



Effects of topographical position on soil organic carbon and nitrogen in Mediterranean olive groves

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INTRODUCTION

The most important and extensive crops in the Mediterranean area are olive groves. Within the last 50 years, the surface occupied by olive groves has progressively increased in Spain including more complex topographies, with steeper slopes and higher altitudes. This situation has caused serious erosion problems; there is a huge range of studies assessing possible solutions to this problem and new tillage and management techniques have been developed (Lozano-García and Parras-Alcántara, 2013). However, topography has influence in soil properties too. The impact of the topographical position on soil properties, including soil organic carbon (SOC) and Nitrogen (N) stocks, and soil quality (expressed as Stratification Ratios-SRs) was evaluated in a Mediterranean olive grove with traditional tillage.

MATERIAL AND METHODS

The study was carried out in a rain-fed olive grove in Jaén managed with traditional tillage (with disc harrow 25 cm) and receiving mineral fertilization. Three topographical positions with the same aspect: summit, backslope and toeslope were chosen for evaluation. The soil samples were taken from four soil sections of 0.25 m (0-1 m) in order to establish a good comparison. Soil properties determined were: soil particle size, SOC and total Nitrogen (N). SOC and N stock, expressed for a specific depth in Mg ha⁻¹. Stratification ratios (that can be used as an indicator of dynamic soil quality) for SOC and N at three different depths were calculated. The effect of topographical position on SOC and N stocks and other soil properties was analyzed using a ANOVA, followed by a Tuckey test.

RESULTS

SOC decreased with depth, in addition, the SOC and N content increased along the downslope direction (5.5, 6.5 and 7.1 g C kg⁻¹; and 0.3, 0.8 and 0.9 g N kg⁻¹ in the surface layer in the summit, backslope and toeslope respectively) as well as SOC stock considering the two first soil sections. The N stock varied significantly along the topographical positions, increasing from the summit to the toeslope (6.2, 8.6 and 10.6 Mg ha⁻¹ in the summit, backslope and toeslope respectively), this may be due to the leaching effect suffered by urea. These increases along the downslope direction were due to erosion processes that occur along the toposequence, leading to organic matter losses (C and N) from the summit to the toeslope. As well, there was movement of the most erodible textural fraction (silt). All the SRs calculated were lower than 2. However, the lower values of SR were obtained in the summit, so the SRs confirm that the low values of SOC and N in this topographical position are progressively decreasing the soil quality in this position. Therefore, alternative management techniques that avoid soil erosion must be considered in order to increase the soil quality, especially in those topographical positions which suffer higher losses of SOC and N.

REFERENCES

Parras-Alcántara, L., Díaz-Jaimes, L., Lozano-García, B., 2013b. Organic farming affects C and N in soils under olive groves in Mediterranean areas. *Land Degradation and Development* (article in press) DOI: 10.1002/ldr.2231.