The characteristics of the western plateau soil and the environmental potential available for investment the soil in agriculture

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ABSTRACT

Soil is an important natural resource for the human being, through which the food crops needed by the human being are cultivated and the variation of soils varies from region to region, soils in Najaf are represented by soils of the sedimentary plain region and soils of the western plateau. The study specialized in studying the characteristics of desert soils and the environmental potentials available for investment in agriculture. As natural and human environmental factors greatly affect the diversity of the characteristics of the soil of the study area, as it became clear that the soil of the study area is characterized by its coarse sandy texture, its high permeability, its low containment of organic materials and the lack of salts therein. As well as the chemical elements and compounds that are within the permissible limits for agriculture, so these soils are good for agricultural production but on the condition that the organic material and water are also provided, as wells in the study area are distinguished by the increase of chemical elements and compounds above the permissible limits, therefore the use of well water will greatly affect the height of salts in the soil and also affects crop growth. Then water desalination systems must be available with the use of modern irrigation techniques of drip or spray to reduce water losses.

Keywords
Irrigation techniques, permissible limits, chemical elements, crop growth, organic material and water

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

The desert soils are one of the soils distributed in the province of Najaf, and there is a lot of these soils in the dry and semi-arid regions such as the Najaf plateau, and this is what made them acquire the characteristics that distinguish them from the rest of the types of soils, as they are characterized by their lack of water and their limited organic and are characterized by their alkalinity and low salinity in them. As well as the lack of availability of nutrients necessary for plants, which requires the addition of fertilizers and organic materials to raise soil fertility, increase agricultural production and improve its quality. The most important features that characterize the study area are the presence of one water resource, groundwater of both types (wells and springs). The province of Najaf is divided according to the diversity of the soil in it into two important regions, the region of the sedimentary plain, and in turn it is divided into the soils of river and river basins. As for the western plateau region, which represents the study area, there are several types of soils that are gypsum desert soils, gravel desert soils and sand dunes soils. These soils cover the southern and southeastern part of the governorate, and the Najaf plateau is considered an extension of the western Iraqi plateau within the lower valleys and plains of stones with a dry desert climate for most of the year, as this plateau constitutes (95%) of the Najaf governorate area, and extends from the western edge of the sedimentary plain until the southwestern corner of the border with Saudi Arabia. The desert soil was exploited after improving its chemical and physical properties and raising its fertility in establishing agricultural activity, and among the crops that are largely cultivated in the study area (tomato, cucumber and eggplant)

First: The Study Problem

1- Do natural environment factors have an impact on the soil of the study area?
2- What is the agricultural reality of the study area?
3- Are there environmental capabilities available for cultivating desert soils in the study area?

Second: The Study Hypothesis

1- Natural environmental factors have a clear impact on the soil characteristics of the study area, which have a role in the variability of the cultivated soils.
2- The agricultural reality of the soil of the study area varies from one soil to another according to the nature of the environmental factors affecting it
3- There are environmental capabilities available for investing desert soil in agricultural production.

Third: The Aim of the Study

The study aims to demonstrate the natural environmental factors affecting soil characteristics, with an indication of the nature of agricultural reality and its variability in the study area, while examining the environmental capabilities available for cultivating desert soils in the Najaf plateau, with the development of solutions and proposals to develop agricultural production.

Fourth: The Importance of the Study

The importance of the study lies in the fact that the desert soils cover most of the Najaf governorate and are represented in the western plateau of the Najaf governorate. As well as the possibility of investing them in agricultural

production, and also a statement of the importance of this large area occupied by this soil and the possibility of using it to increase local agricultural production in the city. It has a future in agricultural production.

Fifth: The Boundaries of the Study Area

Najaf governorate occupies the southwestern part of the Republic of Iraq, and it extends between longitudes (42-45, 50-44) east, and two latitudes (29-32,50-21) north. Thus, its shape is closer to the rectangle, as shown in Figure 1.

Figure 1. location of Najaf from Iraq. Source. Surveying General Establishment, Iraq Administrative Map, Baghdad, (1/35 km), 2018 (SGE, 2018).

It is bordered to the north by the governorates of Babel and Karbala, to the east by the governorates of Al-Qadisiyah and Muthanna. As for the south and southwest, it is bordered by the Kingdom of Saudi Arabia, while it is bordered to the west by Anbar governorate. Within the province of Najaf there are two regions, which are the province of the sedimentary plain and the region of the western plateau. As for the study area, it is represented by the western plateau region, which is located in the southern and southwestern part of the city of Najaf, where the desert soils are found, and it is bounded to the north by the regions of the sedimentary plain, the Anbar governorate to the northwest, the Al Muthanna governorate to the south and the southeast, while the southern and southwestern borders are bordered Iraq with Saudi Arabia (Al-Chalabi, 2002). The area of the study (Najaf plateau) is about (26000 km^2) and represents 95% of the total area of the governorate (Al-Musawi, 2000). Therefore, the study was limited to the western plateau region due to the extension of desert soils within it, while the sedimentary plain region is empty of it.

Sixth: Method

The study relied on the descriptive approach in studying the effect of desert soils on agricultural production in the Najaf plateau and clarifying this through the influence of natural factors as well as the inductive approach through relying on books, letters and theses.

Seventh: The Structure of the Study

The research divided into several axes:
First - The natural environmental factors affecting the soil of the study area
Second: The agricultural situation in the study area.
Third: The environmental potentials available for cultivating the soils of the study area.

Results and Discussion

First - The natural environmental factors affecting the soil of the study area

Climatic Characteristics

Climatic data for the study area include (temperature, wind, humidity, and rain) to determine its effect on desert soil in the Najaf plateau.

Temperatures

It appears from Table 1 that the general average temperature in the study area is 24.5 ^oC and the highest in the month of July reaches ^oC and the lowest in January where it reaches 10.8 ^oC. Also noticeable is the increase in the daily and annual thermal ranges.

Table 1 Monthly averages for climate elements in Najaf Governorate for the period from 1998-2018

Wind Speed (m/s)	Relative humidity %	Evaporation (mm)	Rain (mm)	Average Temperature (m)	Month
1.3	68.7	89.62	14.4	10.7	January
1.8	58.5	156.64	15.1	13.3	February
2.1	51	212	13.3	17.7	March
2.3	41.5	301.95	14.1	24.3	April
2.6	30.6	425.0	4.8	30.1	May
3	23.6	545.16	0	34.1	June
3.1	21.5	617.5	0	36.9	July
2.5	22.7	564.22	0	35.1	August
1.8	28.0	410.44	0	32.3	September
1.5	39.0	284.22	4.8	26.1	October
1.3	55.9	145.67	16.1	17.9	November
1.2	68.2	92.52	19.4	12.6	December
2.5	**42.43**			**24.2**	**Annual Rate**
-	**-**	**3854.0**	**106.4**	**-**	**Total**

Source: Ministry of Transport and Communications, General Authority for Weather Forecast and Seismic Monitoring in Iraq, Water Resources Division, 2018 (MOTC, 2018).

The rise in temperatures, especially during the hot summer months, leads to high evaporation values from the soil surface, which leads to a decrease in their moisture content, which exposes them to dehydration and dislocation and facilitates their annihilation by wind. High temperatures greatly affect the increase in the volume of water losses for agricultural areas. The higher temperatures have a clear impact on the severity of what soil and plants lose from water by evaporation and transpiration on the one hand, and therefore there was no opportunity for the plant to complete its life cycle to produce seeds that start growing in successive seasons. This leads to a lack of vegetation on the other hand, especially in the plateau region, which is expected to be reflected in the low percentage of organic matter in the soil due to its oxidation due to the high temperatures in the summer.

Rain and evaporation

It appears from Table 1 that the total rainfall in the study area reached of 106.4 mm, and this is confined during the cold months of the year, and this amount varies in time as it is noticed that the highest rate in December (19.4 mm) and the lowest rate in the month of May as it reached of 4.8 mm. As for the evaporation rates, they are high, as it appears in Table 1 that the total amount of evaporation is (3854.0 mm). The maximum in the month of July is (617.5) mm, and due to the lack of total annual rain, it cannot be relied upon as an available water resource, as it is characterized by its fluctuation and instability, whether in its quantities or at the time of its fall, and it is mainly winter rain that falls suddenly and quickly and this exposes the soil to the risk of erosion on the one hand as it leads to washing the soil of salts and harmful elements on the other hand, and these rains may not fall for long periods of time or fall very little, which reduces the moisture content of the soil. The process of transporting it by wind is easy (Al-Mudhafar, 2007), and the effectiveness of these rains on agricultural activity is reduced, given that the soil of the area is sandy and permeable high, which causes plants not to benefit from this rain.

Relative Humidity

It appears from Table 1 that the annual mean relative humidity in Najaf Governorate reached of 43 and 42%. This rate varies monthly, as the lowest relative humidity levels were recorded in the summer during the months (June, July and August), reaching 22.7, 21.5, 23.6%, respectively, due to the high rates of temperatures in this season. While the highest rates were recorded in the winter in the months of (January, December and February) and reached of 58.5, 68.2, 68.7%, respectively, because of the decrease in temperatures in these months, it is clear that the decrease in the relative humidity associated with the rise in temperatures during the hot season has a clear effect on soil loss of moisture, increasing its drought, and increasing its water needs, which exposes it to disintegration and makes it ready for transportation by wind and drought in the soil usually cause farmers to increase the number of irrigations informally, which negatively affects the productivity of the plant.

D- Wind: It appears from Table 1 that the annual average wind speed reached of 2 m/s, that the wind speed is active during the hot months (June, July) at rates of 3.0 to 3.1 m/s. The increase in evaporation is directly proportional to the increase in wind speed, especially if the wind is dry, and this is what characterizes most of the windy winds to city. Which leads to an increase in the evaporation values from the soil surface, and the displacement of the dry air of the relatively humid air present on the soil, which causes its dryness, disintegration and ease of transportation from one place to another, and this negatively affects its natural properties such as low moisture content and less thickness. This in turn affects agricultural production as the speed of this wind leads to the formation of dust storms that its negative impact predominates on agriculture, and many studies and research have indicated that the harmful effect of wind begins when the rate of its speed increases at 4 km/hour (102 m/s) and that the annual rate of wind speed in the study area is higher than that mentioned and all of this leads to damage significant in the growth and production of these crops, whether protected or exposed.

The Soil

The study area is a natural extension of the western plateau region, which forms a large area of Iraq. It turns out that the soil in Najaf is divided into two soils, the sedimentary plain and the soils of the Najaf plateau. The study area represents desert soils; we will focus only on its soils.

Territory Soil of Najaf Plateau

The desert soils are the predominant soils in the western plateau region (Najaf plateau), the surface of which is covered with sand and limestone and it is poor with its organic matter that reaches less than 1% and it is shallow soil with a depth not exceeding several centimeters to be exposed to air discharge operations as a result of erosion factors. The soil of this region is characterized by disjointed soils formed from the rocks of the region itself and its vicinity, as dry valleys during the rainy ages moved and deposited them on layers of limestone, mud and sand. Chemical, physical, and biological weathering processes for the transported formations have also helped in its formation,

dividing the soil of this region into three main types (Figure 2).

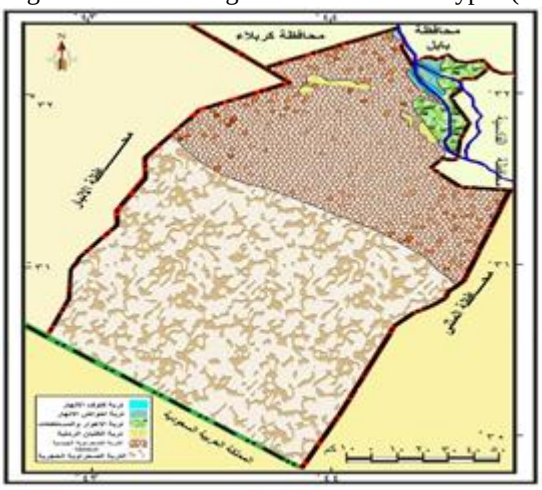

Figure 2. Types of soils in the western plateau of the Najaf Governorate. Source: The General Survey Authority, topographic maps 1/25000, 1/50000 and 1/100000.

Gypsum Desert Soils:

There are in the west areas of the Shatt al-Kufa, within the region of the lower valleys. The thickness of this soil ranges between 20 to 25 cm and its basic materials form gypsum and sandstone, and the proportion of organic matter in it about 0.4% as a result of its poverty of the natural plant due to drought (Al-Asadi, 2012). In addition to limestone and gravel materials, the percentage of gypsum in them ranges between 50 to 80%, and the proportion of lime ranges between 25 to 50% (Al-Jubouri, 2005). It is clear from the physical analysis of these soils that their average content of sand is 80.4%, clay is 7.9%, and silt is 11.7%. According to the soil texture triangle, the soil is of sandy texture, as the movement of water and air in it is fast, and the permeability rate of this soil is about (7 m/day) according to the criterion of classification of soil according to its permeability, the soil is of high permeability Table (2). The increase in the speed of the water movement (vertical and lateral) in these soils leads to an increase in the percentage of water wastes by leaching and deep inundation, and the ability of the soil to retain water is low due to its rough texture.

Table 2 Soil evaluation based on its permeability (m/day) according to the standard of 1954 U. S. D. A (GSA, 1960).

Soil	Permeability m/day
Very Slow	<0.05
Slow	0.05-0.30
Moderately slow	0.30-0.80
Moderately Rapid	0.80-3.5
Rapid	3.5-10
Rapid Very	>10

Stony desert soil:

This soil is located in the area of the stone area and covered by rough limestone stones and rocks with sharp angles and the prevailing soil is sandy soil (Al-Zamili, 2001). Which includes about half of the area covered by the soil in this region and extends in a wide range from the center of the study area to the borders of the Republic of Iraq with the Kingdom Saudi Arabia. The thickness of this soil ranges between 10 and 20 cm consisting of limestone and sand. It is clear from the physical analysis of these soils that their average content of sand is 78.9%, clay is 7.1%, and silt is 13% and according to a triangle of soil texture, it is considered the soil has a sandy texture, as the movement of water and air in it is rapid. The permeability rate of these soils is about of 11 m/day, according to the criterion of classification of soils according to their permeability (Table 2). The soil is of very rapid permeability and is shallow soil. This type of soil is poor with vegetation cover for shallow soils in these areas, but these lands can be reclaimed in the future in order to eliminate the apparent desertification so that wells can be drilled in these areas to cultivate and invest the desert areas.

Sand dune soils

This soil is located in the sand dunes range that extends of 15 to 25 km from the west of the city of Najaf and to the southwest of it. It rises from the adjacent lands within the limits of 12 m and is characterized by its relatively high fluctuation to the fluctuation of wind speed (Al-Zamili, 2001). The physical analysis of these soils shows that their average content of sand is 84%, clay is 5.1%, and silt 10.9%. According to the soil texture triangle, the soil is sandy, as the movement of water and air in it is rapid, and the permeability rate of these soils is about of 20 m/day and according to the criterion of classification of soils according to their permeability (Table 2). The soil has a very rapid permeability, and due to the nature of the properties of this soil, it is not suitable for agricultural production at all.

Water Resources

The water resources in this region are represented by groundwater, as its natural properties will be discussed.

Chemical properties of groundwater in the western plateau region.

10 samples of groundwater were collected and analyzed from the study area and from 5 sites. Samples were taken at the rate of 2 samples from each site, the first during January and the second during August, as 6 chemical elements and compounds were analyzed. Selection of sampling sites within the northeastern edges of this region, as they represent the areas of intensive use of groundwater for agricultural operations. Table 3 shows that the value of pH for groundwater in the study area varies in time as it decreases during the month of January and rises during the month of July. It also varies spatially from well to another and these values are allowed according to the standard (ISEcl).

Table 3 Results of the chemical analysis of groundwater samples for the study area for the year 2018

Well	pH		EC(dS/m)		TDS (mg/l)		TH(mg/l)		SO_4^{-2} (mg/l)		CL^{-1}(mg/l)	
	Nov.	July	Nov.	July	Nov.	July	Nov.	July	Nov.	July	Nov.	July
Well 1	7.8	8	11.8	12.6	3950	4004	770	789	586.2	611.2	1200	1506.2
Well 2	8.1	8.2	13.1	15.1	5060	5460	767	780	541.6	584.8	650	768
Well 3	8.21	8.5	9.7	11.5	2980	3360	499	570	321.1	428.8	879	930
Well 4	7.9	8.1	8.8	10.9	3890	3789	512	645	315	359	430	498
Well 5	7.2	7.9	5.7	6.6	3020	3850	720	787	176	189	366	420

Table 4 shows that the values of pH in the region are appropriate and acceptable for irrigation.

Table 4 The Islamic Educational, Cultural and Scientific Organization (ISEcl) standard for irrigation (WRM, 1997)

Measurements	Max. Limit	Min. Limit	Unit
pH	8.5	6	…
EC	3	0	dS/m
T.D.S	2000	0	mg/l
Cl^{-1}	300	0	mg/l
$So4^{-2}$	200	0	mg/l

Table 3 shows that the amount of EC of groundwater in the study area varies in time, as it decreases during January and rises during July. It also varies spatially from well to well, as it reached of well 1, well 2, well 3, well 4, and well 5 about of 5.7, 8.8, 9.7, 13.1, and 11.8 dS/m, respectively, and rose in July to reach (12.6- 15.1- 11.5- 10.9- 6.6) decimeters / m, respectively, and these concentrations are very high according to the (ISEcl) standard for irrigation (Table 4). The height of EC in these wells is due to the nature of limestone containing salts in these wells, as well as the excessive withdrawal of these wells as the only source of irrigation, all these factors helped to increase the concentrations of electrical conductivity in these wells. Table 8 shows that the amount of T.D.S of groundwater in the study area varies in time, as it decreases during January and rises during July. It also varies spatially from one well to another, as it was recorded in well 1, well 2, well 3, well 4, and well 5 of about 3950, 5060, 2980, 3890, and 3020 mg/l, respectively during the month of January, and increasing in July to reach of 4004, 5460, 3360, 3789, 3850 mg/l. These concentrations are high and not allowed for irrigation according to the (ISEcl) standard for the aforementioned irrigation, and the reasons for the variation in these concentrations can be attributed to many factors, including the variation of geological formations containing groundwater in this region on the one hand, and to withdrawals and the length of investment for each well on the other hand, which is negatively reflected in the increase in the salinity of agricultural soils in the plateau region. The increasing amount of clouds on groundwater comes from the use of traditional irrigation methods, which raises the proportion of water losses. Which leads to an increase in the amount of soluble salts, which causes many damages to this wealth and does not benefit from this resource, but the opposite of that if it was used modern irrigation methods reduce from the process of drawing from wells to reduce these high levels of dissolved salts, in addition to the use of filters for groundwater before being delivered to the plant.

Total Hardness (T.H) for Groundwater

Table 3 shows the total hardness (TH) of the groundwater in the study area varies in time, as it decreases during the month of January and rises during the month of July. It also varies spatially from one well to another, as it was recorded in well 1, well 2, well 3, well 4, and well 5 of about 720, 512, 499, 767, 770 mg/l, respectively during the month of January, and increasing in July to reach of 787, 645, 570, 780, 789 mg/l. These concentrations are prepared according to the hardness classification criterion for irrigation. The concentrations are high and not allowed and cause great damage to the soil and agricultural production.

Table 5 Water Hardness Classification (Todd, 1980).

Water	T.H (mg/l)
Soft Water	0-75
Relatively Hard	75-150
Hardness	150-300
Very hard	>300

Sulfate (SO_4^{-2})

Table (3) shows that the SO_4^{-2} concentrations of groundwater in the study area vary temporally, as they decrease during January and rise during July. It also varies spatially from one well to another, as it was recorded in well 1, well 2, well 3, well 4, well 5 in January about 176, 315, 321.1, 541.6, 586.2 mg/l, respectively, and rose in July to reach of 178, 120, 225.01, 484.2, 514.6 mg/l, respectively, and these concentrations are very high and not allowed for irrigation according to the standard (ISEcl) except for well 5, which is within the permissible limits for irrigation.

Chlorides (CL^{-1})

Table (3) shows the amount of chlorides (CL^{-1}). Groundwater in the study area varies in time, as it decreases during January and rises during July. It also varies spatially from one well to another, as it was recorded in Well 1, Well 2, Well 3, Well 4, Well 5 in January of about 366, 430, 879, 650, 1200 mg/l, respectively, and rose in July to about of 420, 498, 930, 768, 1506.2 mg/l, respectively, and when comparing these concentrations with the aforementioned global standard, all locations are not allowed for irrigation and have high concentrations of chlorine, which causes an impact on agricultural production if used for irrigation. Through the foregoing, it is noted that the concentrations of chemical elements and compounds in the water of some wells in Najaf are high and not allowed for irrigation according to the aforementioned categories, as they cause great damage to agricultural production, so it is necessary to filter the groundwater before it is delivered to the soil.

Second -: The Agricultural Situation in the Study Area

In this section, agricultural production, the problems it suffers from, and solutions for carrying out agricultural activity in the study area will be discussed. The study area is suitable for various agricultural operations due to the flatness of the surface and because the gypsum desert soil is more suitable for clay soil in the cultivation of winter and summer vegetables because it is well-ventilated and easy for the roots of plants to extend through easily and provides light sandy soil texture for the study area. These crops are twice the root group, so loose soil gives them a good possibility to spread their root group and easily penetrate between the grains of the soil, which ranges between 0.1 and 1 mm. Which facilitates the absorption of water and nutrients within the boundaries of the root zone, and this tissue is very suitable for this type of Crops (Ayoub, 2005). Among the crops grown in the study area is the crop of cucumbers grown in protected farms in the Najaf plateau region (Figure 3).

Figure 3. Cucumber crop at guidance farm, Najaf Plateau

Also, the eggplant crop that is a crop that needs high humidity is often cultivated, so it is often successful in an area, the Najaf plateau due to the appropriate conditions required for this crop (Figure 4).

Figure 4. Eggplant crop on guiding farm, Najaf plateau

The same applies to the cultivation of tomato, which is found in many different types (tomato p No, climbing conscience) and others (Figure 5)

Figure 5. Tomato crop on the extension farm, Najaf Plateau

The dependence on groundwater for irrigation of these crops is considered as the only water source present in this region and the high salinity there has led some farmers to use desalination systems (RO) and the production of these systems is about (5000 liters/hour). In addition, two date palm plants were established in the Najaf plateau, with an area of about 30 Acres. That is organized in an organized way as orchards and nurseries (Figure 6). The purpose of establishing these two stations is to improve and multiply the rare types of dates, such as Umm Al-Asafeer and Kantari dates, and others (SEE, 1995). The stations are drip irrigation methods by relying on groundwater, whose salinity is around 13 dS/m. This in turn has led to soil exposure to the problem of salinization. These salts do not affect the productivity of palm trees, but their effect is on the form of dates and palm trees. In order to improve the quality of the soil. The use of organic fertilizers represented by (dab, urea and compound fertilizers) and others. Also, a large area of desert soil was exploited by the upper threshold called the Fadak farm, where a large number of vegetables are cultivated and it has achieved a large production with agricultural crops.

Figure 6 Al-Nakhil Model Station in the Najaf Plateau

Third: Environmental potentials available for cultivating the soil of the study area

The continuous increase in population numbers, which is offset by an increase in the demand for food sources, therefore, future plans must be put in place to provide food security for the population while ensuring the preservation of the soil from deterioration and pollution and preserving the water sources used in agricultural production as following:

1- Environmental assessment of the soil of the study area and its suitability for agricultural production

The four different sites of the study area of soils of about 9 of the chemical elements and compounds in the soil were analyzed to find out the suitability of this soil for cultivation, as it appears from Table 6 that the pH values are different in the studied sites and these values ranged from 7.7 to 8.1. When compared to the international standard, Table 7 noted that it is moderate to basic to medium to basic and it is within the permissible limits and this indicates that the soils of the study area are basic soils, as shown in Table 6. The values of the electrical connection (EC) also vary. In the studied sites and when compared to the international standard according to the American Salinity Laboratory (Table 8), it is noted that the sites (S1, S2, S3) and their concentrations (3.1, 2, 3.9) dS/m were low in salinity. While the location (S4) with a concentration of 4.9 dS/m, the salinity was medium. As for TDS concentrations, it is noticed that they are different in the studied sites, and when compared to the international standard, Table 9 notes that the sites (S1, S2, S3) whose concentrations are (470, 311, 484) ppm are low in salinity while the site (S4) with a concentration of 540 ppm has medium salinity.

Table 6 The chemical properties of the soil of the study area

Soil	pH	EC	TDS	Na	Mg	Ca	K	So_4	Cl
		dS/m	ppm						
Uncultivated desert soil (S1)	8	3.9	470	97	43	84	130	170	100
Sand Dunes (S2)	7.9	2	311	85	36	73	112	110	97
Uncultivated desert soil (S3)	8.1	3.1	484	110	49	134	184	205	170
Cultivated desert soil (S4)	7.7	4.9	540	143	74	146	240	210	193

Table 7 The Global Standard for Soil pH according to the American Salinity Laboratory Standard (U.S.D., 1960)

Soil Characteristics	Intervals
Ultra acid	<4.5
Extreme acidity	4.5-5
Very severe acidity	5-5.5
Medium acidity	5.5 -6
Moderate acidity	6-7
Neutral	7
Moderate basal	7-8
Medium basal	8-8.5
Basal severe	8.5- 9
Very severe basal	>9

Table 8 The international standard for the American National Consultative Committee for soil (EC) concentration (U.S.D., 1960)

Soil	EC (dS/m)
Slightly salty	4-0
Medium salinity	8-4
High salinity	8-15
Very high salinity	>15

Table 9 The Global Standard for Soil Salt Elements of the American Salinity Laboratory (U.S.D.A)/ppm (Pincon, 1991)

Element	Slightly salty	Medium salinity	High salinity
K	<200	200 -400	> 400
Mg	<50	100 – 50	> 100
Ca	< 150	150 – 100	> 150
Na	<100	100200 –	>200

SO_4	< 100	220 – 100	>220
T.D.S	<500	1000 - 500	> 1000
HCO_3	<12.5	35 - 12.5	> 35
CL	< 121	200 – 121	>200
Calcium carbonate	<15	35 – 15	35
Calcium sulfate	0.3	10 – 0.3	>10

As for the concentration of (Na), it is also noticed that it is different in the studied sites. When comparing these concentrations with the aforementioned global standard, it is noted that the two sites (S1, S2) with a concentration of (97, 85) ppm are slightly sodium. While the two sites (S3, S4) with a concentration of (110, 143) ppm with medium sodium. While it is noted that the concentrations (mg) are varied in the studied sites and when compared to the international standard (Table 9), it is noted that the sites (S1, S2, S3) with concentrations of 43, 36, 49 ppm are low in magnesium while the site (S4) has the highest concentration of 74 ppm with medium magnesium. As for the concentration of Ca, they are also varied in the studied sites. When comparing these concentrations with the aforementioned global standard. It is noted that the two sites (S1, S2) with a concentration of 84, 73 ppm are slightly calcium while the two sites (S3, S4) with a concentration of 134, 146 ppm with medium calcium.
While it is noted that the concentrations (k) are varied in the studied sites and when compared to the international standard (Table 9), it is noted that the sites (S1, S2, S3) with concentrations of 130, 112, 184 ppm are low potassium while the site (S4) with concentration of 240 ppm with medium potassium. As for the sulfate concentration (SO4), it is also noticed that they are different in the studied sites. When comparing these concentrations with the aforementioned global standard, it is noted that the two sites (S1, S2) with a concentration of (170, 110) ppm are slightly sulphates while the two sites (S3, S4) have a concentration of 205, 210 ppm, respectively with medium sulfate. It is also noticed from Table 6 that the concentration of chlorine (Cl) is varied in the studied sites. When comparing these concentrations with the aforementioned global standard. It is noted that the two sites (S1, S2) with a concentration of (100, 97) ppm are medium chlorine while the two sites (S3 - S4) the concentrations were (170,193) ppm, with medium chlorine. Through the foregoing, it is noted that the studied sites were few to medium salt concentrations in cultivated soils and some uncultivated so this soil is good for cultivation with various crops, whether it is field crops or some cereal crops, but it must provide in them some important conditions represented in the provision of organic materials necessary as well as providing water, and it is preferable to use filtration systems because most of these wells have high concentrations of salts.

Use of Modern Irrigation Methods

There are several methods for modern irrigation. There is supplemental irrigation, part of which depends on the amount of rain, but the rains in the study area do not help to interest in this type of technology. The northern plateau in the cultivation of wheat crop. Agriculture in this region cannot depend on the method of irrigation with ponds or irrigation, as the ability of the soil to retain water is little to the roughness of its weave, so its cultivation requires adding organic fertilizers on one side and using modern irrigation methods such as drip irrigation and sprinkling on the other hand. Thus, we will summarize the offer on drip irrigation and sprinkler irrigation (axial and aerosol spray):

Drip Irrigation

It is intended to deliver irrigation water to plants in a calculated amount and in a slow manner in the form of separate or continuous points through small parts called points and is usually used to irrigate vegetable crops (tomato, cucumber and eggplant) and ornamental shrubs and forest projects. Where the point lines extend on the surface or the points are buried inside the soil, it is known as drip (subsurface). These depend on the soil type and the type of cultivated plant. The use of this method for irrigation has several advantages, including the ability to control the rates of water and added fertilizers greatly with controlling the addition of chemical fertilizers to the root zone, which provides fertilizer quantities for the surveying unit to reduce the concentration of salts as a result of adding water for short periods and low rates, in addition to that it works on providing manpower, especially in areas with scarce workers, provided that they are trained in such a technique.

Irrigation with Sprinkler

It is one of the modern irrigation systems that is used to irrigate agricultural crops in desert areas with sandy land, which cannot keep water for a long time. This type of irrigation is suitable for most of Najaf governorate's soils. Industrial rain and sprinkler irrigation networks can be divided into two groups used in the study area:
Axial spraying method (Figure 7), whereby each of the systems that use this method and through its axial movement irrigate (80-120) acres, which in turn reduces the need for manpower in irrigation operations, as well as spray, and this method provides a percentage of water estimated with 50%, however, these methods require high costs compared to traditional methods (Aboud, 2008).

Figure 7 One of the axial sprinkler irrigation systems in the Najaf plateau

Fertilization

Fertilizers can be defined in a simple way as those materials that are added to agricultural soils for the purpose of increasing, absorbable nutrients and compensating for the shortage in the soil in order to raise the production efficiency of the agricultural unit whether it is organic

fertilizers (animal or plant waste) or chemical fertilizers with one or more elements.

Fertilizers play an important and effective role in increasing agricultural production and improving its quality, but excessive use of it has become a risk factor in threatening the environmental balance, and fertilizers may be either organic such as poultry, cattle, sheep, or plant residues, or be chemical with a food component one or more, and a variety of fertilizers are used in the agricultural areas in the study area such as leafy chemical fertilizers and that adding them by spraying has achieved positive results in increasing agricultural crops such as tomato and improving its qualitative characteristics and worked to provide half of the quantities of nitrogen fertilizers recommended to be added to the soil (Awda, 2005), But this type of fertilization is still limited and in little use, as it is used only in protected vegetables, especially tomato crops. Since 2011, most of the farms started using one of the types of fertilizers, which is known as (biological fertilizer). Chemicals are also used to combat insects that affect agricultural production, as well as the use of biocides, which is the product of an anti-nature component. Some insects are eliminated through the use of female pheromones, which are placed in a capsule that contains a pesticide that attracts males, thus eliminating them and protecting farms from danger these insects.

The Use of Modern Systems for Storing Electrical Energy

Which the farms use to operate machines and systems to extract water from the ground to water crops and other lighting systems.

Correct Management of Groundwater Investment (Spring Water, Well Water)

Investing in spring water acquires special importance in the study area because it is one of the sources of natural wealth that depends on it in achieving the ambitious development programs for this desert area, especially since its exploitation does not need the effort and costs that the wells need, which requires proper management of these springs through budget, between the amount of its available water for investment and the total of the current needs and finding adequate fields to consume what exceeds those needs in order to prevent their dispersal (Hussein, 1989). As for the wells, they are of great importance also for the study area. The productivity of wells from one region to another and even within the same region itself, the production capacity of the wells is higher in the lower reservoir than in the upper reservoir, where in the case of the upper reservoir does not exceed (5-15) liters/second. While it exceeds 15 liters/sec for the bottom reservoir is therefore necessary to have an efficient management that is able to properly invest this water (Abdula, 2009).

Conclusions

1- Desert soil is one of the soils that can be invested in establishing agricultural activity and large areas in the event of providing the necessary life requirements for the plant, it became clear. This soil was used in the cultivation of several types of agricultural crops such as tomato, cucumber, eggplant as well as palm cultivation, after improving the quality of the soil by adding fertilizers and organ materials, which led to an increase in the quantity of agricultural crops, improving their qualitative characteristics, and using fresh water to irrigate these crops.

2- Through the field study, it was found that the protected farms relied on modern and different systems for extracting water, storing and desalinating them as well, and showing the use of several methods for irrigation are sprinkler irrigation and drip irrigation and sprinkler irrigation is one of the modern irrigation systems that are used to irrigate the desert areas with sandy land that cannot keep water for a period long. This type of irrigation is suitable for most of the Najaf governorate's soils. This type of irrigation techniques is used to irrigate agricultural crops by using sprinklers in the form of artificial rain. Axial spraying technology was used to irrigate wheat and barley crops in the Najaf plateau. As for drip irrigation, it is intended to deliver irrigation water to the plants in a calculated amount and in a slow manner in the form of separate or connected points, through small parts called points and is usually used to irrigate vegetable crops and ornamental shrubs.

3- It was found through the study that the groundwater in the study area suffers from high concentrations of saline elements above the internationally permitted limits for irrigation, which causes major problems if used for agriculture.

4- It became clear through the study that the saline characteristics of the soil of the study area were few to medium in agricultural soils, according to the standard of the American Salinity Laboratory, and this indicates that these soils are good for agriculture, but only on the condition that organic materials are provided in them and good water.

5- There are no organized and sound policies by the Ministry of Agriculture, the Ministry of Water Resources, and even the Ministry of Environment to preserve the underground water resources from low levels and pollution. In addition to the lack of real support for farmers in the Najaf plateau represented by material support or by equipping them with modern and advanced technologies. Through the field study, it was clear that some farmers were reluctant to practice agricultural activity because of the lack of international support and because of the large import of agricultural products, which exposes farmers to loss, and agriculture itself requires large capital to purchase equipment, machinery, seeds, etc., and the poverty of farmers pushed them to sell their lands and migrate to other regions to search for another source of living.

Suggested Solutions

1- Improve the physical and chemical properties of desert soils by adding fertilizers (chemical and organic) and the recommended amounts to add them to the soil for the purpose of increasing agricultural areas and improving the quality of agricultural production.

2- Planting agricultural areas or fencing them with green belts to prevent the negative effects of climatic factors such as strong winds and dust storms that cause the deterioration of agricultural production.

3- Spreading awareness among farmers through the establishment of agricultural training courses and extension seminars that train farmers to use sound agricultural methods such as rationing water and determining the quantities of fertilizers and pesticides that can be used on farms.
4- The use of modern systems in agricultural operations such as water desalination systems used in irrigation of agricultural lands, especially groundwater, due to the high percentage of salts therein, power generation systems, water storage systems, etc.
5- In order to improve the agricultural reality in the province of Najaf and throughout Iraq, there must be support from the state, whether material or through providing farmers with equipment and machinery used in agricultural operations. In addition to providing them with good quality fertilizers that are difficult for most farmers to purchase because of the high prices.
6- Reducing the import of agricultural crops from outside the country in order to encourage local production and thus motivate farmers to stay on and cultivate their lands.
7- Benefiting as much as possible from the falling rain, especially since the region has been exposed to heavy rains in recent years. So set up projects to store water and use it at a time of scarcity of rain that reduces the great pressure on the groundwater.
8- Increasing reliance on animal organic fertilizers by allocating areas for animal husbandry and setting up pastoral reserves for them and caring for them.
9- Developing marketing policies by setting plans that lead to relative stability in crop prices and not all farmers offering the same production at the same time.

Acknowledgements

The authors acknowledge the support of University of Kufa, Iraq. The author is grateful to Dr. B. Almayahi, University of Kufa for assisting me throughout conducting the present research.

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