

## Soil organic matter in crop-livestock systems after 16 years on Midwest Brazil

<sup>1</sup>Salton, J.C.; <sup>1</sup>Zanatta, J.A.; <sup>1</sup>Tomazi, M.; <sup>1</sup>Silva, W.M.

<sup>1</sup>Embrapa West Agriculture, Dourados, MS, Brazil, salton@cpao.embrapa.br

**Introduction** - The adoption of the rotation the crops and pasture in No-till System (NTS) have been suggested as a solution to agricultural problems on midwest region of Brazil: the soil conservation and seasonal production of forage. This new production system is based on integration of crops and pasture, where both get advantages through the rotation species and more complexity. There are innumerable conformations that adapts to different environment edaphic-climatic, showing like the main results the cycle interruption of disease and pests, increasing efficient of fertilizer and correctives, larger recycling of nutrients, larger vegetable production, soil covered through of the plants and/or straw that results on better soil quality and environment (Balbino et al., 2011; Franzluebbbers, 2007). The pasture in rotation with crops on integrated crop-livestock system (ICLS) changes dramatically the addition and the dynamic of the carbon on the soil, in relation to systems containing only grain crops. The increase or reduction of carbon stock on the soil is the balance between C assimilated through photosynthesis or animals, and C released to the atmosphere through soil respiration, oxidation, fermentation and erosion.

**Materials and methods** - The experiment, an area of 28 ha of a clayey Oxisol, was installed in 1995 at the Embrapa Western Region Agriculture, Dourados, Mato Grosso do Sul state, Brazil (22°14'S– 54°49'W) with 430 m of altitude. Before implementation of the experiment, the area was used for grain crops under conventional soil tillage since the 70's. This site is in a transitional area between the Cerrado and the Atlantic Forest biomes, and climate in this region according to Köpen classification is Cwa mesothermal humid, with hot summers and dry winter. Distinct soil and cropping management systems were implemented in 1995 and since then these areas have been managed as follows: CS - Conventional system: Grain crops grown under conventional soil tillage, with monoculture of soybeans at the summer and oats in the winter time; NTS – No-tillage system: Grain crops grown under zero tillage, with crop rotation including soybean and corn grown in summer. During the fall-winter and spring time, wheat planted for grains, or oat and turnip are planted for cover crop. CLS – Crop-livestock system: Rotation between crops (soybean/oats) and pasture (*Brachiaria decumbens*) conducted under no-till, rotating every two years. The pastures are grazed by cattle with stocking rate adjusted to maintain a constant supply of forage of around 7% (7 kg of dry mass for 100 kg of living animals per day). Soil fertilization is done only in grain crops along the crop rotation. PP – Permanent pasture: Area where *B. decumbens* is grown under grazing, with the number of animals adjusted to keep constant forage supply of around 7%.

In the experimental area was established a grid of points spaced by 30 x 30m in which soil samples were collected in the 0-5, 5-15 and 15-30cm along the years totaling 250 points.

These samples were processed for determination of soil organic matter (SOM) (wet combustion -1996 to 2006 and dry - 2008 and 2011). Meanvalues were calculated for each system and soil depth, data were also plotted on a map of the experimental area, showing the spatial distribution of SOM content in three layers and for the years sampled.

**Results and discussion** - The average values of SOM on soil profile are shown in Figure 1, where there is, for all systems, the increased levels in the superficial layer, except only for the CS. Higher amounts of SOM were found in the PP system and in the CLS when the sampling coincide after the presence of phase pasture. The Figure 2 shows the spatial and temporal distribution of SOM in the experimental area and in the years evaluated. In 1996 sampling of the experimental area has been relatively homogeneous with values around 30 g kg<sup>-1</sup>. On the second sampling (1996) will CLSb area, under pasture after two years, had values between 40

and  $50 \text{ g kg}^{-1}$  showing the rapid increase in SOM. The alterations in the surface layer are much more visible, with the reduction in CS and alternating bands with CLS, coinciding with the previous presence of the pasture. The last sampling (2011) coincided with the end of the complete cycle of crop-livestock, resulting the effect of two years of the correspondent use of soil. In layer 0-5 cm we can observe more expressive difference in SOM (Fig 1 and 2), indicating that succession soybean/oats for two year decrease SOM. On the other hand, in pasture phase verified small losses and higher input of C through grass increased or restored the C stock level.

Conclusion - The analysis of the results indicate that changes in the levels of SOM are very dynamic, occurring even in relatively small time intervals. The alterations in the SOM content exhibited a spatial variations in a straight line, coinciding exactly with the boundaries between management systems, both in the surface layer as in the deepest. It is notable effect of the pasture presence on changing the values, which can be assigned in a special mode with the root system because changes occurred even in the deeper layers.

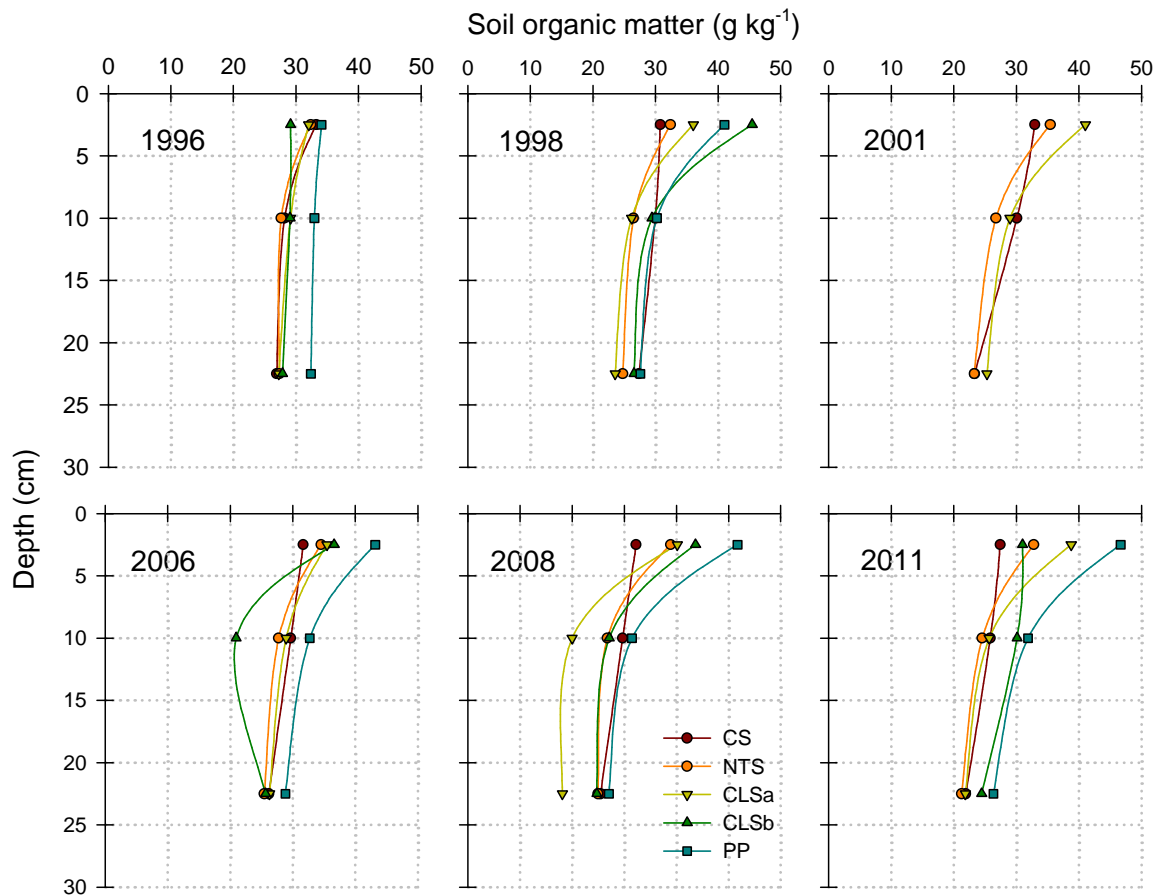


Figure 1 - Distribution of the contents of organic matter in the oxisol profile at different times under management systems in Dourados, Brazil

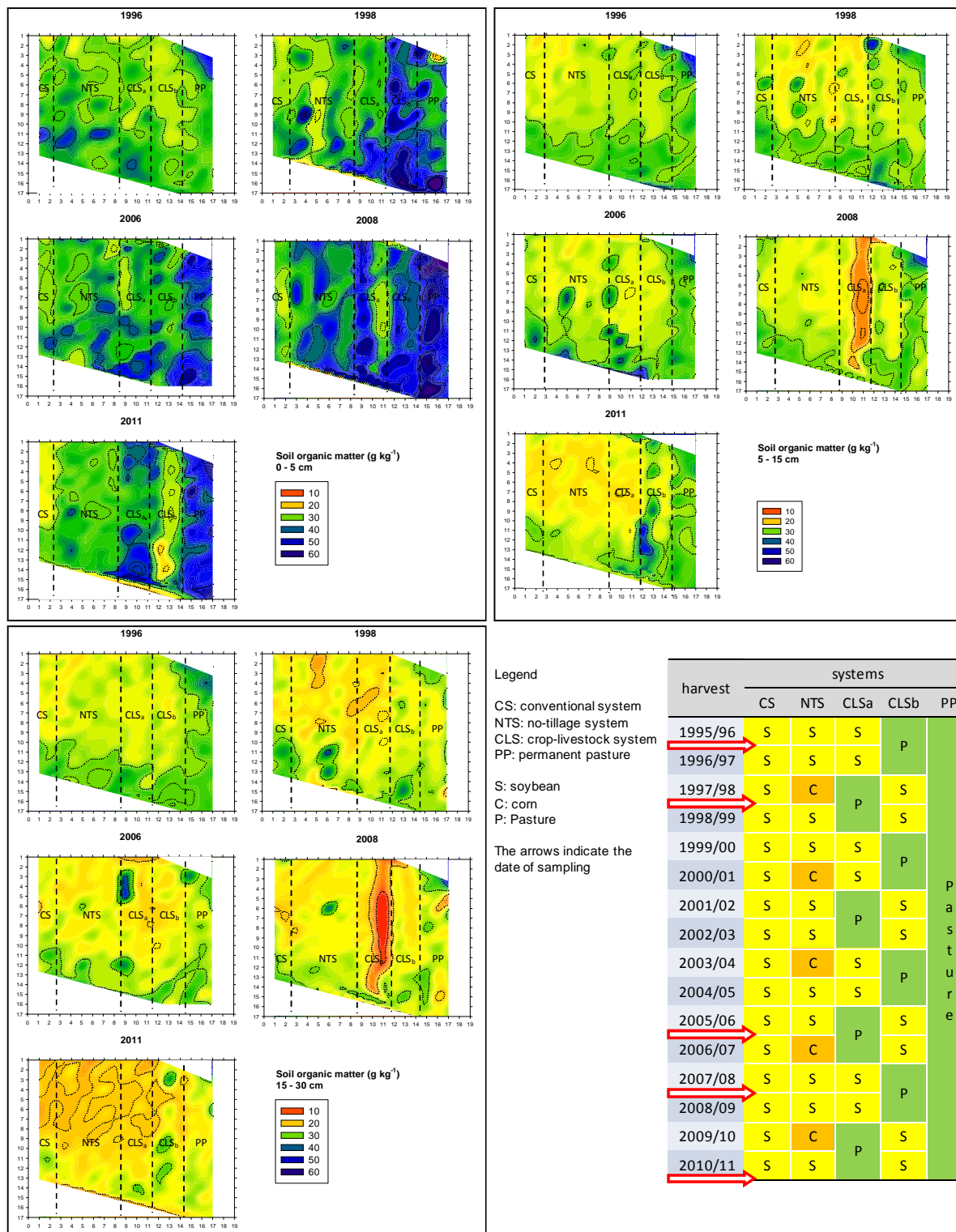


Figure 2 – Spatial distribution of soil organic matter, measured in six years and three depths on oxisol with four management systems, in Dourados, Brazil.

References

Balbino L.C., Cordeiro L.A.M., Porfirio-da-Silva V., Moraes A., Martínez G.B., Alvarenga R.C., Kichel A.N., Fontaneli R.S., Santos H.P., Franchini J.C., Galerani P.R. (2011) Sistemas de integração lavoura-pecuária-floresta no Brasil. *Pesquisa Agropecuária Brasileira* 46, i-xii.

Franzluebbbers A.J. (2007) Integrated crop–livestock systems in the Southeastern USA. *Agronomy Journal* 99: 361–372.