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Assessment of soil quality using soil organic carbon and total nitrogen and microbial properties in tropical agroecosystems

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ABSTRACT

Assessment of soil quality is an invaluable tool in determining the sustainability and environmental impact of agricultural ecosystems. The study was conducted to assess the quality of the soils under arable cultivation, locally irri-gated and non-irrigated, forestry plantations of teak (Tectona grandis Lin.) and gmelina (Gmelina arborea Roxb.), and cashew (Anacardium occidentale Lin.) plantation agro ecosystems using soil organic carbon (SOC), soil total ni-trogen (STN) and soil microbial biomass C (SMBC) and N (SMBN) at Minna in the southern Guinea savanna of Nigeria. Soil samples were collected from soil depths of 0-5 cm and 5-10 cm in all the agro ecosystems and analyzed for physical, chemical and biological properties. All the agro ecosystems had similar loamy soil texture at both depths. The soils have high fer-tility status in terms of available phosphorus and exchangeable calcium, magnesium and po- tassium. The irrigated arable land had significantly ($P < 0.05$) higher SOC and STN in both soil depths than all the other soils due to greater C inputs into the soil and fertilizer application. The cashew plantation soil had the lowest SMBC value of 483 mg kg-1 while teak soil had the highest value of 766 mg kg-1 which was sig-nificantly ($P < 0.05$) different from that of the other soils at the surface layer. At both soil depths, in all the soils, the SMBC/SMBN ratios were >6.6 suggesting fungal domination in all the agroecosystems. The forestry plantation soils had higher SMBC and SMBN as a per-centage of SOC and STN respectively than the cultivated arable land soils. Burning for clearing vegetation and poor stocking of forestry planta-tions may impair the quality of the soil. The study suggests that the locally irrigated agro- ecosystem soil seems to be of better quality than the other agroecosystem soils.

KEYWORDS

Agroecosystems; Microbial Biomass; Soil Organic Carbon; Soil Total Nitrogen; Tropical

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