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"Filling gaps and removing traps
for sustainable resource management"

Management Effects on Soil Microbial Stoichiometry and Fungal-Bacterial Ratio of Rural-Urban Interfaces in Bengaluru

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Abstract

Soil microbial communities perform functions essential to agricultural production, and to regional and global element dynamics. The specific element ratios (stoichiometry) of these soil communities are directly linked to organic matter decomposition rates and may allow to predict patterns of nutrient mineralisation or immobilisation. Such stoichiometry is affected by the type and intensity of land management such as governed by urbanisation, nitrogen fertilisation and irrigation. However, the underlying pathways and their variation across agroecosystems are difficult to predict, due to the many factors involved. To contribute in filling this knowledge gap we analysed the elemental ratios (C, N and P) and microbial communities, including their fungal and bacterial portions, pH, water content, texture and water-holding capacity of typical Nitisol top-soils exposed to different management intensities in the rapid-growing city of Bengaluru, India. Samples were collected in plots that differed in water supply (intensively irrigated and rain-fed), low versus high N-fertilisation intensity and two major crops (maize and millet). Our results showed that differences are largest between the two experiments. Organic C and total N, microbial biomass C and N, the ratio of organic C to total N and the contribution of the fungal biomarker, ergosterol to microbial biomass were higher in the irrigated site. In contrast the microbial biomass ratio of C:N and microbial biomass phosphorus were higher in the rain-fed experiment. Treatment effects within each experimental site are less pronounced, and the stoichiometric differences between crop types seemed to be larger than among N fertilisation intensities. The different stoichiometric patterns observed in this study reflect management effects on microbial carbon use efficiency and, therefore, in nutrient cycling and organic matter stabilisation.

Keywords: Irrigation, microbial stoichiometry, nitrogen fertilisation, soil organic matter, soil stoichiometry

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