Measuring the Electrical Conductivity of Soils Located in the South of the in Cost Line

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Abstract:

The laboratory analysis provided the ideal approach for the investigation of the validity of the information which was obtained previously. This research used a laboratory equipped with the necessary tools and adhering to laboratory safety requirements, in order to save the samples during the process of laboratory analysis. The samples were collected randomly from different regions and directions in the study zone, to measure the rate of electrical conductivity (which refers to the level of salinity in the soil), by using a German device made in 2005. This type of equipment is designed for scientific purposes. With the help of the team

from the Institute of Technology in Libya, the testing of the samples took exactly four months. The soil samples that were collected could be sent to a laboratory for full analysis, which would identify a wide range of soil properties, including salinity. Regular soil tests would monitor the condition of the soil, and enable better land management decisions.

Introduction

Soil salinity in irrigated areas is becoming a serious problem for agriculture, especially in arid and semi-arid climates. Saline soil conditions have resulted in a reduction of the value and productivity of considerable areas of land throughout the world. Salinity commonly occurs in irrigated soil, due to the accumulation of soluble salts introduced from the continuous use of irrigation waters containing high or medium quantities of dissolved salts. Saline soils are characterized in general by poor ventilation due to the presence of a high water level; these soils are also very poor in organic matter content, with a percentage not exceeding 0.5%. Thus, this soil has become a major problem in the agricultural activity, and could not be used for farming except under extreme circumstances, after reclamation by washing and drainage. Thus, it would be useful for agriculture sector if soil salinity could be identified and mapped highly and at low cost (Ahmed , 1989).

However, soil EC measurements also have the potential for estimating variations in soil physical properties where soil salinity is not a problem, including texture, moisture, depth of top soil plus others. The important aspect to remember is that anything that affects conductivity in the soil will influence measurements, so it is important to ground reference to understand the driving variable(s) for soil EC measurements. Agriculture Technology Providers (ATPs) and Precision Ag Services use soil EC sensors to generate EC variation maps using them as base spatial layers for site-specific management of inputs, practices or other management decisions. This fact sheet serves to provide growers and consultants with an overview of soil EC sensors and potential use within Precision Ag programs.

Factors influencing soil Ec measurements

Libya is arid and semi-arid, and soil salinity is a natural phenomenon where the rate of accumulation of salts resulting from the evaporation of rain water is greater than the amount of precipitation it is unlike regions with wet climates. Although there have been many different studies of the soil in the mentioned area, in terms of soil classification, the issue of soil salinity has received little attention from geographers.

Soils in Libya are: inceptisols and entisols (49.1 %), aridisols (11.5 %), salorthids (10.7 %) and sandy soils (Atiah, 2005). Sandy soils bear more developed vegetation, with more regular and higher primary productivity than finer textured soils. Thus, profitably and commercially cultivated rain-fed olive orchards are grown on deep sandy soils under as little precipitation as 200 mm/year in the Tripoli area, although this is not possible without additional runoff to complement silt soils (ACR, 2004).

This type of soil is prevalent in the studied area, characterized by sandy textures, where the percentage of sand is more than 85%. Sandy soils formed as a result of sediment wind, they typically have very low water-holding capacities, are extremely low in all essential nutrients, most especially phosphorus, and are highly acidic in all except very arid climates (Alhkidy, 1989). This type of soil develops under semi-arid climate conditions, with an average annual amount of precipitation from 200-400 mm and mean annual air temperature of 18-21°C

Location of the study area

Study area located in the northwestern part of Libya, Al-jafarah plain is considered valuable farmland; it is a region of economic attraction as it functions as the agricultural backbone of the entire region, and it is densely populated. The studied area is confined to the northern part of Al-jafarah plain, between the longitudes of 11° 15´ 14° 00´ and latitudes of 32° 00´, 33° 30´ to the north, It extends in approximately a rectangular shape, from Al-khoms to Ras-Gedair. Figure1.1

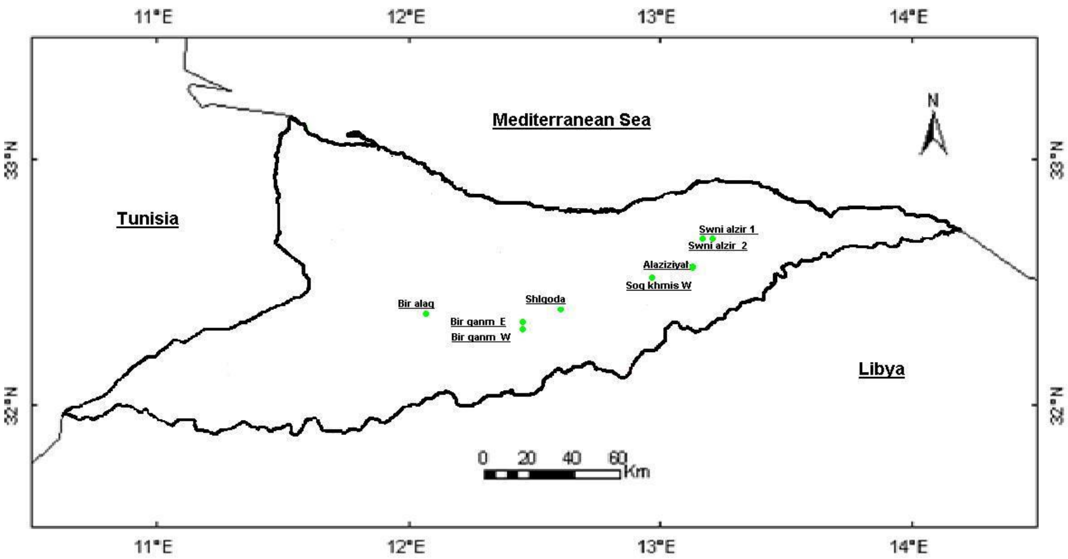

Figure1.1 location of the study area

Al-jafarah plain is arid and semi-arid, and soil salinity is a natural phenomenon where the rate of accumulation of salts resulting from the evaporation of rain water is greater than the amount of precipitation it is unlike regions with wet climates. Although there have been many different studies of the soil in the mentioned area, in terms of soil classification, the issue of soil salinity has received little attention from geographers.

Methodology:

Sample of soil salinity selections The approach presented in this study involves integrating spatial analysis to predict soil salinity. The selection of the sampling points was carried out by using the Global Positioning System (GPS). 8samples were selected since according to Agriculture Centre, 2005, samples are sufficient to represent the region, soil salinity data was collected in the field, at Aljafarah. A total of 8 locations were identified.

Samples were randomly collected before the irrigation season (May-August, 2021) from the 10- 50 Cm surface soil layer, to get real soil, and to avoid the effects of fertilizer and irrigation water which result in the concentration of nutrients, salinity was performed with three replicates of each sample.

Steps of the laboratory analysis

According to the Libyan laboratory standard procedures (Centre of Water and Soil, 2010) and the Agriculture Centre, 8 random samples of the different regions of Al-jafarah Plain were taken before the irrigation season, using CPS, and analyzed for electrical conductivity to detect salinity. The Al-jafarah Plain was divided into 8 units, and all the areas sampled were mapped and numbered.

The materials used for the study included:

1-Distilled water 2-Plastic spoons

3- Paper towels 4- Electric oven

5- Electric heater 6- Sieve

7- Electrical Conductivity device

The study used a (HAAN) device to measure the electrical conductivity of soil salinity by measuring the electrical conductivity ratio, which was made in Germany in 2005. Measurement of the 8 samples took place about three months before the irrigation season to ensure accurate measurements were taken. All samples were tested in the lab for measuring electrical conductivity ratio .

Electrical conductivity device has a display and data processing program and it allows the transfer of measurement data on soil salinity. The device contains a cable with an index to measure salinity, allowing it to read the data within a few seconds (Photo1.1).

Photo1.1 Electrical conduction equipment

Laboratory analysis steps took place as follows:

1- Soil samples were collected from a depth of 10-50 Cm in a random sample for the 60 samples (Photo1.2). Each sample was numbered by a serial number in order to avoid confusion at the analysis stage. Items such as a shovel, bags, plastic cups, and paper were used to number the samples during the process of withdrawing them.

Photo1.2 Collection of soil samples from a depth of 10-50 Cm

2- The soil collected was cleaned from stones and plant residues. The samples were dried aerobically in the laboratory for three days, to prevent microbiological activity

Photo1.3 Process of drying the samples

3- The soil was grinded by a mill made of steel, and after that passed through a sieve with 2 mm pores to produce a fine soil, to avoid impurities and obtain a homogeneous soil.

4- The vine was weighed in order to subtract the total weight from the soil, to get the weight of the soil.

Photo1.4 Weighing the vine

5- 50 grams of dried soil was extracted to be added to 50 CM³ of distilled water at a 1:1 ratio and heated using an electrical heating device

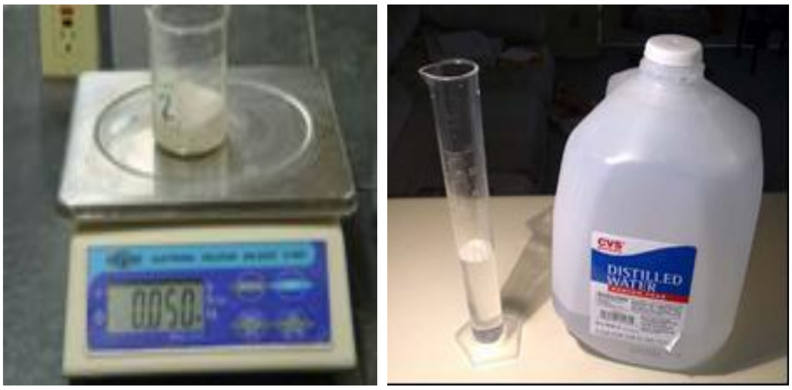

Photo1.5 Distilled water

6- The sample was shaken well, and left long enough to obtain deposits from the solution.

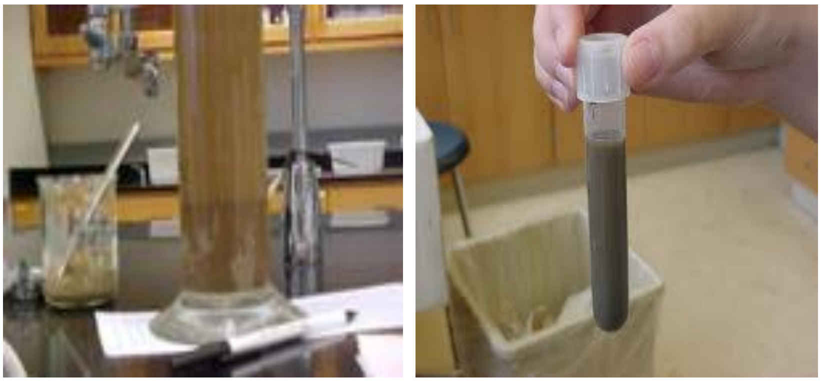

Photo1.6 Shaking the sample

7- Samples were heated using an electric furnace at a temperature of 250C, for the homogeneous mixture, and prepared to measure the conductivity ratio.

Photo1.7 Heating of samples

8- The solution was left for a few minutes before testing. The salinity device was placed in the solution and the display was read when it had stabilized. The device electrodes and sample jar were washed with distilled water and dried

Photo1.8 Measuring electrical conductivity

The results have obtained from laboratory analysis will be shown in the results.

Results and discussion of laboratory analysis

Results of the laboratory test indicated that the value of electrical conductivity in most of the study area was less than 2 dS/m, and that the Al-jafarah Plain is not classified as saline soil land. There were differences in the percentage of salinity in the soil; the results also showed that there was no increase in the percentage of salt in the soil from east to west or north to south. Results of the laboratory analysis are recorded and compared according to The standard used in the classification maps of salinity in the following table 1.1.

Degree of salinity	Degree of electrical conductivity dS/m
Non-saline	0-2
Slightly saline	2-4
Medium saline	4-8
High-salinity	8-16
Very high-salinity	>16

Source: Agriculture Centre, Tripoli, 2004, 2005

According to Agriculture Centre, (2005), Karim, (2001) . Samira ,(2012), the soil samples near from the sea about 1-3 km were recorded high electrical conductivity compared with the samples that far away from the sea over a distance of 10 km. In this study high electrical conductivity values were recorded in several cities as result from its location that near the sea in the northwestern coast. The most intensive process of salt accumulation and saline soil formation were observed within the close depressions of the coastal plain. The main sources of salt, such as marine (that is, sea water penetration) and the accumulation of salts in soil may be distinguished. The following table shows the locations and coordinates the samples near from the sea about 1 km with spatial coordinates.

However, there was no a difference in salinity between the cities, as shown by the next table 1.1with the same samples that have been presented in the last two maps. In addition, the absence of gravel and stones on the surface should be noted, and some of the content on the white crust also differed in hardness from the crust, as in the Anakazh, Birqanm, Alaziziyah , and SoqkhmisW samples.

Table 1.2 Results of Electrical Conductivity 0f some samples away from sea more than 50 Km

Site	Depth/cm	Electric conductivity dS/m	coordinates latitudes	Coordinates longitudes
Bir alaq	10	0.20	32° 18´	12° 03´
Anakazh W	50	0.37	32° 40´	14° 06´
Alaziziyah	30	0.21	32° 31´	13° 01´
Bir qanm W	50	1.13	32° 17´	12° 34´
Bir qanm E	20	1.16	32° 18´	12° 34´
Swni azir 1	10	0.28	32° 44´	13° 04´
Swni azir 2	20	0.27	32° 42´	13° 04´
Soqkhmis	10	0.26	32° 31´	13° 13´

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