Geophysical Research Abstracts
Vol. 19, EGU2017-5025, 2017
EGU General Assembly 2017

The use of soil gypsum concentration as an indicator of arable land degradation

Irene Robledo (1), Maria Jose Marqués Pérez (1), Zulimar Hernandez (1), Pilar Carral (1), Stephen Crittenden (2), Blanca Sastre (3), and Ramón Bienes (3)

(1) Autonomous University of Madrid, Geology and Geochemistry Department. C/ Francisco Tomás y Valiente, 7. 28049. Madrid, Spain, (2) Nutrient Management Spear Program. Department of Animal Science. 325 Morrison Hall. Cornell University. Ithaca, NY, 14853, (3) Applied Research Department, Finca "El Encín" - IMIDRA, Alcalá de Henares, 28800 (Madrid), Spain. Tel: +34918879488

Gypsiferous soils are frequent in arid and semi-arid areas. These soils can be used for farming but shallow soils and steep slopes are detrimental to establishing their profitability. Tillage of sloping land increases risk of soil erosion processes that lead to diminished thickness of the richer topsoil layer. Topsoil loss exposes subsoil layers with higher gypsum concentration.

This increased gypsum concentration can influence the potential biomass production and agricultural suitability of gypsiferous soils. In the literature, soils having more than 15% gypsum tend to have weak soil structure and inhibited root growth. Consequently, there is a need to diagnose these eroded soils and to develop a soil protection strategy for arable land if continued soil loss is to be abated and productivity is to be restored or maintained. Indicators to establish the level of degradation are needed, particularly ones that are easy to measure. We hypothesize that pale soil colours indicate proximity to soil conditions linked to high concentrations of gypsum that are detrimental to plant growth.

Spain leads the list of European countries having gypsiferous soils, with an area of approximately 35 000 sq km covered. Gypsiferous soils analysed in this study are located at the centre of Spain, where average temperature is 16ºC and soils receive around 400 mm of rainfall per year.

Sampling was conducted in various areas of a sloping agricultural land with olive trees. Topsoil disturbed samples were randomly collected, in addition, six 70 cm deep soil core were collected. Two soil cores at the top, two in the middle, and two at the bottom slope areas were taken. Colour and gypsum concentration were analysed in the soil samples and also for sub-samples each 5 cm of the core samples. Gypsum was analysed by chemical and thermogravimetric methods. Other parameters like aggregate stability, electrical conductivity, water retention, and bulk density were also analysed.

Gypsum concentration ranged from <1% to more than 50%. At the top of the slope, high concentrations were found at 10 to 15 cm soil depths, while at the bottom areas gypsum increased at 30 to 50 cm depths.

The effective root zone depth is thin, ranging from 10 to 50 cm according to the sample location of the slope. Colours varied from 10 YR 5/3 to 10 YR 8/2. As gypsum concentration is linked to the colour of soil, this parameter, easily measured by spectroradiometry can be used as an indicator of degradation caused by tillage and erosion.