



Impact of afforestation on soil quality and organic matter dynamics in an eroded calcic soil in arid land, NE Spain

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1 Abstract

Rural development, sustainable agriculture and environmental conservation strategies are increasingly important in the Agricultural Policy of European Union. The content of the present reform of the CAP (Berlin European Council, 1999) ensures that “agriculture is multifunctional, sustainable, competitive and spread throughout Europe”. The Council Regulation (EC) No 1257/1999 establishes the framework for Community support to sustainable rural development, promoting agro-environmental measures and forestation of agricultural soils. The adoption of this regulation has led to the implementation of a new forestation policy on arid land ($R=380\text{mm}$; $PET=800\text{mm}$) in Navarre (NE Spain), where the adverse soil conditions (low organic matter content and fertility) make fallow unavoidable and agriculture unprofitable. As a consequence, an important surface of rainfed cereal-producing land has been afforested. These forestation measures have implied changes in soil management over the last years.

The aim of the work was to study the effect of forestation on soil quality using early indicators and soil organic matter fractions (Total C, C in the particulate organic matter

(POM), and C linked to the mineral fraction (CMF)), in two plots located in Fustiñana (Navarre). We studied the soil of two adjacent plots cultivated to barley since 1998. The soil was enriched in calcium carbonates, clayey, non-saline and poor in organic matter and nutrients, developed on clay limestone from the Tertiary. In 2005, one of the plots was afforested with shrub-like creepers (*Pistacia lentiscus*, *Lavandula angustifolia*, *Salvia* sp., *Rhamnus* sp., *Juniperus phoenicea*, *Ephedra fragilis*, *Salsola vermiculata*, *Thymus* sp., *Stipa tenacissima*). No control on adventitious vegetation (*Lolium rigidum*) was done in this plot. Soil was sampled at 0-5, 5-15 and 15-30cm depths two years later, keeping the non-afforested plot as a control for the studied soil parameters.

Soil bulk density was higher in the control plot. As expected, the afforested soil showed a significant increment both in C concentration and stock, and this increment was not homogeneous in depth and among organic fractions. The upper soil layer (0-5cm) showed the most significant gain in organic matter. Strikingly, the increase of C stock in the CMF accounted for most of this gain.