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Soil type as factor controlling the effects of forest transformation to agricultural use in soil aggregation and related properties

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The stability of aggregates has an important role in soil functioning and its behavior to avoid erosion and degradation, the ability to transfer liquids and gases, which are important features for crop production and ecosystem health (Tisdall and Oades, 1982). It's also a property that is highly influenced by land use and management (Angers et al., 1993). The stability of aggregates provides key information about the capacity of soil functions that defines the soil quality.

This study has aimed to identify the long-term effects of forest transformation on agricultural use on soil structure and related properties. For the research was chosen seven localities in the Alicante Province (E Spain) with different soil types in all cases to compare how the land use changes can affect as a function of soil type and characteristics. In every site, samples were collected from agricultural land use (dry crops with tillage management), and in forest areas close to them with similar soil type that are used as references. On the samples, selected physical and chemical properties were analyzed such as Soil aggregate stability (AS), Organic matter (OM), Mean weight diameter (MWD) of aggregates and Water repellency (WR).

As expected, in all cases the AS was significant lower in agricultural sites than in forest. But in some cases the differences were much higher than in others. In forest sites the AS varied between 46 to 82% while in agricultural sites ranged between 14 to 45%. The results showed strong positive correlation of AS with OM. The lowest initial values of AS were found in wettable sandy soils. The agricultural land use lead to relative decrease in AS by 39 to 79% compared to forest soils, indicating that some soils are much more vulnerable to land use than others. These differences can be explained mainly because intrinsic soil properties, such as OM content, texture, and WR. Particularly, the decrease in OM content and absence of WR are responsible for the decrease in AS due to agricultural land use. Soil WR was found in three of the sites, and its presence plays a key role in the aggregation and its stability, especially in one of the sites with severe WR, since that type of soil is very sandy and despite we expected initially a very low aggregation, the results showed 38 and 62% of AS for agricultural use and forest respectively, which is comparable to other soils with high clay and carbonates content as stabilizing agents. The MWD was in most cases higher in forest than in agricultural sites, except of two wettable sandy soils with the lowest initial AS, where the MWD was higher in agricultural sites.

As conclusions we can say that the use of tillage in agriculture affects aggregate stability, but the magnitude is quite dependent of the soil organic matter, the texture and the presence of WR. Some soils can be much more vulnerable than others to land use. In some cases the presence of hydrophobic substances can play a key role in the formation and stabilization of soil aggregates, contributing to maintain good levels of OM and avoiding higher levels of soil degradation.

References:

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