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Effects of changes in land use on soil physical properties and soil organic carbon content in a wheat-corn-sunflower crop sequence, in a loam soil of Argentina.

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The Argentinean Humid Pampas extend over about 60 million hectares, 90% of which are agricultural lands. The Southeast of the Buenos Aires Province is part of the Humid Pampas, it covers over 1,206,162 hectares, the mean annual temperature is 13.3 °C and the climate is sub-humid. At the present only 6% of the lands are used for pasture. The main activities are agriculture and cattle production. The main crops are wheat, sunflower, corn and soybean. The tillage systems used in the area are: moldboard plow (MP), chisel plow (CP) and no-till (NT).
Excessive soil cultivation under MP generates decreases in the levels of soil organic carbon (SOC). The magnitude of such decrease depends on the intensity of the tillage system, the tillage timeliness and the amount and quality of the residues. Adopting NT may reduce the effects of intensive agriculture, through the maintenance and accumulation of SOC. However, there are evidences that, under NT, the bulk density (b) in the superficial layers of the soil increases. The soil compaction causes degradation of the soil structure, reduces the soil water availability and reduces the soil hydraulic conductivity.
With this scenario and the tendency to increase the surface under NT in the Southeast Humid Pampas, we evaluated the evolution of some soil physical properties and the SOC in a 10-year experiment with a wheat-corn-sunflower rotation. The experiment was carried out in four localities at farmers′ fields under three different tillage systems: MP, CP and NT in a randomized complete block design, considering each locality as a block. Each plot had 50 m in width by 100 m length and the treatments were: NT, MP and CP.
The results of this experiment have allowed us to verify that: i) the wheat-corn-sunflower crop sequence showed a tendency to reduce the values of bulk density (b) but NT increased b in the superficial soil layers; ii) the more intensive the tillage system, the higher the change in the mean weight diameter (MP > CP > NT); iii) the unsaturated hydraulic conductivity (K) showed interaction with time and only was significantly different between the tillage systems in the year 2007; iv) the SOC was statistically higher in NT than in MP and CP, time had no significant effect on SOC, and vi) the tillage system did not affect the yields of the wheat-corn-sunflower crop rotation.