black soil (Abstract)

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ABSTRACT

Nitrite-oxidizing bacteria (NOB) have been recognized as important members for nitrogen cycling in agricultural ecosystems, and how NOB respond to long-term fertilization and variations at soil aggregate levels remain unclear. In this study, the potential nitrite oxidation activity (PNO) and the abundance of nitrite oxidizers were examined in three aggregate fractions (2000-250, 250-53, <53 μm) of a Black soil under four fertilization regimes. Pyrosequencing was utilized to characterize the composition and distribution of *Nitrobacter*- and *Nitrospira*-like NOB populations. PNO was higher in microaggregates (250-53μm) and lowest in silt+clay fraction (<53μm). Fertilization affected PNO to a higher extent than the aggregate sizes. The maximum abundances of *Nitrobacter* and *Nitrospira* were observed in macroaggregates (2000-250μm), followed by microaggregates and silt+clay. Dominant (relative abundance >1%) *Nitrobacter* OTUs were phylogenetically related to some known groups of *Nitrobacter* environmental clones and those of *Nitrospira* were affiliated with the Namibia soil cluster, *Nitrospira* lineage II and V, and Unknown affiliation. Multi-response permutation procedures analysis indicated that nitrifier community was strongly affected by the fertilized regimes but that the aggregate effects were only detectable in the unfertilized soils. Redundancy analysis showed that the community composition of *Nitrobacter*- and *Nitrospira*-like NOB was affected by soil total phosphorus, available phosphorus, total potassium and NH_4^+ content. Our findings suggest that fertilization treatments rather than soil aggregates play more important roles in shaping NOB community structure.

Keywords: Nitrite-oxidizing bacteria, potential nitrite oxidation, black soil, longterm fertilization.