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Crop organic management on soil properties in semiarid areas

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Appropriate soil management is the key to agricultural sustainability, since soil properties determine, to a greater or lesser extent, the type of management that should be practiced, and also because in the long term, soils are positively or negatively altered by agricultural practices.
However, the complex and variable nature of soil processes make difficult to predict the conditions within them; therefore, crop technology should be developed from a general knowledge of the response to soil fertility levels, drainage, water storage capacity, wetting-drying cycles in the different soil textures, etc. It is therefore not surprising the difficulty in making decisions about the type of tillage and when and how to perform it depending on the soil properties.
This paper compares, in two different texture soils (clay and sandy loam) and under organic management (Council Regulation (EC) No 834/2007 organic production), various parameters of productivity such as soil mineralization capacity, yield stability, moisture management, soil microbial biomass, organic matter, macroelement content and tillage practices. The results were obtained in a long-term trial conducted at the "La Higueruela" Experimental Farm (4º26' W, 40º04' N, altitude 450 m) (property of the Spanish National Research Council), Santa Olalla, Toledo, in the semi-arid region of Castilla-La Mancha, central Spain.
Clay soils support higher contents of microbial biomass than sandy loam, with significant differences throughout most of the year; but this increased amount of microbial biomass does not result in increased nitrification, since it is subject to soil moisture, temperature and aeration, and these proper conditions are more often in the coarser textured soils. This increased organic matter mineralization rate leads to increase soil soluble phosphorus but, consequently, to decrease soil organic matter content.
The effect of soil tillage can differ depending on the soil texture. It is noted that in the lighter soils and in an average of 23 years of study, cereal production is slightly lower when tillage is practiced than in no-tillage systems, whereas in clayey soils the effect is the opposite. This is due to the air-water balance in the soil, essential for microbial life and responsible for the recycling of nutrients. In the sandy loams, characterized by enough air (macroporosity), tillage labours destroy the micropores where water is retained; however, in the clay soils, with high water retention capacity (microporosity), tillage labours increases the soil air.
In cereal crops under organic management, in which part of fertilization is based on the mineralization of crop residues, sandy loam soils are more productive but less stable (measured as the fluctuation of yields over the years) and sustainable (measured as the maintenance of appropriated yield levels over time) than clay soils, the latter with greater resistance to lose organic matter and solubilize soil nutrients.