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Abundance and diversity of total and nitrifying prokaryotes as influenced by biochemical quality of organic inputs combined with mineral nitrogen

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Ammonia-oxidizing bacteria and archaea (AOB, AOA) co-exist in soil, but they respond differently to distinct fertilization strategies in agricultural soils. Accordingly, effects of organic inputs and combination with mineral nitrogen (N) on AOB and AOA remain poorly understood. The aim of this study was to compare soil amendment with contrasting quality of organic inputs (i.e., high quality *Tithonia diversifolia* (TD; C/N ratio: 13, Lignin: 8.9 %; Polyphenols: 1.7 %), intermediate quality *Calliandra calothyrsus* (CC; 13; 13; 9.4) and low quality *Zea mays* (ZM; 59; 5.4; 1.2)), and combination with mineral N on the abundance (i.e., DNA-based gene quantification) and community structure (i.e., T-RFLP analysis) of total bacterial and archaea (16S rRNA gene), as well as AOB and AOA (targeting the *amoA* gene) communities in a Humic Nitisol. Soils (0-15 cm depth) were sampled prior to the onset of the rainy season in March 2012 in a 10 years old field experiment established in the central highlands of Kenya in 2002. Since the start of the experiment, organic inputs were applied annually at a rate of 4 Mg C ha^{-1} and mineral N twice a year as calcium ammonium nitrate ($5Ca(NO_3)_2NH_4NO_3$) at a rate of 120 kg N ha^{-1} growing $season^{-1}$. Quality of organic inputs posed only a significant effect on the AOB community structure between TD versus ZM and CC versus ZM. Moreover, TD significantly increased the size of AOB over ZM input, while higher abundances for total bacteria, total archaea and AOA were measured in ZM and TD over CC. This was explained by high and available N in TD, but low lignin and polyphenol contents in TD and ZM as opposed to CC. AOB responded sensitively (i.e., complete community structure separation) to mineral N, specifically when combined with low quality ZM. Hence, AOB community was specifically responsive to quality of organic inputs and combination of low organic input with mineral N over AOA and total prokaryotic communities in the studied soil. The results presented were however, generated on one occasion soil sampling representing the effect of continuous organic and inorganic fertilizer application for ten years. We therefore recommend for prospective research, further investigations to rule out the temporal (short-term) variations of microbial decomposer dynamics at different crops growth stages during a cropping season as well as comparing different soil types.