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Table (1) – Effect of Soil Type, Pour Volume and Method of Application in Hydraulic Conductivity (cm/min) **

**S×V×M highly significant at 1% level, LSD, 5% for different methods under same soil and pour volume - 6.40, for different pour volume under same soil and method - 5.21, for different soils under same pour volume and methods -5.70.

METHODS							
		M1			M2		
SOIL TYPE	POUR VOLUME	Before	Change %	After	Before	Change %	After
S1	V1	0.02600	56.53	0.0113	0.02600	35.18	0.0169
	V2	0.02600	64.37	0.0093	0.02600	59.00	0.0104
S2	V1	0.00673	26.52	0.0049	0.00673	8.28	0.0062
	V2	0.00673	37.84	0.0042	0.00673	18.05	0.0055

MEANS FOR TWO WAY INTERACTIONS								
	S x V			S x M			V x M	
	V1	V2		M1	M2		M1	M2
S1	45.86 (0.0141)	61.69 (0.0099)	S1	60.45 (0.0103)	47.09 (0.0137)	V1	41.53 (0.0081)	21.73 (0.0116)
S2	17.40 (0.0056)	27.95 (0.0049)	S2	32.18 (0.0046)	13.17 (0.0059)	V2	51.11 (0.0068)	38.53 (0.0080)

MEANS FOR MAIN EFFECTS					
SOIL TYPE		POUR VOLUME		METHODS	
S1	S2	V1	V2	M1	M2
53.78 (0.0120)	22.68 (0.0053)	31.63 (0.0099)	44.82 (0.0074)	46.32 (0.0075)	30.13 (0.0098)

to limit water flow through the soil columns. This is could be attributed to the low percentage of clay in both soils, which reached 9% in S1 and 3% in S2. From the data presented in table (1), It was clear that the average K_{sat} values of S1 under all experimental treatments were slightly higher were it was 0.0120 cm/min compared to 0.0053 cm/min in S2. This might be due to the high percentage of sand in S1, which reached 73% compared to the percentage in soil 2, which contains 57% sand.

Hydraulic conductivity depends on the space, proportion of air in the soil and the salt content of the soil. The K_{sat} in intermittent pouring was lower than the continuous pouring and the reverse was true for (PV). 6-PV had less hydraulic conductivity a s compared to 3-PV, Table (1). In another study, it was found that reduction in the hydraulic conductivity was due to the gradual escape of entrapped air between the soil pores (Swarez *et al.,* 1984). In a laboratory work (Nielson *et al.,* 1966, Keller and Alforo, 1966) and some carefully controlled field experiments (Miller et al., 1965) indicated that the efficiency of salt leaching was greatly increased by controlling the soil water content and flow velocity of water during leaching.

A continuous leaching of sandy loam saline soil (S2) under study with distilled water was found to increase the K_{sat} of the soil while, on the contrary, it led to a decrease in the Ksat of the saline sodic soil (S1). This is could be attributed to the plugging of pores by dispersed clay particle along the packed soil columns. A continuous leaching of clay soils with distilled water was found to increase the hydraulic conductivity of the soil (Pupisky and Shainberg 1979).

true for intermittent leaching. All parameters reduce with time in continuous leaching in comparison to intermittent leaching (Nesrin and AL-Mansori, 2018).

Two sandy loam soil samples (0 - 30 cm) depth were collected from Taworgha Agricultural project, located about 300 km east of Tripoli / Libya. Soil samples were air dried, passed through a 2-mm sieve. These air dry surface soil samples are saline sodic (S1) and saline soil (S2) were previously leached using two different methods of water pouring, intermittent and continuous one were used as M1, M2 respectively for each soil type using two pour volumes of water, 3 and 6 pour volumes were used as (V1, V2). After that those soil samples were air dry and sieved passed through a sieve (< 2.00 mm) and repacked in soil leaching columns (3.5 cm in diameter, 17 cm in length), Saturated hydraulic conductivity of the soil samples was then measured using the constant head method as described by Klute and Dirksen (1986).

Experimental design: -

The experiment consists of interaction of two soil types, two methods of water application, and two pour volumes.

Data analysis: -

All data from the experiment was statistically analysed by double split design using procedure described by Thomas and Hills (1975).

RESULTS AND DISSCTION

According to the range of K_{sat} values in soils reported by Klute and Dirksen (1986), the saturated hydraulic conductivity (K_{sat}) of the soils under study is moderately slow to slow (Table 1). This might be due to the low organic matter content of those soils. Moreover, the magnitude of the measured decrease in Ksat in soils under study was not sufficient exchangeable sodium was a major cause of reduced soil hydraulic conductivity for surface soils irrigated with sodic waters. Shainberg *et al.* (1981) stated that the mineral soils with low rates of mineral dissolution, should be susceptible even at lower exchangeable sodium percentage (ESP) values. Also, surface soils, when leached with rainwater, will be especially susceptible at such low levels of exchangeable Na.

The hydraulic conductivity for seven soils of varying clay mineralogy were decreases in the (ESP) range of 20 to 35 at salt concentrations of 3 to 50 meq/liter. The decreases were largely irreversible upon the reapplication of high salt or high Ca solutions to the soil, except for those soils containing greater than 10% montmorillonite on a whole-soil basis have been noticed by (McNea and Coleman 1966). In a laboratory work Nielson *et al.*, Keller and Alforo (1966) and some carefully controlled field experiments, Miller *et al.* (1965) indicated that the efficiency of salt leaching was greatly increased by controlling the soil water content and flow velocity of water during leaching. A continuous leaching of clay soils with distilled water was found to increase the hydraulic conductivity of the soil (Pupisky and Shainberg, 1979).

MATERIALS AND METHODS

Continuous leaching is accomplished by continuously ponding water on the soil surface and in intermittent leaching ponded water application is interrupted with rest periods allowing redistribution of salts held in macro pores. Several experiments have been conducted to test the efficiency of continuous and intermittent leaching methods. Due to the above facts the present study was carried out in the laboratory to compare the continuous and intermittent leaching methods for reclaiming saline and saline sodic soils. In continuous leaching, a large quantity of water is required over a short leaching period, the inverse soil. Therefore, it is wiser to correct soil salinity before it develops into soil alkalinity.

Two major mechanisms of swelling and dispersion of clay particles have been proposed to be responsible for reduction in hydraulic conductivity. Saturated hydraulic conductivity (K_{sat}) of soil describes its ability to transmit water at saturated condition, which is an important indicator of soil pore geometry and structure dynamics. Several factors and their interactions can affect hydraulic conductivity they include (1) hydraulic properties, such as viscosity, density, sodium adsorption ratio (SAR) and electrolyte concentration (EC) of the leaching solution (Bennett *et al.*, 2019,); (2) soil chemical properties, such as exchangeable ion percentage (EIP), organic carbon content, oxides, carbonates (Ezlit *et al.*, 2013); and (3) soil physical properties, such as the total porosity, pore size and tortuosity, clay minerals and texture. Among these, soil pore geometry and connectivity are the direct factor determining hydraulic conductivity whereas pore size distribution and interconnectivity are affected by disaggregation, swelling and dispersion of particles (Bennett *et al.*, 2019, Dang *et al.*, 2018,).

Sameni and Morshedi (2000) found that the gypsum application modified the suppressing effect of salinity and sodicity on the hydraulic conductivity values of the tested soils, and the effects were more concluded that the slaking of the soil structure is responsible for blockage of the conducting pores and reduction in the hydraulic conductivity of the tested soils pronounced for higher rates of gypsum applied and also they concluded, that the slaking of the soil structure is responsible for blockage of the conducting pores and reduction in the hydraulic conductivity of the tested soils.

Frenkel *et al.*, (1978) clarified that the plugging of pores by dispersed clay particle along soil columns packed with montmorillonitic, vermiculitic, and kaolinitic soils adjusted to different levels of

Reclaim the salt affected soils using continuous and intermittent leaching methods

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ABSTRACT

A laboratory experiment was conducted to measure the saturated hydraulic conductivity (K_{sat}) of two surface soil samples, saline sodic (S1) and saline soil (S2) collected from Tawergha Agricultural project, located about 300 km east of Tripoli / Libya before and after leaching processes by the intermittent and continuous leaching technique using the constant head method as described by Klute and Dirksen (1986). hydraulic conductivity depends on the soil pore space, proportion of air in the soil and the soil salt content. The K_{sat} under intermittent pouring (M1) was lower than the continuous pouring (M2) and the reverse was true for (PV) at 6 - PV soils had less K_{sat} as compared to 3 - PV, Table (1).

الملخص

- أجريت تجربة معملية لقياس التوصيل الهيدرولكي التشبعي للتربة التي تم غسلها باستخدام طريقة الغسيل المتقطع والغسيل المستمر عن طريق العمود الثابت كما وصفها Klute and Dirksen (1986). و يعتمد التوصيل الهيدروليكي على مساحة المسام ونسبة الهواء في التربة ومحتوى التربة من الاملاح. لقد تبين من النتائج المتحصل عليها من التجربة بان التوصيل الهيدروليكي التشبعي للترب تحت الغسيل المتقطع ((M1) كانت أقل من التوصيل الهيدروليكي للترب تحت الغسيل المستمر (M 2) والعكس صحيح في حجم الماء (PV) حيث ادى PV -6 (V2) الى توصيل هيدروليكي اقل للترب تحت الدراسة مقارنة بـPV -3 (V1) كما يتبين ذلك من الجدول (1).

INTRODUCTION

Soil salinity is one of the major causes of soil degradation in the world, particularly under arid condition. A further stage of soil salinity is soil alkalinity; soil salinity might be corrected by leaching practice but soil alkalinity requires soil amendments in addition to leaching to reclaim