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Identification of vulnerable sites in salts affected agricultural soils from South-Eastern Spain

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Soil salinization is one of the main problems in many soils under intensive agricultural practices, especially in arid and semiarid zones. Two important reasons for the occurrence of salinization are i) the use of low quality irrigation water and ii) climatic conditions reducing soil quality. The results of salinization can be quite serious. It limits the growing of crops, constrains agricultural productivity, and in severe cases, leads to the abandonment of agricultural soils. There are mainly two kinds of soil salinity: naturally occurring dry-land salinity and human-induced salinity caused by the low quality of irrigation water, excessive water and fertilizer applications. In both cases the development of plants and soil organisms is limited. Natural occurrence of salts in soils is very difficult to handle and requires higher investments than the reduction of human-induced salinity. For these reasons, identification of vulnerable sites is essential for sustainable agricultural management, especially in these semiarid and arid environments. The main aim of this study was to examine spatial and vertical distribution pattern of salts in a semi-arid study site in South-Eastern Spain in order to identify vulnerable sites.

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. The area was divided using a square grid of 1000 m and the samples were taken from these squares. The ionic concentrations were used as the input data for distribution maps. The software used for the spatial analysis was Arcview 3.1. An interpolation method called the Inverse Distanced Weighted (IDW) method was adopted for the interpolation of the data.

The results indicated that the concentrations of most anions are higher in summer. The difference was particularly large for chloride, most likely because of its high mobility and little adsorption to soil colloidal particles. However, other ions such as sulfate, calcium, magnesium, and sodium also displayed significant increases in concentration in July. This can be explained by the movements of soluble salt to the surface due to evaporation and capillary rise and subsequent precipitation of the salts during high temperatures and low rainfall. Rainfall or irrigation events enhance the leaching of salts to deeper soil horizons.

The most affected area is located in the west of the study area, at the lowest altitude within the study area. Depressions favour accumulation of salts, due to both runoffs from higher areas during rainfall periods and poor quality irrigation water. It is recommended to use a better quality of water, at least before the summer, in order to reduce the amount of salts in the surface layer, likely to cause stress to crops growing on the soil in question.

In conclusion, the spatial distribution of anions in the soil solution is very useful for predicting where higher increases in salinity will be produced. This will allow for identification of vulnerable areas and subsequent implementation of the necessary measures to decrease the risk for sensitive crops.

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