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Correlations between soil respiration and soil properties in sugarcane areas under green and slash-and-burn management systems

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Soil management causes changes in soil physical, chemical, and biological properties that consequently affect its CO2 emission. In this work we studied soil respiration (FCO2) in areas with sugarcane production in southern Brazil under two different sugarcane management systems: green (G), consisting of mechanized harvesting that produces a large amount of crop residues left on the soil surface, and slash-and-burn (SB), in which the residues are burned before manual harvest, leaving no residues on the soil surface. The study was conducted after the harvest period in two side-by-side grids installed in adjacent areas, having 20 measurement points each. The objective of this work was to determine whether soil physical and chemical properties within each plot were useful in order to explain the spatial variability of FCO2, supposedly influence by each management system. Most of the soil physical properties studied showed no significant differences between management systems, but on the other hand most of the chemical properties differed significantly when SB and G areas were compared. Total FCO2 was 31% higher in the SB plot (729 g CO2 m-2) when compared to the G plot (557 g CO2 m-2) throughout the 70-day period after harvest studied. This seems to be related to the sensitivity of FCO2 to precipitation events, as respiration in this plot increased significantly with increases in soil moisture. Despite temporal variability showed to be positively related to soil moisture, inside each management system there was a negative correlation ($p<0.01$) between the spatial changes of FCO2 and soil moisture (MS), R= -0.56 and -0.59 for G and SB respectively. There was no spatial correlation between FCO2 and soil organic matter in each management system, however, the humification index (Hum) of organic matter was negatively linear correlated with FCO2 in SB (R= -0.53, $p<0.05$) while positively linear correlated in G area (R=0.42, $p<0.10$). The multiple regression model analysis applied in each management system indicates that 63% of the FCO2 spatial variability in G managed could be explained by the model: FCO2(G)= 4.11978 -0.07672MS + 0.0045Hum +1.5352K -0.04474FWP, where K and FWP are potassium content and free water porosity in G area, respectively. On the other hand, 75% of FCO2 spatial variability in SB managed plot was accounted by the model: FCO2(SB) = 10.66774 -0.08624MS -0.02904Hum -2.42548K. Therefore, soil moisture, humification index of organic matter and potassium level were the main properties able to explain the spatial variability of FCO2 in both sugarcane management systems. This result indicates that changes in sugarcane management systems could result in changes on the soil chemical properties, mostly, especially humification index of organic matter. It seems that in conversion from slash-and-burn to green harvest system, free water porosity turns to be an important aspect in order to explain part of FCO2 spatial variability in green managed system.