Geophysical Research Abstracts
Vol. 12, EGU2010-571, 2010
EGU General Assembly 2010

Long-term effect of conservation tillage on structural properties and organic carbon in aggregates of a Mediterranean loamy soil

Nuria Blanco-Moure (1), M. Victoria López (1), Luis A. Angurel (2), M. Ángeles Limón (1), and Ricardo Gracia (1)

(1) Depto de Suelo y Agua. Estación Experimental de Aula Dei (CSIC), Zaragoza, Spain , (2) Depto. de Ciencia y Tecnología de Materiales y Fluidos, ICMA (CSIC-UZ), Zaragoza, Spain

The architectural arrangement of the soil matrix determines the functions required for plant growth and the sustainability of the ecosystem. In agricultural lands inadequate tillage management leads to a decline in soil structure and, consequently, soil degradation, but little is known about the impact of the tillage practices on the individual aggregate properties. The understanding of mechanical properties of aggregates is crucial to explain the macroscale functions of the soil system because the properties of aggregates may differ from those of the whole soil due the dynamics of aggregate formation. In semiarid Aragon (NE Spain), particular soil and climate characteristics make this region prone to land degradation by wind and water erosion. Conservation tillage has been proposed as a management alternative to preserve soil and water resources in this area. The objective of this work was the evaluation of the long-term effect of conservation tillage after (20 years) on structural properties of soil aggregates and the role that SOC plays in these properties.

Soil surface samples (0-5 cm) were taken from four adjacent fields. Three of them were cultivated sites under different tillage systems: conventional tillage (CT, mouldboard ploughing), reduced tillage (RT, chisel ploughing) and no-till (NT).The fourth was a nearby uncultivated land (NAT). The soil samples were dry sieved in order to obtain aggregates of four different sizes (16-8, 8-4, 4-2 and 2-1 mm). Tensile strength (TS) and organic carbon (OC) content of soil aggregates were determined for all sizes while water aggregate stability (WAS) was assessed only in 2-1 mm class. The TS was significantly lower in soil aggregates from NAT and NT fields than those from CT and RT for all aggregate sizes. The highest TS values corresponded to the smallest aggregate size, indicating an important effect of the aggregate size in this property. In fact, aggregate size and organic carbon explained a 90% of the TS variability in this soil ($p \leq 0.001$). The WAS data show that this cultivated soils were extremely susceptible to disruption by water. Thus, almost all aggregates from CT and RT were breakdown in the first minutes of wet sieving (80-90%) This disruption was also large in the soil under NT (70%) and comparatively lower under the NAT soil (15%). In the cultivated fields, slaking was the main destabilization process (60-70% of total breakdown). In natural soils however this percentage only arose to 5%. The slaking magnitude was strongly related with the soil disturbance level (CT>RT>NT>NAT). Swelling and dispersion represented a little amount of the breakdown in tillage lands (8-10%). In NT and NAT, this percentage was worthless. Again OC of aggregates is a key factor to explain the soil destabilization. Good regressions were obtained between OC and slaking (r^2=0.605; $p \leq 0.01$) and swelling (r^2=0.504; $p \leq 0.05$). However, further research must be made to evaluate the role of porosity in these disruption processes.

We can conclude that in semiarid Aragon, agricultural management reduces the content of OC in the soil surface and declines the soil structure. Despite of that, conservation tillage practices as NT can improve soil structure enhancing physical and chemical soil quality.