

TITLE: ENZYMATIC ACTIVITY IN CERRADO SOIL UNDER CROP-LIVESTOCK-FOREST INTEGRATION SYSTEM IN THE CENTRAL REGION OF MINAS GERAIS

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ABSTRACT:

Integrated crop-livestock-forestry system (ICLF) constitutes a potential alternative to achieve economic and environmental sustainability of agriculture in Brazil. However, an agricultural management practice is sustainable only when it maintains its soil quality over time. Biological parameters such as soil enzyme activities have been suggested as sensitive indicators of soil health and quality. Therefore, the objective of this work was to evaluate the biological quality of a Cerrado soil (savanna) under ICLF system. Soil enzymes involved in nutrient cycling (nitrogen and phosphorus) were used as bioindicators. Soil samples were collected in 2014 at the depths of 0-5 cm and 5-20 cm from an ICLF system implemented in 2008 at the Santa Rita Experimental farm/Epamig, located at the central region of Minas Gerais state, Brazil. The trial design was randomized complete blocks of 7 treatments replicated three times. The treatments consisted of ICLF systems containing eucalyptus arranged in double line (3x2)+20 m (T1), (2X2)+9 m (T2) and single line 9x2 m (T3), Cerrado vegetation (T4), pasture in full sun (T5), eucalyptus in the conventional system (3x2) (T6) and a tester area (degraded pasture) (T7). The activity of arginase and urease (nitrogen cycling) was determined by the quantification of ammonium released after hydrolysis of arginine and urea, respectively. Acid and alkaline phosphatase activities (phosphorus cycling) were assayed at pH 6,5 and pH 11, respectively, by measuring the absorbance of p-nitrophenol released from p-nitrophenyl phosphate. Results showed significant differences ($p < 0,05$) in enzyme activities between treatments and between soil depths, except for the activity of acid phosphatase. In all treatments, the activities of arginase and alkaline phosphatase were higher in the superficial layer of the soil (0-5 cm), reaching values of $23,36 \mu\text{g N-NH}_4^+ \text{ h}^{-1} \text{ g}^{-1}$ and $169,42 \text{ p-nitrofenol h}^{-1} \text{ g}^{-1}$, respectively. Arginase activity was significantly higher in soil under Cerrado vegetation (T4) than in soils from the other treatments. The presence of eucalyptus plants in the ICLF system caused a significant depletion in enzyme activities in all of the arrangements tested, suggesting the release of harmful metabolites to the soil microbial community. The management and use of the soil under ICLF system caused alterations in the soil biological quality, which could be detected by the activity of the enzymes arginase and alkaline phosphatase.

Keys words: nutrients dynamics, sustainability, enzymes

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