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[DS2] Soil Development and Soil Properties and Functions

Cover Crops Species As Affecting Soil Aggregation, Aggregate Stability, Organic Carbon Concentration and Soil Bulk Density in Different Soil Aggregate Fractions

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Soil aggregation is the important factor for plant growth, and directly affects the infiltration of water, soil biodiversity, dynamics of the soil biomass, oxygen availability to the roots and soil erosion. Soil aggregation and the distribution of total organic carbon (TOC) in different aggregate fractions could be affected by soil tillage system and cover crops species. The objectives of this study were to elucidate the effects of crop rotation with cover crop species in the soil aggregation, TOC concentration in the whole soil and in the soil aggregates fractions and soil bulk density (SBD) of the cultivated soil under no-tillage system (NTS) and conventional tillage system (one plowing and two disking).

A field experiment was conducted in Santo Antonio de Goias, GO, Brazil (16 ° 27' latitude, 49 º 17' longitude and 823 m elevation). The regional climate is tropical savanna, characterized as an Aw by the Koppen classification. There are two well defined seasons: the dry season from May to September and a rainy season from October to April with1500 mm annual mean rainfalland 22.7°C annual mean temperature. The area has been under NTS for six years (2001 - 2007) with rotations of corn (2001, 2003 and 2005) and soybean (2002, 2004 and 2006) in the rainy season (summer) and fallow in the dry season (winter). Soil was a Rhodic Ferralsol in gently undulating topography. This was a three years' study with cover crop-rice-cover crop-rice rotations. Crops were planted in November 2007 (cover crops), November 2008 (upland rice), March 2009 (cover crops again), and November 2009 (upland rice again). The cover crops were: 1) Fallow (spontaneous vegetation, predominantly Bidens pilosa, Commelina benghalensis, Conyza bonariensis and Cenchrus echinatus), 2) Panicum maximum Jacq., 3) Brachiaria ruziziensis R. Germ. and C.M. Evrard, 4) Brachiaria brizantha (Hochst. Ex A. Rich.) Stapf. - cultivar Marandu, and 5) millet, Pennisetum glaucum (L.) R. Br. - cultivar BN-2. An additional treatment was included as 6) fallow plus conventional tillage system (CTS, one plowing and two disking) as a control. The experimental design was a randomized block design with seven treatments and three replications. Plots size was 6.0 x 10 m with 1 m buffer between plots. Soil samples were collected from the top 0 to 10 cm after the second rice harvesting (April 2010). The data were used to assess the state of soil aggregation. Parameters expressing the size distribution of aggregates (aggregation indices) were determined by the mean weight diameter (MWD), mean geometric diameter (MGD) and aggregate stability index (ASI). The soil aggregations fractions were divided in three classes by size (> 8mm, 2-8 mm and < 2mm). In the whole soil samples and of the aggregate size classes was determined on finely ground samples the total organic C concentration. This evaluation was made by dry combustion with a Perkin-Elmer CHNS/O Analyser 2400. Regarding soil bulk density, soil

samples were collected in each treatment in all replications, using the volumetric ring (50 cm-3) in the layers 00-0.10 m and 0.10-0.20 m to evaluate soil bulk density. Next, these samples were packed separately in plastic bags and sent to the laboratory for analysis.

No-tillage system provided greater stability of soil aggregates (ranging from 90.10 to 94.44%) compared to fallow plowed (79.50%). Fallow plowed provided the highest amount of aggregates lower than 2 mm (49.96 g per 100g soil), which indicates that plowing soil broke the soil aggregates. The cover crops significantly affected the soil bulk density and the lowest soil density were from the treatments of millet at no-tillage system (1.08 g cm-3) and fallow plowed (1.14 g cm-3). The greater amount of root system on the soil surface probably was the cause to have lower soil bulk density at 0-0.10m (1.20 g cm-3) than at 0.10-0.20m (1.27 g cm-3). The deployment of cover crop straw on the soil surface provided the greater accumulation of total organic carbon in the surface layers of soil. The total organic carbon positively correlated with aggregate stability index in all depths and the total organic carbon concentration correlated negatively with the soil bulk density.

Keywords：*Brachiaria brizantha; Brachiaria ruziziensis; Panicum maximum; Pennisetum glaucum; soil management;*