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Land use and plant diversity drive soil enzymatic activity in tropical agricultural systems.

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Understanding interactions among management, edaphic attributes, spatial heterogeneity, and microbial activity in soils is essential to assess ecosystem functioning and nutrient cycling in tropical agroecosystems. Soil enzymatic activity is a sensitive indicator of microbial dynamics, particularly those related to carbon and phosphorus cycling. This study evaluated β-glucosidase and acid phosphatase activities (colorimetric methods) under different land uses at Areão Farm, Piracicaba-SP, aiming to identify microbial response across contrasting spatial contexts in agricultural and natural environments. Soil samples (0-15 cm; four replicates) were collected from pasture, coffee plantation, cover crop mixture, and native forest. Within each system, spatial positions were defined: near roots and between plants in pasture (*Urochloa ruziziensis*); under canopy and inter-row in coffee; cover crop mixture with and without weeds; and, in the native forest, interior and edge adjacent to cultivated areas. Differences were observed among treatments for both enzymes (Tukey's test, $p < 0.05$). β-glucosidase activity was highest in coffee inter-row and lowest at the forest edge (108.3 and 54.8 µg pNP g^{-1} soil h^{-1}, respectively). Acid phosphatase activity was higher in more diverse systems, with highest values in native forest and cover crop mixture (877 µg pNP g^{-1} soil h^{-1}), followed by mixture with weeds (805 µg pNP g^{-1} soil h^{-1}), and lowest in areas with *U. ruziziensis* (471 µg pNP g^{-1} soil h^{-1}). These results indicate that land use and management practices are the main drivers of soil enzymatic activity, with plant diversity playing a key role, while spatial variation within systems was not significant.

KEYWORDS: Soil microbiology; Soil management; Bioindicators; Soil quality; Aboveground biodiversity; Soil enzyme activity.