Plant Archives Vol. 20, Supplement 2, 2020 pp. 4020-4024 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

PREPARATION OF SPATIAL DISTRIBUTION MAPS FOR SOME CHEMICAL PROPERTIES OF SOILS IN AL–KIFL REGION IN BABYLON GOVERNORATE USING GEOGRAPHICAL INFORMATION SYSTEMS

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Abstract

The study area is located in the Kifl district of Babylon governorate, which is about 30 km south of the city of Hilla, the center of the governorate, with an area of 49981.5 hectares, and it is located between the longitude lines 44°21'0.00" to 44°31'0.30"east and two latitudes 30°11'0.00"to 32°27'0.00", most of the region's land is abandoned due to its vulnerability to salinity, and the other part of it is dominated by agriculture, this study aims to prepare spatial distribution maps of some chemical traits using geographical information systems**.** Soil samples were obtained from 50 sites from the depth 0 - 50 cm by the method of networking of the study area and then revealed 6 pedons representing the area and described its horizons and a fundamental morphology description and then samples were obtained from each horizon for the purpose of conducting the necessary laboratory measurements**.** The results of the study indicated that the soil is deep in all locations, and the percentage of organic matter in the soil of the study area ranged between 0.32 - 1.7%. The results also indicated that the saline content is varied, as the electrical conductivity values ranged between 2.6 - 20.12 dS^{-1}. The reaction of the soil ranges from 7.3 to 8.1 The values of the reciprocal amplitude of positive ions in the soils of the study area ranged between 15.1 - 30.6 Col+kg^{-1}. As for the ratio of the mutual sodium ranged between 0.65 - 28.57% and the total carbonate levels were high, they ranged between 19.1 - 31.1%, and the gypsum ratios ranged from Between 0.07 - 7.98%**.** The study soils were classified as the Entisols under the Typic Torrifluvents, and they were also classified according to the series classification, as the soils took the order of the following chains: MM11, MD116, DW115, DM97 and MM9, DF97

***Keyword*:** Chemical properties, Geographical Information Systems, Spatial Distribution.

Introduction

This requires the integration of information related to both Earth and its use, and the climate (AL-Moshraki *et al.*, 2011), and for the sake of information integration, an effective tool or means should be available that helps in building a strong, solid and discreet database to be a reliable reference for many researchers and those interested in agricultural planning for land uses and the preparation of useful maps. Geographical information systems that rely on the study of distribution and digital spatial analysis of different geographical features to be ready for retrieval, interrogation and production of maps. This effective technology helps support decision-makers for proper planning and efficient management.

Mousawi, 2001, indicated that the use of geographic information systems for future forecasting of problems facing soil and land use with the possibility of managing them properly. Foody, 2003 showed that traditional methods of land use maps are cost-effective and time-consuming, and with little accuracy and detail, so GIS methods are used for mapping **.**Pavei and Atila, 2004 used geographic information systems to produce soil maps for a number of regions in Serbia. The system contains several layers, such as agriculture, water and forest resource management, environmental resource protection, etc. These maps are important in protecting land and water resources, Khoram *et al.*; 2004 mentioned that GIS technologies enabled to display land susceptibility data and land classification data in a distinct way through its automatic and standard work in producing accurate maps compared to boring manual methods, and therefore it should be recommended to use them and count the future technology.

Moore and Tille, 2005 clarified that the results of the natural resource surveys are summarized in the survey report, description of soil pedons, land use information and final maps related to the status of similar groups from the land unit in the map unit and that the main use of the Earth resources maps is the spatial analysis of geographical data using the GIS program, As for (Fazal, 2008), it was defined as a system for capturing, storing, verifying, integrating, processing, analyzing and displaying data, which is spatially referenced to Earth with the participation of a computer database with spatial reference and application of appropriate software. Patel *et al.* (2008) indicated that modern means and modern technologies such as geographic information systems (GIS) provide a new and efficient dimension in monitoring and managing land resources in an integrated agricultural environmental manner, as these technologies play an important role in the land assessment process for the purpose of sustainability due to the multiplicity of stages Integrated method for assessing lands. Therefore, the research directed to achieve the following goal, which is the preparation of spatial distribution maps of chemical properties using GIS.

Materials and Methods

The study area is located in the Kifl district of the Babylon Governorate, which is about 30 km south of the city of Hilla, the center of the province, and has an area of 49981.5 hectares, and is located between the longitude lines 44°21'0.00" to 44°31'0.30" east and two latitudes 30°11'0.00" to 32°27'0.00" as shown in Figure 1.

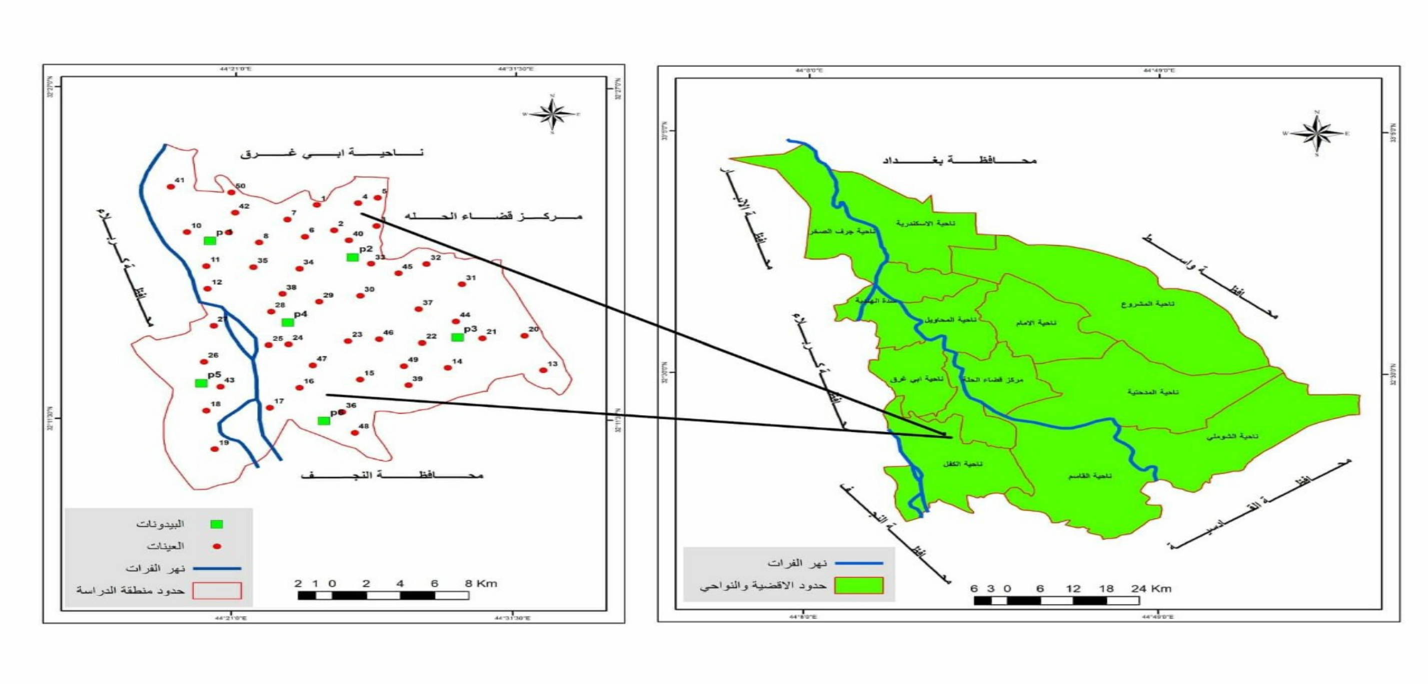

Fig. 1 : Map of the study area and the locations of the samples and the pedons

The study area is dominated by natural plants of *Prosopis stephaniana, Alhagi maurorum*, *Rumex dentatus, Cynodon dactylon* and *Imperata cylindrica*. These plants are an indication that the soil is of high salinity. As for agricultural crops, many of them are cultivated in the lands of the region, especially wheat and barley cereal crops, as well as the cultivation of jetties and vegetables, and the spread of palm trees in the region in a wide manner, then obtaining samples from each site to a depth of 0-50 cm, which is Depth, which represents the growth and penetration of the wall of most agricultural crops, as 50 sites were identified, including 6 bedouins distributed in various directions to cover the study area, and then the pedons prospects were described as a fundamental morphology description according to the modern system (Soil Survey Staff, 2010).

The samples were taken and preserved in nylon bags, then dried at room temperature, crushed and sifted with a sieve with a diameter of 2 mm, and transferred to the Faculty of Agriculture laboratory at Al Qasim Green University to carry out the necessary chemical measurements on it. Since the electrical conductivity ECe and the pH soil reaction in the soil paste extract were calculated according to the method mentioned in Richards, 1954 And the organic matter was estimated by a method of wet oxidation and according to Jackson, 1958, the percentage of calcium carbonate minerals was estimated using acid (HCL1m) and the remaining pulverization of the acid by N (NaOH 1) according to Jackson, 1958 and CEC was estimated by the method of sodium acetate as mentioned In (Bashour and Al-Saegh, 2007).

A database was created for the study area, as the metadata that was obtained laboratory was linked to the existing spatial data, as the soil characteristics were entered in the Excel 2010 release schedule. The Excel file table was called in the GIS environment by ArcMap 10.3, and the file was converted to a Point vector data format. The spatial completion method is used IDW technology in mapping and is the inverse distance method used when the characteristics change regularly, especially in the lands Flat and then calculate their areas and proportions.

Results and Discussion

Spatial distribution of the chemical properties of the study area soils

pH soil reaction

The results of Table 1 indicate that the soil interaction ranged between 7.3 - 8.1, as the soil of the study area is classified as moderate to light basal, and these ratios are suitable for crop growth.

As for the distribution of the characteristic of the soil interaction in the study area, the results of Figure 2 indicated that the soil whose interaction falls within the range 7.58 - 8.0 has occupied the largest area as it reached 41390.63 hectares and a rate of 83.53% of the total area of the study area, and the reason for this is that the study area is from the soil The sediment with a high content of calcium carbonate which leads to raising the reaction of the soil, followed by the range 7.46 - 7.56 in terms of area, as it reached an area of 6430.39 hectares and 12.98% of the total area of the study area.

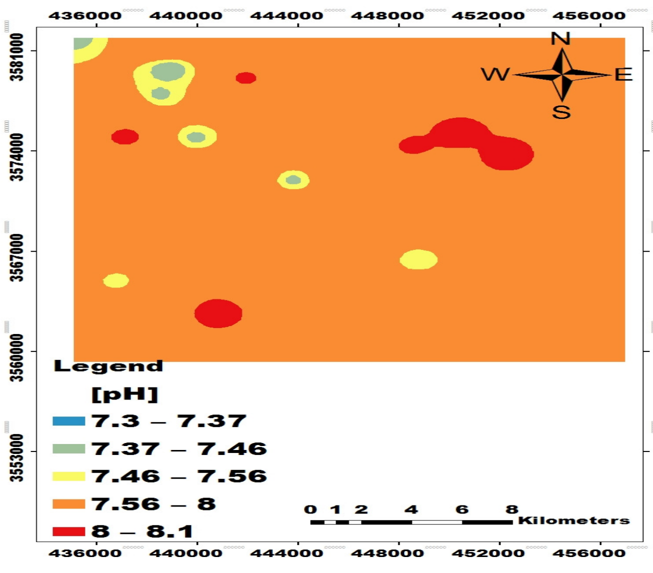

Fig. 2 : Spatial distribution of soil interaction in the study area

Electrical conductivity ECe

The results of Table 1 indicate the variation of the electrical conductivity values, as the highest value was 20.12 dSm^{-1} and the lowest value was 2.6 dSm^{-1}, as it is clear that the study area includes salinity affected soils in varying degrees depending on its location and the method used for agricultural purposes. The salts in the surface layer, as a result of the evaporation of the ground water from the ascending soil surface by capillary properties, so the salts accumulate in the soil surface, and this was confirmed by the results of Table 2 and Figure 3 as the electrical conductivity classes in the surface layer were on several varieties, as the class S3 occupied the largest area reached 43286.13 hectares, 87.35% of the total of the study area is located within the range 4-8 dSm^{-1}, followed by the class S2 as it occupied an area of 5284.06 hectares with a rate of 10.66% of the total area, followed by the class S4 with an area of 748.26 hectares and a rate of 1.51%, then the class S5 with an area of 196.04 hectares and the proportion 0.40%, and class S1 occupied the lowest area, as it reached 38.55 hectares, or 0.08% of the total area of the study area. The reason for the salinization of the soil is due to the conditions of dry climate, land blasting, low rainfall and low vegetation, as well as high levels of groundwater in some locations.

Table 1: Some chemical properties of soil in the study area

CEC	$CaCO_3$	OM	ECe	pH	Sample NO.
17.7	30.4	0.42	15.4	7.5	1
17.2	28.2	0.61	12.3	8.1	2
16.6	24.6	0.93	8.2	8.0	3
27.3	23.7	1.21	3.0	8.0	4
28.6	20.3	1.09	3.6	8.0	5
30.2	20.0	1.4	3.4	7.5	6
17.6	29.8	0.86	15.2	8.1	7
20.4	27.3	0.77	10.4	7.6	8
30.1	25.4	1.42	8.5	7.4	9
18.8	21.0	0.69	4.4	7.6	10
16.4	29.03	0.37	12.4	8.1	11
15.7	31.06	0.47	15.6	8.0	12
17.7	26.34	0.44	10.3	7.7	13
18.8	25.22	0.53	7.3	7.8	14
20.2	22.62	0.91	4.2	7.7	15
30.4	25.34	1.03	8.3	7.8	16
21.4	25.90	0.64	9.4	8.1	17
21.09	25.98	0.50	11.2	8.0	18
20.46	25.87	0.62	10.6	8.0	19
18.71	25.88	0.43	11.7	7.6	20
17.34	25.88	0.44	11.3	7.7	21
17.30	24.67	0.71	8.2	7.8	22
30.60	24.31	1.22	3.0	8.0	23
30.41	21.09	1.20	3.11	7.6	24
28.61	21.32	0.95	4.6	7.7	25
28.74	21.45	0.93	4.7	8.0	26
24.1	25.0	1.30	4.30	8.0	27
20.3	24.24	1.20	3.50	7.8	28
21.4	24.43	1.13	3.20	7.4	29
20.3	22.60	1.41	3.40	8.0	30
25.4	22.70	0.72	11.32	8.1	31
20.4	29.70	0.76	9.62	8.1	32
18.7	29.30	0.63	9.71	7.4	33
18.3	30.11	0.54	11.21	7.6	34
17.5	28.12	0.39	10.34	7.4	35
20.0	20.16	1.42	9.59	8.0	36
17.6	21.51	1.33	3.41	7.7	37
17.0	20.24	1.40	3.64	7.8	38
18.3	29.04	0.45	7.91	7.7	39
18.6	27.16	0.44	4.50	7.6	40
18.4	27.31	0.47	3.61	7.4	41
17.3	30.40	0.32	16.33	7.3	42
17.0	30.06	0.47	20.03	8.0	43
18.12	29.21	0.36	17.11	8.0	44
18.22	28.41	0.37	17.01	8.1	45
17.45	31.03	0.34	18.30	7.8	46

17.30	31.10	0.33	20.12	7.8	47
20.33	26.41	0.81	8.74	7.7	48
22.11	26.42	0.76	9.91	7.4	49
22.4	27.0	0.65	8.42	8.0	50
20.3	20.6	1.7	10.4	7.7	P1
22.4	19.1	1.44	9.8	8	P2
20.3	22.3	1.23	4.4	7.4	P3
20.4	20.4	1.41	15.2	8	P4
17.3	28.3	1.31	13.3	7.4	P5
20.6	20.7	0.98	12.2	8	P6

Table 2 : The areas and percentages of some chemical properties of the study area

Percentage %	**Area (Hectare)**	**Percentage %**	**Area (Hectare)**	**Percentage %**	**Area (Hectare)**	**Percentage %**	**Area (Hectare)**	**Percentage %**	**Area (Hectare)**
%	**CEC**	%	**$CaCO_3$**	%	**SOM**	%	**Ece**	%	**pH**
10.57	5235.75	0.12	58.49	76.21	37765.37	0.08	38.55	0	0
73.23	36286.81	2.84	1405.21	23.40	11596.23	10.66	5284.06	0.62	309.62
12.39	6139.27	22.76	11279.71	0.32	159.18	87.35	43286.13	12.98	6430.39
3.82	1891.21	73.98	36656.98	0.07	32.26	1.51	748.26	83.53	41390.63
0	0	0.31	152.65	0	0	0.40	196.04	2.87	1422.4
100	**49553.04**	**100**	**49553.04**	**100**	**49553.04**	**100**	**49553.04**	**100**	**49553.04**

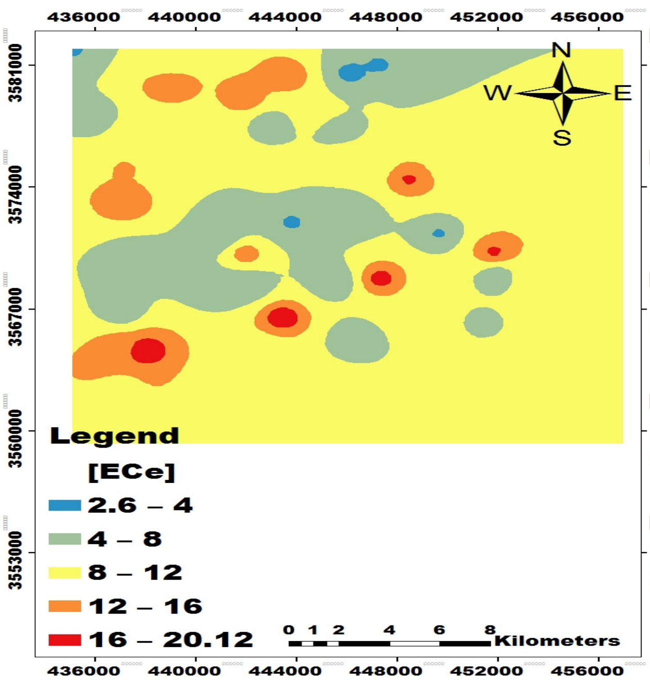

Fig. 3 : Electrical conductive spatial distribution in the soil of the study area

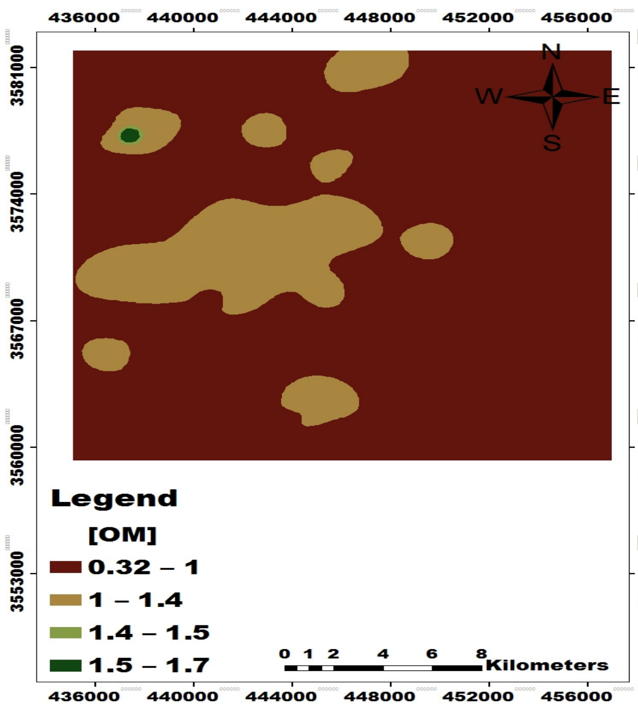

Fig. 4 : Organic matter spatial distribution in the soil of the study area

The organic matter in the soil

The results of Table 1 indicate that the content of organic matter in the soil is low as it ranged between 0.32 - 1.7 g kg^{-1}, as Table 2 and Figure 4 show that the range 0.32 - 1.0 occupied the highest area of 37765.37 hectares and at a rate of 76.21% of the total area of the study area, followed by the range 1.0 - 1.4 occupied an area of 11596.23 hectares, at a rate of 23.40% of the total area of the study area, followed by ranges with a higher content of organic matter, and this indicates the lack of cultivated areas and thus the weakening of fertilization processes that contribute to raising the content of organic matter, as this content is natural in soils Dry and semi-dry areas, as the soil content is of organic matter It is linked to the status of the climate and the type of natural vegetation and style farming practice.

CEC positive exchange capacity

The results of Table 1 show that the values of the CEC in the soil of the study area ranged between 15.7 - 30.6 cm + kg^{-1}, and these ratios are good because the soil has a medium-soft and smooth texture that contains quantities of clay that are proportional to the ratios of CEC, since this property has importance Great for plant growth, as it reflects the susceptibility of the soil to retaining nutrients and preparing them for the plant when needed, as Table 2 and Figure 5 show that the range 20-25 occupied the highest area of 36286.81 hectares at a rate of 73.23%, followed by the range 15.7-20 as it occupied an area of 6139.27 hectares and 12.39% Of the total area of the study area.

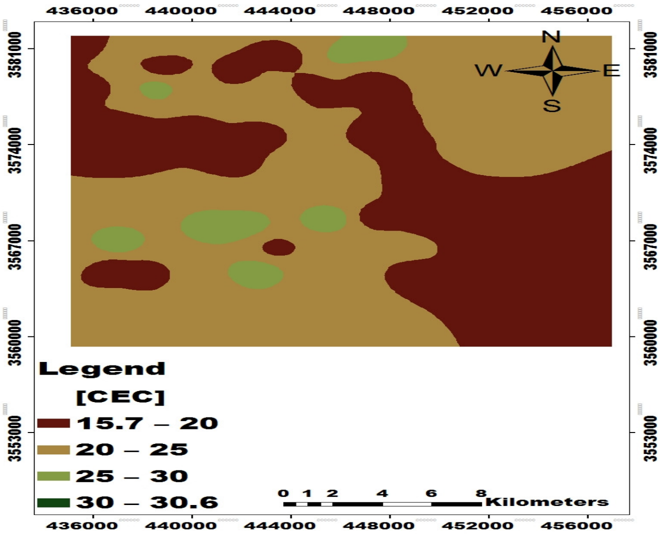

Fig. 5 : The spatial distribution of the reciprocal amplitude of positive ions in the soils of the study area

Total calcium carbonate

Table 1 shows that the calcium carbonate content in the study area ranged between 19.1 - 31.1 gm kg^{-1}, as Table 2 and Figure 6 show that the range 25-27 occupied the highest area of 36656.98 hectares and at 73.98% of the total area of the study area, followed by the range 23 - 25 occupied an area of 11279.71 hectares, 22.76% of the total area of the study area.

Carbonate minerals are among the important minerals found in soils of arid and semi-arid regions, as this mineral precipitates when the rains are limited or few, and its precipitation increases when the value of evaporation is higher than the amount of rain, in addition to the sedimentary soils most of which have a lime origin rich in carbonate minerals.

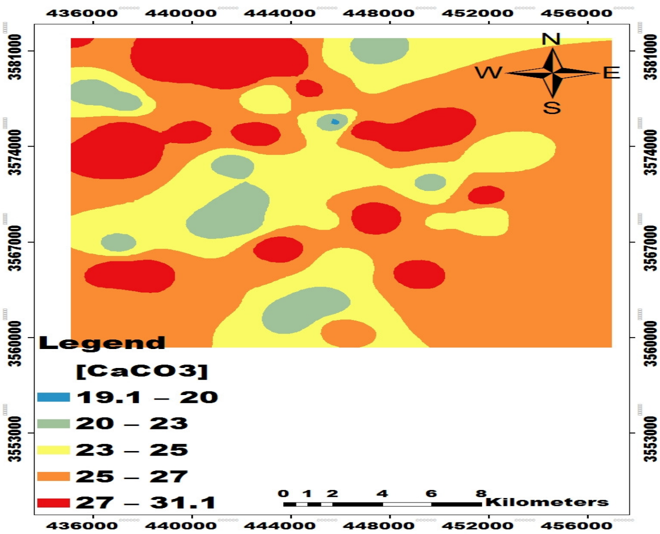

Fig. 3 : Caco3 spatial distribution in the soil of the study area

Conclusions

The soil of the study area has different chemical properties, and geographic information systems are considered an important means in mapping and preparing soil maps.

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