

WADI PROJECT - Water Demand Integration – INCO2003 - MPC2 - 015226

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The soil salinization in the Grosseto Plain: materials and methods of the research.

The DISAT activity inside the Wadi Project, concerning the salinization phenomenon of the cultivated land of the Grosseto Plain induced by the irrigation practice, aims the elaboration of:

- the ***map of the potential salinization risk of the soils***, which provides information about the inherent risk of salinization of each type of soil of the Grosseto Plain because of their chemico-physical characteristics and their spatial distribution;
- some aspects of the ***climatological scenarios*** of the Grosseto Plain, for evaluating the climatic risk of salinization of the soils through the valuation of the soil salt leaching effect of rainfall;
- an ***agronomic instrument*** for the management of soil salinity and saline water irrigation, of simple and immediate use for farmers, useful for policy makers too, which is based on quantitative data for soil, crops and irrigation water, and that provides information about the yields expected, the irrigation crop water requirements and the leaching requirements for maintain a good salt balance in the soil.

The work methodology and the experimental plan involves:

- ***soil investigations: sampling and analysis of soil***
- ***climatological analysis***
- ***agro-climatic elaborations***

Soil investigations. The basic information for soil investigations is represented by the pedological cartography available for the study site. According to the “Soil map of the Grosseto area, scale 1:50.000” (University of Amsterdam, 1986), upgraded with the “Soil map of Tuscany, scale 1:250.000” (Regione Toscana, 2004), for each type of soil of the map, samples are taken for laboratory analyses to determine the chemical (reaction pH, electrical conductivity), physical (bulk density, texture) and hydropedological (hydraulic conductivity, field capacity, wilting point) characteristics of soils related to salinity and salinization. The field investigations are carried out following the FAO guidelines (FAO,1990), while the chemical and physical analysis of the soil are performed according to the “*Official methods of soil analysis*” of the Italian Ministry of Agriculture and Forestry (MiPAF, 1994).

Soil sampling. Three frames of 30 by 30 cm of soil depth by hand-augering are taken for each sampling location. For the determination of bulk density, field capacity and wilting point, a volume of 100 cm³ of soil is taken from each depth of soil using the excavation method with metal cups.

Texture analysis. The particles composition of soil, expressed as the percentage contents of sand, silt and clay, is determined with the pipette method or by densimetry with the Bouyoucos' hydrometer. The soil texture is classified according to the USDA-FAO textural classes.

Bulk density analysis. It is the mass (weight) of the unit volume of oven dry soil in the state of natural aggregation including the pore spaces, expressed as g/cm^3 or t/m^3 of soil.

pH analysis. The pH shows numerically the soil reaction degree and the analysis consists in a potentiometric determination of a water-soil suspension in distilled water with 1:2,5 ratio.

Salinity analysis. The salinity diagnosis of the soil is performed with the determination of the electrical conductivity of a water-soil suspension (expressed as mS/cm) using the conductivity method in distilled water with 1:5 ratio.

Hydraulic conductivity. It is the easy with which water penetrate or pass through a bulk mass of soil, expressed as mm/h . It is determined using the SPAW pedo-transfer function elaborated by the US Department of Agriculture (USDA, 2006).

Field capacity. The amount of water which can be held by soil in its capillary pores against the gravitational force, expressed as % of the soil volume. It is determined by Richards' apparatus at a pressure of 33 kPa.

Wilting point. The amount of water holds by soil in its capillary pores that can not be absorbed by plant roots, expressed as % of the soil volume. It is determined by Richards' apparatus at a pressure of 1500 kPa.

Climatological analysis. The climatic risk of salinization of the soils in the Grosseto area is investigated analysing the climatological data of the 50-year long period 1956-2005 at the meteorological station of Grosseto (altitude 5 m, latitude $42^\circ 45' 58''$, longitude $17^\circ 0' 54''$).

Three climatological parameters are considered: evapotranspiration, rainfall and the Climatic Water Balance. Other than the annual values, these parameters are analysed for different seasonal aggregation of the climatic data: the dry season (April to September), the wet season (October to March), the spring season (March, April and May), the summer season (June, July, August), the autumn season (September, October, November) and the winter season (December, January and February).

The statistical analysis of the annual and seasonal values of the climatic parameters are performed with the Linear Regression procedure.

Agro-climatic elaborations. For the most important irrigated crops of the study area (sugarbeet, purple alfa-alfa, maize, melon, pepper, tomato, soybean, peach-tree), crop water requirements are estimated from climatological data according to the FAO methodology, and as a consequence the quantity of water to be applied for irrigation is assessed. The climatological data of a 50-year long period (1956-2005) are

provided at the meteorological station of Grosseto, and includes daily measurements of rainfall, temperature, humidity and evaporation.

The agro-climatic elaborations, according to the FAO procedure, are based on the reference or potential evapotranspiration (ET_o) values and different cultural coefficients (kc) for crop and phenological phase.

References

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