

The effect of salt toxicity on soil pH in the northern region of Tébessa (Aouinet, Morsot, Boukhadra) Algeria

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Abstract: This work is the subject of a study of the pH variability of saline soils of the North Tébessa region (Morsot, El-Aouinet, Boukhadra).

In the experiment, soil salinity assessment was performed for the nine samples from the study area (from South to North). We noticed through the results, that the salinity of the soil varies from one region to another, the highest rates are recorded in the area of El-Aouinet and the lowest were recorded in Morsot, May with regard to the acidity of the soil, the results are similar. By comparing the results of the sample analysis, the effect of electrical conductivity, soluble salt level and salinite on soil pH was not observed, so the soil acidity is not affected by the salinity.

Keywords: soil electrical conductivity, soluble soil salt, soil salinity, soil acidity, North Tébessa, Algeria.

INTRODUCTION

In arid and semi-arid ecosystems, strong water evaporation results from soil (Munns et al, 2006), and irregular and insufficient rainfall (Mezni et al, 2002).

It also comes from irrigation, which is often poorly controlled (Ben Naceur et al, 2001). According to Servant (1986)

In natural conditions, the climatic conditions (precipitation, evaporation) differentiate descending, ascending or complex vertical dynamics that characterize the saline profiles of halomorphic soils (Loyer, 1988). three million two hundred thousand hectares are subject to varying degrees of severity of salinization, much of which is located in the steppe regions, where the salinization process is more marked because of the high temperatures for most of the year as well as the lack of efficient drainage.

In Algeria, there are no reliable and accurate cartographic studies delineate areas affected by soil salinity and quantification of salt content in the soil, nevertheless there are some fragmentary data that give a general idea on the phenomenon of salinity and land degradation. According to Szablocs (1989)

In this subject, there is a presentation of the electrical conductivity and TDS compared to the ground Ph of the northern region of the Tébessa collapse basin, located between two municipalities (Morsot and El Aouinet)

1. Material and method:

1.1 Equipment

1.1.1 Region of study

Soils in the arid lands of grasslands as a result of management change that affect the abundance and movement of water and salts in the rhizosphere, several other factors contribute to the regulation of processes: topography, the content of parent rock salt, underlying layer geology and hydrology .

Geographic

The study area is located in the extreme east of Algeria at the edge of the desert, about 230 km south of Annaba on the Mediterranean coast, the region is limited to the south by the wilaya of Eloued to the west by that of constant and to the East by Tunisia. (Fig 1).

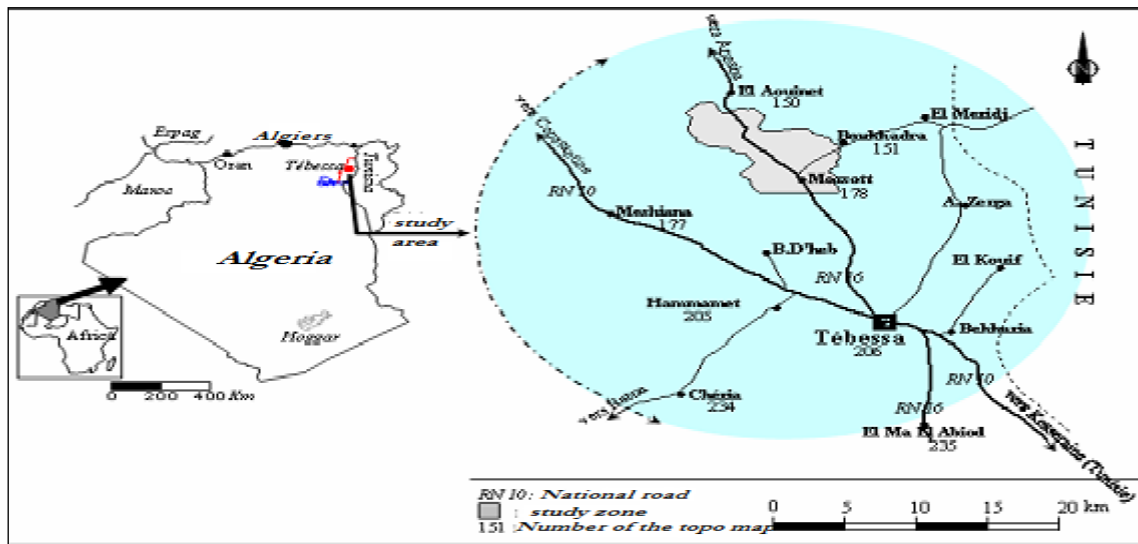


Fig 01 : Geophyque location of the study

Geological

This zone is limited to the north by the city of El Aouinet to the south, this is the Tébessa Morsott collapse basin, to the east this study zone is confined by the municipality of Boukhadra to the west by the basin of Miskiana. (Fig 2)

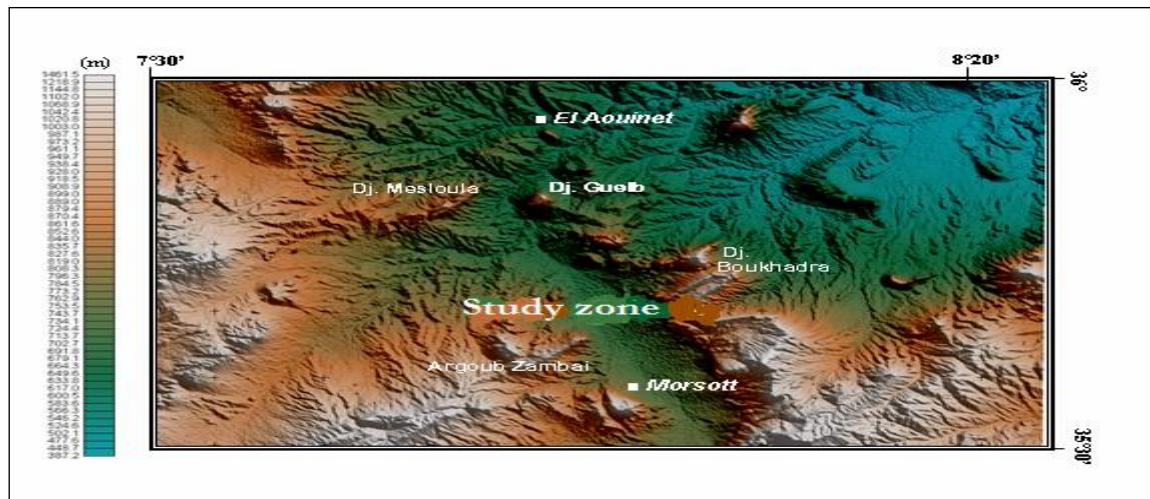


Figure 2: Topographic map of the study area (digitized by the O.R.G.M on

Mapinfo from topographic maps at 1/50000)

The hydrography

The hydrographic network is well developed and represented with small temporary streams with broad and well-developed valleys, flowing into large wadis, the most important of which are Oued Mellegue and Oued Chabro.

edaphic

The distribution of soils being generally very heterogeneous, moreover, if we consider salinity as a regionalized variable Rezkallah, et al (2014).

Measuring points located above characterized by a successive accumulation of salts in depth, those which are located an accumulation of salts on the surface (job, 1987).

1.2 Method:

1.2.1 Sampling

A series of sampling of the nine random soil samples was carried out on a Compagne in all the study stations; (Figure.03).



Figure 03: Soil sampling map of the study area

Soil sampling in this study consists in exploiting the main parameters that characterize each type of subterranean soil and which are represented on the sampling map of the region (Figure 03), the soil samples were taken to a depth of (0-30 cm), The choice of this depth is dictated by the fact that it is the part of the soil where the roots thrive by fixing the plant on its support and feeding it in different factors of plant growth. The nine soil samples were dried, crushed and sieved to 2 mm.

Characterization of soil salinity usually focuses on the determination of the ionic composition of the solution of an aqueous soil extract (Halitim, 1988).

These salts can also be assayed in more dilute aqueous extracts (1/5 and other soil / water ratio); and extraction is faster and consumes less land (Mathieu and Pieltain, 2003).

In order to achieve this goal, the soil analyzes are carried out at the water and environment research laboratory, University of Tébéssa and CERAD FERPHOS laboratory of Tebessa

In this context the study area is characterized by outcropping of evaporitic formations, which in contact with water and through dilution give the waters an excessive salinity up to the non-utilization of this resource.

1.2.2 Parameters studied

The different analysis methods used for the soil (saturated paste extract) and well water, on the saline balance are as follows:

- Electrical Conductivity (EC) through the use of Conductivity Meter.
- Acidity of the soil (pH_{water}) by the use of pH meter.
- Dissolved salt level (TDS) through the use of multiparameters.

Statistical study of the data

The averages of the variables measured on the different sampling areas were subjected to a correlation analysis, between the different variables measured, using the XLSTAT software.

2. RESULTS AND DISCUSSION

2.1 Geochemical characterization and identification of salinity parameters of collected soils

In the northern part of Tebessa, edaphic salinity is expressed with different degrees, whether it is a salinity of origin or a salinity by irrigation, we will study them in general and we will illustrate by typical situations recognized in the field.

The detailed cartographic study could not be carried out, which would have allowed a more detailed census of the different types of soil and their situation in the geopedological landscape. However, the field survey was long and thorough, resulting in a large number of profiles and a summary of the most representative types. This inventory makes the state of the soil salinity during the year 2013.

2.1.1 Electrical conductivity ($\mu\text{S} / \text{cm}$) and dissolved salts (mg / l)

The results show that almost all samples exceed the recommended standard for agricultural soils. Areas of high mineralization are located almost in all parts of the study area, especially at the eastern and northeastern edges, while low mineralization values are located in the southern part of the study area on the eastern side. of Morsot (Figure 04).

From a quantitative point of view, and according to Job et al (1981), the volume of soil explored is adjustable but the system is cumbersome, the conductivity of only a few dm^3 is measured, a salinity gradient of $6 \text{ mS} / \text{cm}$ for the studied soil this corresponds to 0.006% in volume NaCl, the measurement points situated above characterized by an excessive accumulation of salts at depth and the accumulation of surface salts due to evaporation.

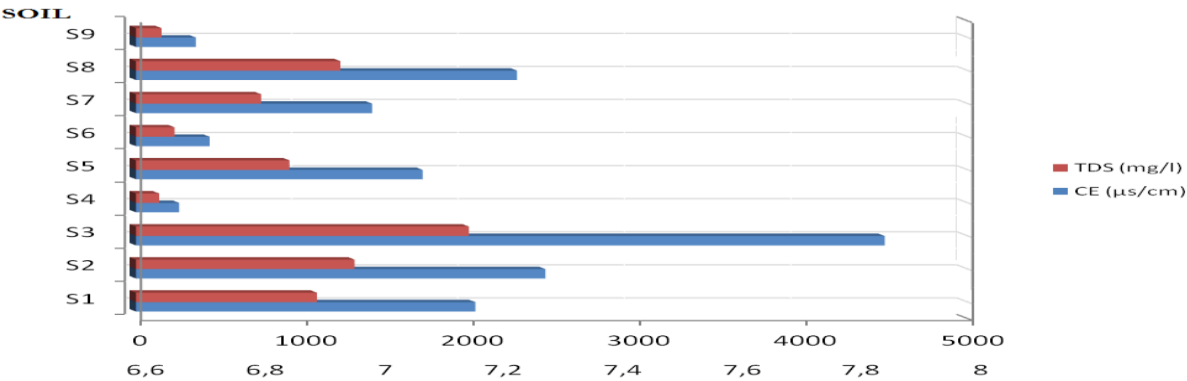


Figure 04: Variation of electrical conductivity (EC) values and the rate of dissolved salts (TDS) in the soil of the study area

In the East (Jebel Boukhadra), Central and North (Jebel Mesloula and Jebel Belkfif) parts, the influence of the Halite-rich triassic saline soils is strongly felt. An increase in the global mineralization of soils reaching an equal conductivity value is noted. at 4500 $\mu\text{S} / \text{cm}$ at sample level S3.

Moving further upstream (Morsott region), the influence of the Trias is amortized, the overall mineralization decreases, the conductivity between 259.75, 360 and 443 $\mu\text{S} / \text{cm}$, at the level of the samples S4, S9 and S6 mark a decrease in electrical conductivity (Figure 05).

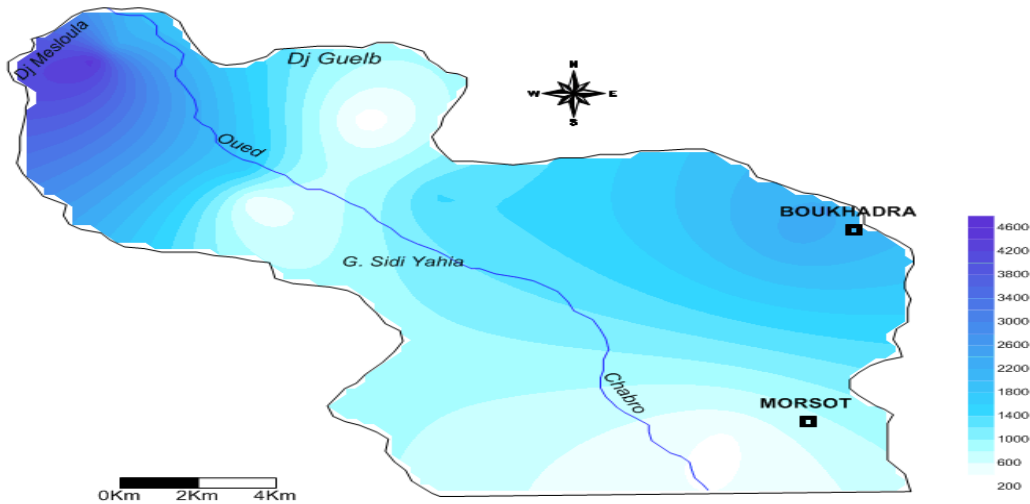


Figure 05: EC Electrical Conductivity Map ($\mu\text{S} / \text{cm}$) of soil in the study area

The same remark for the TDS results at the S3 sample for 2000 mg / l , the overall mineralization decreases at the S4, S9 and S6 samples (Figure 06) with TDS of 139, 153 and 232 (mg) respectively. / l).

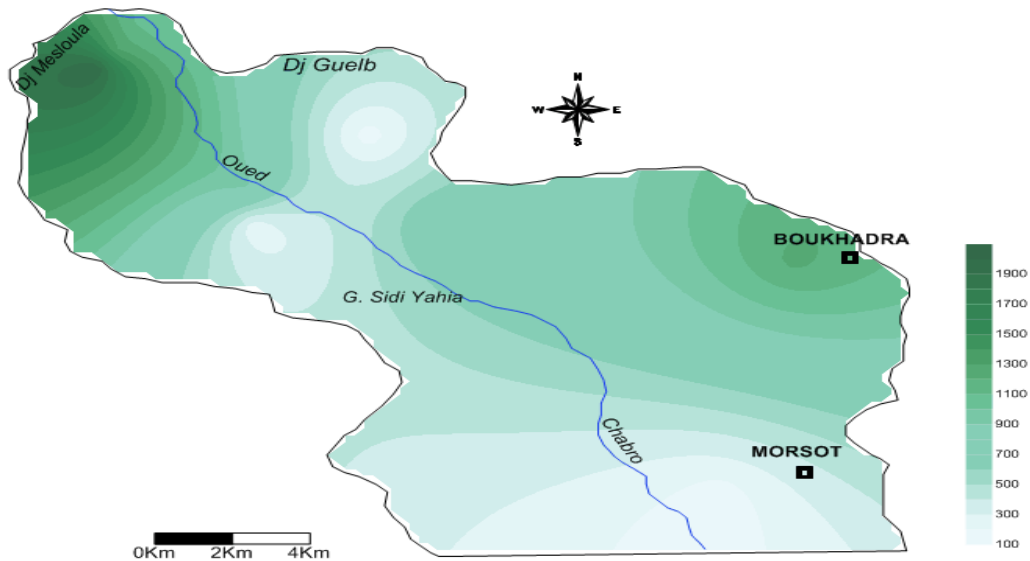


Figure 06: TDS soluble salt content map (mg / l) of the soil of the study area

The same for salinity, the results show an increase of samples S3, S1, S8 between 2.6, 1.3 and 1.2 mg / l successively, while at the level of samples S4, S9 and S6 the salinity is decreasing, translated by the influence of the carbonate formations of the curbs and those of the Cenomanian and Turonian marly soils (Figure07).

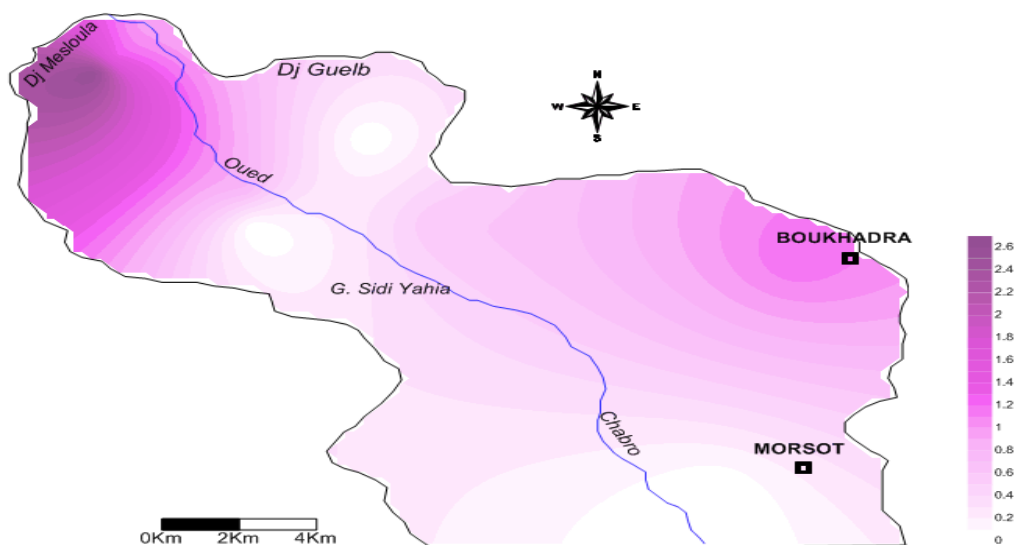


Figure 07: Salinity map (mg / l) of the soil of the study area

2.1.2. PH

The pH is defined as the activity of the hydrogen ion of a water at 25 ° C, when the pH is equal to 7, the activities of H^+ and OH^- are equal ($H^+ = OH^- = 1 \times 10^{-7}$). The pH value depends on the constant temperature pK, as shown in the following formula: $pH = pK - \log C_{Ca} - \log CHCO_3 + \log f(t)$

Where: Pk: the constant temperature, C_{Ca} and CHCO₃: concentrations in meq / L.

f (t): the correlation factor that depends on the ionic strength.

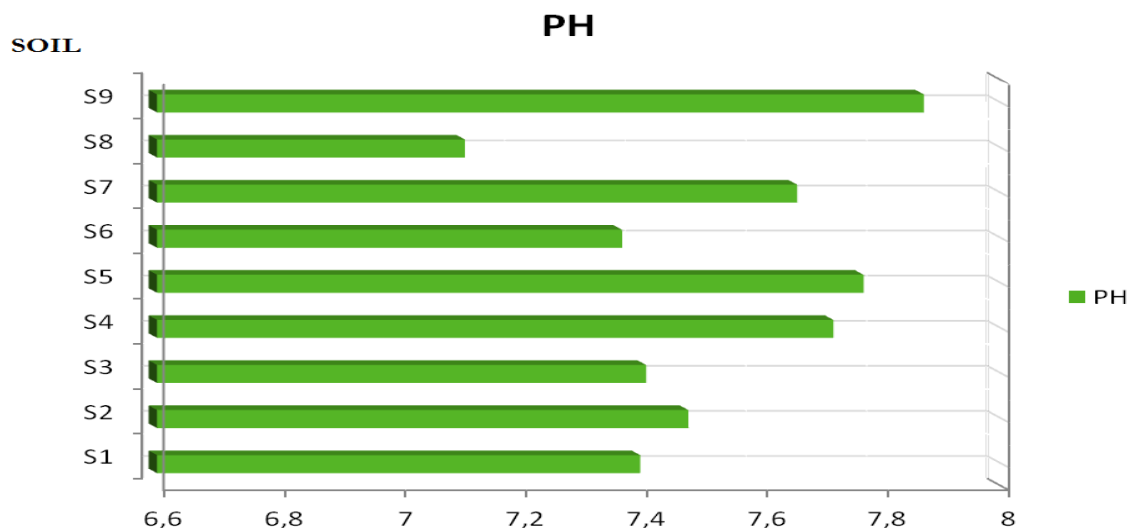


Figure 08: Variation in soil pH values in the study area

Figure 09 gives the information that going from the South to the North of the studied area, we note that the pH values are a little heterogeneous and very close on all the profiles. Neutral values are in the range of 7.11 to 7.87. According to Tessier et al (1996) the strong acidity and the minerals of the soils can be partially dissolved, the dissolved salts TDS and the pH give a very precise information on the state of acidification of the soil.

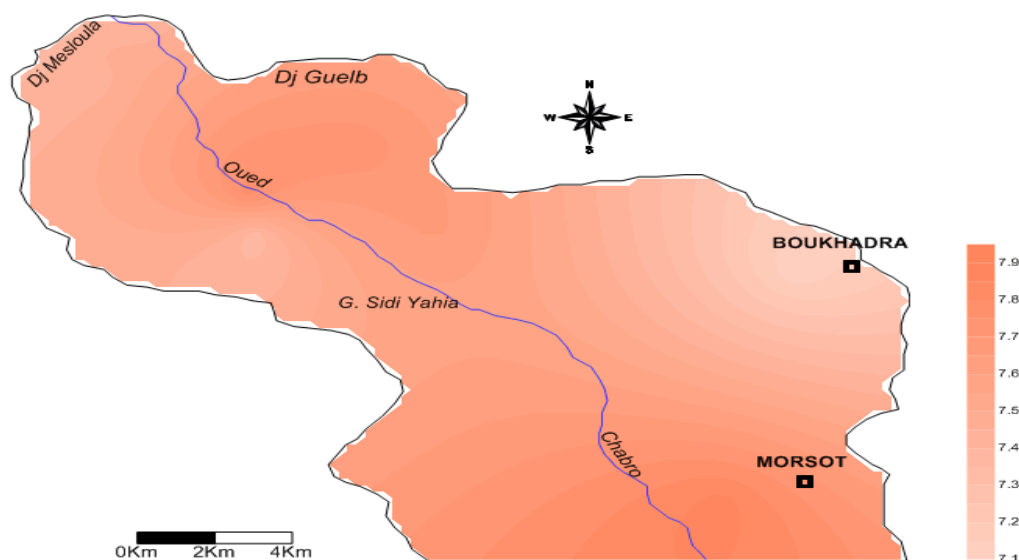


Figure 09: Acidity pH map of the soil of the study area

2.1.5.3. Inter-element correlation statistical analysis

Climatic factors such as low evaporation and precipitation and the nature of the source rock, as well as edaphic conditions, influence the mechanisms of soil chemistry.

For a better characterization of these mechanisms and their evolutions, statistical analysis was carried out by correlation of the various parameters analyzed during the whole period of investigation (conductivity, TDS, salinity, and pH).

The correlation coefficients of electrical conductivity with respect to TDS, Salinity, PH were calculated and the results are shown in Table 01

Table 01: Correlation coefficients of soil analysis

Variabls	CE	TDS	Salinité	pH
CE	1			
TDS	0,990	1		
Salinité	0,999	0,985	1	
PH	-0,475	-0,516	-0,469	1

Observation	Classe
CE	1
TDS	1
Salinité	1
PH	2

The electrical conductivity of the different samples shows a good correlation with TDS and Salinity, where the correlation coefficients vary between 0.985 and 0.999, these high values indicate the direct contribution of the ions in the salinity of the soils.

PH is not correlated with salinity elements.

We point out that there are weak and strong correlations between the elements, thus these elements divide into two (02) different classes (C1, C2), according to their degree of correlation.

3. Conclusion

The variety of soils at the scale of a study area implies that the management of soil heritage in relation to salinity problems can not have a single answer.

The results show that the salinity parameters (EC, TDS, Salinity) for the characterization and development of salty soils, make it possible to overcome the problem of the heterogeneity of

the distribution of salts (cation and anions). in the ground ; these advantages can be exploited provided that pH measurements are made.

The variety of soils at the scale of a study area implies that the management of soil heritage in relation to salinity problems can not have a single answer.

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