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# Fractal dimension analysis of landscape scale variability in greenhouse gas production potentials

Elton da Silva Bicalho (1), Kurt Spokas (2), and Newton La Scala Jr. (1)

(1) FCAV/UNESP, Universidade Estadual Paulista—Departamento de Ciências Exatas, Via de Acesso Prof. Paulo Donato Castellane s/n, Jaboticabal, SP, 14884-900, Brazil (bicalho.elton@gmail.com), (2) USDA-ARS—Soil and Water Management Unit, University of Minnesota—Department of Soil, Water and Climate, 1991 Upper Buford Circle, 439 Borlaug Hall, St. Paul, MN, 55108, USA (kurt.spokas@ars.usda.gov)

Soil greenhouse gas emission is influenced by tillage and management practices that modify soil attributes directly related to the dynamics of soil carbon in the agricultural environment. The aim of this study was to assess the soil $CO_2$ and $N_2O$ production potentials and their spatial variability characterized by fractal dimension in different scales, in addition to their correlation with other soil attributes. The quantification of soil $CO_2$ and $N_2O$ production was carried out from dry soil samples collected in a grid of 50 $\times$ 50 m containing 133 points arranged symmetrically on a sugarcane area under green residue management in southern Brazil. Laboratory incubations were used to analyze greenhouse gas dynamics by gas chromatography.

Soil $CO_2$ and $N_2O$ production were correlated significantly ($P < 0.05$) with microbial biomass, silt and clay content, pH, available phosphorus, sum of metal cations (bases), and cation exchange capacity. Similarly, these soil attributes also were correlated with microbial biomass, supporting their role in soil microbial activity and greenhouse gas production. Furthermore, variations in the fractal dimension over the scale indicate that the pattern of the spatial variability structure of soil $CO_2$ production potential was correlated to that observed for microbial biomass, pH, available phosphorus, sum of bases, and cation exchange capacity. On the other hand, only the spatial structure of the clay content, pH and the sum of bases were correlated with the soil $N_2O$ production. Therefore, examining the fractal dimension enables the spatially visualization of altering processes across a landscape at different scales, which highlights properties that influence greenhouse gas production and emission in agricultural areas.