



Impact of tillage on soil magnetic properties: results over thirty years different cultivation plots

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Cultivation may favour or not different processes such as air and water circulation, organic matter and fertilizers supplies..., consequently it can a priori induce significant changes in local oxido-reduction conditions which determine the magnetic properties of soils: the soil magnetic signal. If laboratory measurements on soil samples can be slow and irreversible, it is also possible to perform in field measurements by using electromagnetic devices that allow quick and easy measuring over the relevant soil thicknesses both in time (TDEM) and frequency (FDEM) domains.

The object of this study is to compare the variation of two magnetic properties (magnetic susceptibility, measured by FDEM apparatus and magnetic viscosity measured by TDEM apparatus) and their ratio along depth for three different types of tillage (no tillage, ploughing, and simplified tillage).

An experimental plot of 80 m by 50 m total area, on which these three types of tillage have been conducted for more than thirty years, was surveyed. The plot is divided in five strips of 16 m by 50 m area, each of which being cultivated by one type of tillage only. Each strip is divided in two parts, one half with nitrogen-fixing crop during intercultivation winter period and the other half with bare soil during this period. On each part, the variation along depth of both magnetic properties was assessed by surveying with different devices corresponding to three different volumes of investigation. For the magnetic susceptibility measurements the devices used were the MS2 of Bartington Ltd with the MS2D probe and the CS60 a slingram prototype use in VCP and HCP configurations. For the magnetic viscosity, the devices used were the DECCO from Littlemore ltd. And the VC100, a slingram prototype, used at two heights.

Eleven values of the two magnetic properties have been recorded using each device and their medians calculated. The data were inverted to define the median magnetic profiles of each half-strip. Magnetic properties profiles corresponding to different tillage vary significantly. A small difference is also observed between the nitrogen-fixing crop covered half-strips and the bare ones.