



Soil physical and hydrological properties as affected by long-term addition of various organic amendments

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The use of organic residues as soil amendments in agriculture not only reduces the amount of waste needing to be disposed of; it may also lead to improvements in soil properties, including physical and hydrological ones.

The present study examines a long-term experiment called “Qualiagro”, run jointly by INRA and Veolia Environment in Feucherolles, France (near Paris). It was initiated in 1998 on a loess-derived silt loam (787 g/kg silt, 152 g/kg clay) and includes ten treatments: four types of organic amendments and a control (CNT) each at two levels of mineral nitrogen (N) addition: minimal (N_{min}) and optimal (N_{opt}). The amendments include three types of compost and farmyard manure (FYM), which were applied every other year at a rate of ca. 4 t carbon ha⁻¹. The composts include municipal solid waste compost (MSW), co-compost of green wastes and sewage sludge (GWS), and biowaste compost (BIO). The plots are arranged in a randomized block design and have a size of 450 m²; each treatment is replicated four times (total of 40 plots).

Ca. 15 years after the start of the experiment soil organic carbon (OC) had continuously increased in the amended plots, while it remained stable or decreased in the control plots. This compost- or manure-induced increase in OC plays a key role, affecting numerous dependant soil properties like bulk density, porosity and water retention. The water holding capacity (WHC) of a soil is of particular interest to farmers in terms of water supply for plants, but also indicates soil quality and functionality. Addition of OC may affect WHC in different ways: carbon-induced aggregation may increase larger-pore volume and hence WHC at the wet end while increased surface areas may lead to an increased retention of water at the dry end. Consequently it is difficult to predict (e.g. with pedotransfer functions) the impact on the amount of water available for plants (PAW), which was experimentally determined for the soils, along with the entire range of the water retention curve. The impact of organic amendments on water retained at field capacity (FC) and wilting point (WP) as well as the retention curve in general differed compared to CNT but also depends on the definition of FC (the associated matric potential). Overall, within the first 15 years of the experiment, the organic treatments affected and generally improved various soil properties relevant in terms of quality, functionality and productivity.

Acknowledgment: This work was granted by ADEME within the Pro-Extern project.