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Seasonal Effect on Enzyme Activities in Calcareous Soils from the Yucatan Peninsula, Mexico

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Abstract

Under tropical conditions, the temperature varies within a narrow range and the rainfall regulates soil processes and nutrients release. In most tropical semiarid regions, the water availability is episodic, with long droughts alternating with short periods of high precipitation. The Yucatan Peninsula located in the most eastern part of Mexico, presents a great diversity of soils. Previous study has shown problems related to nutrient availability under contrasting soil moisture conditions. Soil enzymes play an important role in catalysing reactions for the organic matter decomposition and nutrient cycling. Therefore, the aim was to study the activities of four enzymes involved in C (β -glucosidase), N (protease) and P (acid and alkaline phosphatase)-cycling. The study sites were located in the communities of Hocaba and Xmakuil, Yucatan. The sampling was done once during the dry season and once during the rainy season (December 2004 and September 2005). Three land use systems were studied: Milpa, Homegarden, and Forest. Two soil types were chosen: black soil (Lithosols) and red soils (Rendzinas). The soil samples were taken at 0–10 cm depths. Acid phosphatase activity significantly increased during the rainy season (16–70%). The high activity might indicate P-deficient conditions. In the rainy season the plants are normally in a growth period, require major concentration of nutrients, there is more demand of P and the acid phosphatase activity shoots up. Protease activity decreased during the dry season (15–46%) and slightly increased during the rainy season. Both β -glucosidase and alkaline phosphatase activity did not vary between the dry and the rainy seasons. Forest soils always had the highest activity of the enzymes studied, due possibly to high substrate concentration which promotes the activities.

Keywords: Calcareous soils, enzyme activities, land use systems, seasonal effect, Yucatan