Geophysical Research Abstracts
Vol. 12, EGU2010-8044, 2010
EGU General Assembly 2010

Identification of the origin of salts in an agricultural area of SE Spain

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In spite of soil salinity having been widely studied in many part of the world, origin of salinity has not been addresses in detail in some of the most productive agricultural areas of Europe (e.g. southeast of Spain). According to the European Commission, salinization affects about 1 to 3 million ha of the area of the European Union and Candidate Countries. In Europe, most of the salt-affected land surfaces are concentrated in the Mediterranean basin. In Spain, about 3% of the 3.5 million hectares of irrigated land are severely affected by salts and another 15% is at serious risk of imminent salinization. Due to the limited water resources in southeast of Spain, water with marginal quality is used for irrigation. The use of this water has led to degradation, reduction of the land's production capacity and soil salinization. The main aim of the present study was to identify the origin of the salts involved in such salinization, using classical and multivariable statistical techniques.

In order to achieve this objective, surface soil samples were collected in January and July 2009 at 48 sites located in a representative lemon production area close to City of Murcia, covering a surface area of 44 km2. Soil pH, electrical conductivity, ionic composition, total organic matter, equivalent calcium carbonate, cation exchange capacity and particle size distribution were determined. The Pearson correlation coefficient, r, was used to measure the relationship between two quantitative variables and principal components analysis was used to study the correlations among anions and cations and their grouping into several factors.

Results indicated that the high electrical conductivity found in the study area indeed comes from poor quality irrigation water used for agriculture. Anions and cations responsible of the salinity were chlorides, sulphates, calcium, magnesium and sodium. Mismanagement of water and traditional irrigation system resulted in salt build-up in the soil system. Therefore, there is an urgent need to manage irrigation considering the soil type, climatic factors, and crop requirements. A change to drip irrigation system is desirable in this respect. Phosphate, ammonium, nitrate and potassium found in the soils under study were found to be associated with fertilization. They have been applied to the soil mainly as ammonium nitrate, potassium nitrate, and monoammonium phosphate. The previous indicated that these ions are not involved in secondary salinization of the soils. Finally, SEM-EDX analysis suggested that calcium sulphate found in the agricultural soil of Murcia originated from two sources: i) irrigation water and ii) pedogenic sources. This was confirmed by different crystal morphology and occurrence.

In conclusion, multivariable analyses combined with advanced laboratory analysis (e.g. SEM-EDX) are very useful to identify the possible sources of salts.

Acknowledgements: to "Fundación Séneca" of "Comunidad Autónoma de Murcia" for its financial support.