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EFFECT OF WETTING AND DRYING CYCLES ON SOME PHYSICAL AND CHEMICAL TRAITS OF DIFFERENT SOIL TYPES IN DHI QAR PROVINCE (SOUTHERN IRAQ)

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Abstract

A laboratory experiment was conducted to studying the effect of wetting and drying cycles on some physical and chemical soil traits of different soils types, one of which is reclaimed saline and the other non-reclaimed saline taken from two different locations from Dhi Qar province (southern Iraq). The soil was subjected to drying and wetting processes with normal water and acidic water using concentrated sulfuric acid in three stages. Seven soil samples were selected for each location to estimate the physical and chemical traits (for example the percentage of sodium exchange, dispersion percentage, electrical conductivity). The results showed a significant increase in the sodium percentage when using two types of water (normal and acidic), For reclaimed soil, the highest value was reached during the third wetting period (6.73%) and (7.15%) respectively. In the saline soils, we notice a significant increase in the use of normal water during the third wetting period (9.32%), unlike the acidic water which caused a significant decrease (4.54%) at the third wetting period. However, Soil reclaimed with normal water and acidic water reached the highest value during the third wetting period (56%) and (63%) respectively. In the saline soils we notice a significant increase in the use of normal water compared with acidic water, which caused a significant decrease in the third wetting period (41%). In the results of the electrical conductivity, a significant decrease was found in both saline and reclaimed soil when using two types of normal and acidic water in third wetting period.

Key words : Wetting cycles, saline soils, electrical conductivity.

Introduction

Soil aggregates are exposed to Breakdown during wetting by irrigation or rain, which results in the dispersion of these aggregates, then the fine soil particles transfer With soil suspension in the pores of large soil which works on clogged it, It is then a hard crust on the surface of the soil during drought, Their thickness ranges from a few millimeters to several centimeters (Mclntyre, 1958). Wetting processes have significant effects on the physical and chemical traits of soils, particularly electrical conductivity, Exchange sodium percentage (ESP) and the percentage of dispersion. Pupisky and Shainberg (1979) indicate that under low the exchange sodium percentage ESP and Very diluted solutions for the washing solution result in the dispersion of the clay and its transition into main active mechanical pores and the closure of the soil pores. As for high exchange sodium percentage (ESP), The swelling of the clay is a major mechanism that leads to reduction of the soil constipation by reducing the size of the pores. Bohn (1979) explained that the main risk when removing salt from the saline-sodic soils is the removal of dissolved salts be more rapid than the displacement of sodium exchange, which is the reason for the conversion of soils to the sodic soil. This can lead to deterioration of the soil structure and then the was ability of the control Salinity Some studies have suggested that the addition of sulfuric acid to soil reduces dispersion percentage (Aldrich, 1948).

As Christenssen and Lyerly (1954) have shown, the addition of sulfuric acid may improve physical soil traits by increasing the electrolytic concentration in the soil solution and reducing the exchange sodium percentage on the exchange complex. A number of researchers found that the use of sulfuric acid in the reclamation of soils affected by sodium has led to increased rates of water

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filtration from the soil (Tobia and A. G., 1958; Ryan and Archer, 1977). Follett and Soltanpour (2001) indicate that the sodium directly affects soil salinity by binding to other ions such as chlorides, carbonates and bicarbonates, forming salt compounds that works on soil salinization, making it toxic to some sensitive crops. Hodgkinson and Thorburn (1996) reported that the sodium ions exchange have a significant negative effect on the stability of soil aggregates measured by the dispersion percentage. They noted that the percentage of sodium exchange and the dispersion of clay particles increases with depth, where indicated that the dispersion rate increased from 25% To 60% when ESP values increased from 10% to 30% in surface and subsurface depths, respectively. Shainberg *et al*. (1981) reported that the clay dispersion and the values of the conductivity are very sensitive to the levels of exchange sodium percentage (ESP) and the salts concentration in the soil solution. Oades (1988) cleared that calcium works to reduce dispersion by making connections between clay particles and organic substance particles. In addition, Al-bakri (2010) found an increase in the dispersion of fine soil particles with the process of repeating the periods of wetting and drying. The presence of salts has a negative effect on the dispersion of fine soil particles and thus deterioration of physical soil traits. Therefore, the study aims to know the effect of water quality in the wetting and drying cycles on some physical and chemical soil traits.

Materials and Methods

A laboratory experiment was conducted in the laboratories of college of Agriculture, Sumer University using two soil samples taken from the Surface horizon (AP) and for depth (0_30 cm) from two different locations of Dhi Qar province in southern Iraq. The first site with reclaimed saline soil was cultivated with barley and the second location was non-reclaimed saline soil, The two soils were classified as Torrifluvents according to the modern American classification (Al-Eakidi (1996). Seven samples of each location were taken randomly by a Metal cylinder (sample core) for the purpose of conducting research analyzes. A representative sample of the soil of each site was taken and dried, aerated and grinded with Ceramic Mill and sieved with a 2 mm diameter sieve. It was then filled with nylon bags for the purpose of performing the required analyzes for two location soils. Table 1 shows some physical and chemical traits of the two soils used in the study according to the methods of work mentioned by Black *et al*. (1965), Page *et al*. (1982), Richard (1955), Jackson (1979). The dispersion percentage of fine particles (0.05 mm) in soil

Table 1 : The physical and chemical properties of two studied soils.

Traits	Soil texture	Reclaimed soil	Non-reclaimed soil
EC	5.17	30.02	ds.m^{-1}
PH	7.75	7.17	
SP	33	45	%
O.M	12	6	g.kg soil
Ca	4.05	6.2	mmol.L^{-1}
Mg	2.04	4.03	
K	1.44	1.29	
Na	2.76	35.28	
Co_3	Nil	Nil	
HCO_3	1.3	7.41	
SO_4	12	26.41	
CL	5.17	28.28	
CEC	7.75	21.92	cmol. charge. kg^{-1}
Clay	33	61	g.kg soil
Silt	12	248	
Sand	4.05	691	
Texture	Loamy soil	Loamy sand	

was estimated byGreacen (1958) and described by Salih (1978), Al-Bakri (1984) the 20 g was taken as a soil sample with less than 2 mm size. It was placed in a 500 ml plastic vial, add to it 350 ml of distilled water, placed in the shaker device for two hours and then the solution was fully transferred to a 1000 ml cylinder, Complete the size to the mark. The dispersion models were taken depending on the temperature of the solution and the time needed to move the soil particles according to Stoke's law. The 25 ml of suspension pulled into the cylinder, for 25 cm depth and time according to the temperature of the dispersed model. The model took, put in a 50 mL baker, dry at 105^{0}C temperature and for 24 hours after that the dry weight was taken. The electrical conductivity of the saturated paste extract was estimated by an EC-Meter device. The exchange sodium percentage (ESP) was estimated according to Richard (1955) and according to the equation :

$$ESP = 6.28 + 0.64\ SAR$$

In the study treatments, three stages were used to wet and dry the samples from the soil of each location. In the three stages, the soil was saturated with water or acid for 24 hours. The soil samples were then dried for 10 days. One sample of reclaimed soils and one sample of saline soil took which soaked with water Normal and one of the reclaimed soils and one of the saline soils saturated with sulfuric acid (0.1N) water were randomized. The data was statistically analyzed using CRD design using the least significant difference of LSD at a probability level of 0.05 for all the traits under study.

Results and Discussion

The results showed in table 2 the increase in the exchange sodium percentage (ESP) in reclaimed soils when using two types of water (normal and acidic). The highest value in normal water during the third wetting period in reclaimed soils reached (6.73%) compared to the control treatment (4.56%). As for the soil reclaimed with acidized water, it reached the highest value at the treatment of the third wetting of (7.15) compared to control treatment which amounted to (4.54). In saline soils, a significant increase was observed when using normal water. The highest value was (9.32) compared to control treatment (8.35). There was a decrease in the third period of wetting was (4.54) compared to the control treatment, which amounted to (8.21) and the reason for the increase in the exchange sodium percentage (ESP) when using normal water in reclaimed soils is due to the increase of the surface area of these soils, the high proportion of ions and the length of the addition of water led to the retention of large amounts of sodium exchange and high values of ESP, which leads to the destruction of soil building and low porosity and high density and calcium displacement from the soil and replace the sodium instead it, which leads to the deterioration of physical and chemical soil properties (Yunnan, 2008; Mays and Hunar, 2005; Ezlit, 2009). The reason for the low sodium content in saline soils is that the addition of sulfuric acid to the soil increases the proportion of calcium ions and substitutes it instead of sodium ions on the soil exchange complex (El-Sharawy *et al*., 2008).

Table 3 shows the high values of dispersion percentage in the reclaimed soil irrigated with normal water and the acidized water which reached the highest value in the normal water in the third wetting period (56%) compared to the control treatment (47%). As for the acidized water was also the highest value in the third treatment was estimated (63%) compared to the control treatment. In the saline soils, we notice an increase in the dispersion percentage when using the normal water in the third wetting period (67%) compared to the control treatment (60%). The results showed a decrease in the third wetting period (41%) compared with the control treatment (61%). The reason is that the use of acidized water as a moisturizer in reclaimed soils causes the increase of calcium carbonate dissolving in the soil, And increase the deterioration of soil construction and increased dispersion percentage. Hillel (1980) showed that when wetting the soil with water, the aggregates of weak construction will shatter and dispersed of clay particles and work to fill the pores between the interface, which impedes the process of gas exchange between air and air and soil and this reflects negatively on the growth and penetration of plant roots and thus on production either when using normal water as a wetting agent, the sodium ions increase in the soil, which in turn

Table 2 : The effect of wetting and drying cycles on the exchange sodium percentage (ESP) using normal water and acidized water in reclaimed and saline soil.

Treatments	Normal water		Acidized water	
	Reclaimed soil	Saline soil	Reclaimed soil	Saline soil
CO	4.56	8.35	4.54	8.21
W1	4.71	8.54	4.83	7.21
W2	5.64	9.07	6.32	6.08
W3	6.73	9.32	7.15	4.54
Average	5.41	8.82	5.71	6.51
LSD	**2.267**	**0.025**	**0.039**	**0.02**

Table 3 : The effect of wetting and drying cycles on the percentage of dispersion using normal water and acidized water in reclaimed and saline soil.

Treatments	Normal water		Acidized water	
	Reclaimed soil	Saline soil	Reclaimed soil	Saline soil
CO	47	60	48	61
W1	49	62	52	57
W2	53	64	54	45
W3	56	67	63	41
Average	51	63	54	51
LSD	**0.01**	**0.02**	**0.03**	**0.01**

Table 4 : The effect of wetting and drying cycles on the electrical conductivity using normal water and acidized water in reclaimed and saline soil.

Treatments	Normal water		Acidized water	
	Reclaimed soil	Saline soil	Reclaimed soil	Saline soil
CO	3.45	9.75	3.33	8.42
W1	3.25	8.76	2.45	4.15
W2	2.91	7.73	1.57	2.59
W3	2.82	5.53	1.12	1.42
Average	3.11	7.94	2.12	4.15
LSD	**0.03**	**0.008**	**0.03**	**0.01**

leads to the dispersion of soil particles (Mohammed and Marroub (2007) and increased soil degradation due to the wetting and drying processes.

The results showed in able 4 that there was a decrease in reclaimed and saline soils when using two types of water (normal and acidized). The percentage of decrease in reclaimed soils using normal water during the third wetting period was 2.82 compared to the control treatment (3.45), In the saline soils using normal water, the decrease of soil in the third wetting period was (5.53) compared to the control treatment (9.75). As for the use of acidized water, we notice a decrease in both soils. The percentage of decrease in reclaimed soils in the third wetting treatment was (1.12) compared to the control treatment (3.33). The salinity of the saline soil was less than the value of the third wetting treatment (1.42) compared to the control treatment which gave the highest value (8.42%). The reason for the low connectivity in the soil, when the use of two types of water is due to the positive effect of ions in the water, which causes the dispersion of some clay particles and the washing of the ions that cause the accumulation of salts. Pearson (2003) noted that the repeating of wetting periods lead to reduced electrical conductivity due to the exposure of the soil to continuous washing, which has an effect on the stability of the soil complexes and thus reduce the conductivity, as the washing process leads to the destruction of soil aggregates due to the increased swelling of the clay. This is confirmed by Rose (1966).

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