



## **Conservation agriculture on silty soils: coupling soil physical properties with 3D geophysical survey over the transition period in Northeast Italy**

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Conservation agriculture is one of the agro-environment measures promoted by Veneto Region (Northeast Italy) to regulate and support many ecosystem services. This study presented the outcomes from a 3-yr soil monitoring under conservation agriculture (CA) on four farms in Veneto Region silty soils in comparison with conventional (CV) management. Experimental design was set up in 2010, CA system consisted in no-tillage, cover crop usage and crop residues on soil surface while CV in soil ploughing with crop residues incorporation, disk-harrowing and bare soil between the main crops. Soil monitoring was performed inside 24 monitoring areas (3 areas  $\times$  2 treatments  $\times$  4 farms) in August 2014, July 2015 and May 2016 at crop full bloom; maize (*Zea mays* L.) soybean (*Glycine max* (L.) Merr.) and winter wheat (*Triticum aestivum* L.) respectively. Every year, inside each monitoring area, 3 undisturbed soil cores (0-90 cm) for bulk density (BD) and volumetric water content (VWC) measurements, 9 soil penetration resistance (PR) profiles (0-80 cm) and a 3D electrical resistivity tomography (ERT) were performed in the inter-row. A total of 1944 BD and VWC analyses, 648 PR profiles and 72 3D ERT were considered in this work.

In three out of four farms, characterized by silty loam/silt clay loam soils, the results agreed showing CA treatment associated with a higher VWC in the top soil layers as a results of crop residues on soil surface and, on the other hand, with a higher degree of compaction in the first 30 cm as highlighted by both BD and PR analyses. ERT monitoring was in line with classical methods observing lower resistivity values in CA shallow layers as results of both higher VWC and BD. Conversely, in the farm with a coarser texture (loamy soil) and very low soil organic carbon content ( $\leq 0.8$  g 100 g<sup>-1</sup>) a dense plow pan was observed in CV treatment below the plowing depth (35 cm) and confirmed by both classical (BD and PR) and geophysical (ERT) methods.

This research did not demonstrate any specific benefits of conservation practices on soil physical properties after 4- to 6-yr of conservation management adoption in silty soils. On the contrary in loamy soils, the application of CA avoided the formation of a plow pan. The strong interactions existing between management systems and soil local conditions explained the results clusterization according to soil texture. However, the soil properties analyzed in this study represent only some of the numerous ecosystem services provided by conservation systems; some of these depend on the quality of the top layers (research funded by 'Helpsoil' life + European project, LIFE12 ENV/IT/000578).