Performance of the Manure-DNDC Model in Estimating Soil Organic Carbon Stocks of (Sub)Tropical Soils Under Different Pedoclimatic Zones and Farming Systems

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The aim of this study was to assess the performance of the Manure-DNDC model in estimating the soil organic carbon (SOC) stocks of (sub)tropical soils in two sites in Brazil under different pedoclimatic zones and farming systems: BR3 (sandy soil – tropical climate with well-defined rainy and dry seasons) and BR4 (clayey soil – subtropical climate with abundant rain all year round). Treatments: BR3.T1 = Integrated crop-livestock system without pasture management; BR3.T2: Integrated crop-livestock system with pasture management (Low Carbon Brazilian Beef); BR3.REF = Tropical savannah; BR4.T1 = Successional system under no-till (wheat – soybean); BR4.T2 = Rotational system under no-till with cover crop and green manure (wheat – soybean – vetch – sorghum – oats – soybean); and BR4.REF = Atlantic rainforest. Soil depths: 0–10; 10–20 and 0–40 cm. Data analysis: Model performance was assessed by calculating the Weighted Mean Absolute Percentage Error (wMAPE). Our results indicated that the Manure-DNDC model performed better at the BR4 site (wMAPE = 7.3%) compared to the BR3 site (wMAPE = 18.6%), suggesting that the Manure-DNDC model estimates the biogeochemical processes in clayey soils better than sandy soils. However, we did not compare our datasets with larger datasets comprising soils of contrasting soil textures, which certainly deserves attention in future studies. Nonetheless, our results indicate that the Manure-DNDC model could be used to estimate the SOC stocks in (sub)tropical soils. Future studies should use larger datasets to assess the performance of the Manure-DNDC model in other pedoclimatic zones and farming systems and calibrate the model if necessary.

Keywords: Integrated systems; Crop rotation; Climate change mitigation; Clayey soil; Sandy soil