



Organic matter: a critical soil health indicator in agrosystems within the Cerrado of Bahia, Brazil and South Florida, USA

Flavia Cristina dos Santos¹, Manoel Ricardo de Albuquerque Filho², Johnny Rodrigues Soares³, Tanjila Jesmin¹, Noel Manirakiza¹, Antonio Carlos Reis de Freitas⁴, Marcia Cristina Teixeira da Silveira², Ieda de Carvalho Mendes⁵, Jehangir H. Bhadha^{1*}

¹ Soil, Water & Ecosystem Sciences Department, University of Florida, Belle Glade, FL, USA

² Embrapa Maize and Sorghum, Sete Lagoas, Minas Gerais, Brazil

³ Embrapa Rice and Beans, Santo Antonio de Goias, Goias, Brazil

⁴ Embrapa Cocais, Sao Luis, Maranhao, Brazil

⁵ Embrapa Cerrados, Planaltina, Distrito Federal, Brazil

*Corresponding author

Abstract

Soil health indicators, as organic matter (OM) content and enzymatic activity (EA), play a key role in soils associated with better crop production systems. This study evaluated the relationships between OM, EA, and soil nutrient content across different systems in Brazil: (i) integrated crop-livestock-forestry (ICLF); (ii) integrated crop-livestock (ICL); (iii) conventional system (Conv) (low-input pasture management); and (iv) Cerrado (Cer); and USA: (i) corn-cover crop-corn (CCcC) rotation ; and (ii) vegetables-cover crop-vegetables (VCcV) rotation. Brazilian top-soil samples were collected from 0-10 cm (2019 and 2023 years), and South Florida from 0-15 cm before, and after cover cropping. Soil analyses were: two EA (beta-glucosidase and arylsulfatase), and chemical properties. All data were analyzed using Pearson's linear correlation ($p < 0.05$) and Principal component analysis (PCA). In the two years Brazilian sites showed that OM had a positive correlation with CEC and EA. The two main components of the PCA analysis explained more than 60% of the total variance. In relation to the agrosystems, the variables most closely related to ICL and ICLF were beta-glucosidase, arylsulfatase, P, K, Ca, and Mg. The EA increase over time in the agrosystems, but OM only increased in the ICL. In addition, mineral soils across South Florida showed that all evaluated soil indicators did not significantly changes between pre and post cover cropping periods. Results of Pearson's correlation coefficients indicated that cover cropping improved correlation among soil indicators, especially the EA were strongly correlated with most of the indicators. However, despite these correlations, the health indices remained unchanged following cover cropping. The findings from Brazillian and United States studies confirm the effectiveness of using the EAs as indicators of soil quality, which were correlated with OM, and these are therefore related to the improvements in soil and plant and animal production obtained with better crop systems.