# A NEW METHOD TO ESTIMATE TOTAL DISSOLVED SALTS IN SOIL SATURATUION EXTRACTS FROM ELECTERICAL CONDUCTIVITY UNDER EGYPTIAN CONDITIONS

EI-Sayed, M. H. and M.M.I. EI-Kholy

Soil, Water and Environment Res. Inst., Agric. Res. center, Giza, Egypt

### ABSTRACT

Fifty two soil samples with different quantities and qualities of salt were taken from different places in Egypt to present the most soil types. A saturation extract from each sample was prepared and its electrical conductivity (EC) and total dissolved salts (S) were determined. Both EC and S values ranged from 0.74 to 185 dSm<sup>-1</sup> and from 0.44 to 309 g dm<sup>-3</sup>, respectively.

The relationship between S and EC was not linear. When the saturation extracts were diluted with progressively large quantities of distilled water [1(saturation extract):10, 25, 50, 100, 250, 500, 1000 (distilled water)] and their electrical conductivity were calculated (EC<sub>e</sub>) with the equation:  $EC_e = (EC_d - EC_w)F$ , where  $EC_d$  and  $EC_w$  were the conductivity of the diluted extract and the distilled water, respectively, and F was the dilution factor, the relationship between S and  $EC_e$  tended to be linear.

The highest linear correlation coefficient relating S (mg dm<sup>-3</sup>) and EC<sub>e</sub> (dS m<sup>-1</sup>) was reached when EC<sub>e</sub> values were calculated for dilution with an electrical conductivity (EC<sub>d</sub>) between 0.1 and 0.5 dSm<sup>-1</sup> (EC<sub>e</sub><sup>\*</sup>). The regression equation was S=425 EC<sub>e</sub><sup>\*</sup> with R<sup>2</sup>=0.989. This relationship can be used in all saturation extracts, regardless of the concentration and type of ions present.

Keywords: Soil saturation extract, total dissolved salts and electrical conductivity.

# INTRODUCTION

The soil solution is a source of plant nutrients and medium for all reactions, nutrient cycling in ecosystems, and pollutant transformation and transport in soils. Chemically, it can be defined as the soil water and its dissolved electrolytes, gases and water soluble compounds (Agbenin, 2003). The composition of the soil solution is greatly affected by nutrient uptake, fertilization, leaching (Nemeth *et al.*, 1970) and other soil properties, which vary in time and space. So, it is different to predict total dissolved salts from electrical conductivity measurements for soils with a high content of soluble salts.

If the temperature and geometry of a cell, through which an electric current is passed, are fixed, the electrical conductivity of a solution will be a function of the concentration, total charge and mobility of the ion species (Simon *et al.*, 1994). This relationship between ion concentration and electrical conductivity means that the latter parameter is highly useful for calculating the total content of salts dissolved in soil extract (US Salinity Laboratory Staff, 1954 and McNeal *et al.*, 1970). However, the relationship is not completely linear because electrical conductivity is directly related to total charge and ion mobility, and as the concentration increases there is a concomitant decrease in both these parameters due to relaxation and

electrophoretic phenomena and also to the formation of ion pairs (Tanji and Bigger, 1972; Marion and Babock, 1976). This last factor depends in turn upon the type of ions in solution. More ion pairs are formed with  $Ca^{2+}$ ,  $Mg^{2+}$  and  $SO_4^{2-}$  than with Na<sup>+</sup> and HCO<sub>3</sub><sup>-</sup> (Alzubaidi and Webster, 1983, and Simon *et al.*, 1994)

For this reason the numerous attempts that have been made to establish a relationship between electrical conductivity (EC) and total quantity of dissolved salts (S) in saturation extracts of soil have yielded very different results, depending on the concentration and type of ions present. Therefore, results of those attempts have limited application. In Spain, Simon *et al.*, 1994 investigated this above relationship using thirty-nine soil samples and reached a highest linear correlation coefficient between total dissolved salts (S); mg dm<sup>-3</sup>, and EC<sub>e</sub>, dSm<sup>-1</sup>, when EC<sub>e</sub> values were calculated for dilutions with a conductivity (E<sub>d</sub>) ranged from 0.1 to 0.3 dSm<sup>-1</sup>(E<sub>ce</sub><sup>\*</sup>); and they established this regression equation: S=  $490E_{ce}^*$ , R<sup>2</sup> = 0.999<sup>-1</sup>

The aim of this study is to establish an equation relating electrical conductivity to total dissolved salts, which would be applicable to any kind of soil-saturation extract, whatever was the salt concentration or composition, under Egyptian conditions.

# MATERIALS AND METHODS

Fifty two soil samples with different quantities and qualities of salt were taken from different places in Egypt to present the most soil types. A saturation extract from each sample was prepared and its electrical conductivity (EC) and total dissolved salts (S) were determined (US Salinity Laboratory Staff, 1954). Each saturation extract was then diluted to increasingly large distilled-water: soil-extract ratios (10, 25, 50, 100, 250, 500 and 1000) and the electrical conductivity of each dilution (EC<sub>d</sub>) was determined. From electrical conductivity value of diluted sample and that of distilled water (EC<sub>w</sub>), we calculated new electrical conductivity values (EC<sub>e</sub>) for each of the soil extracts via the equation:

$$EC_e = (EC_d - EC_w) F \quad (1)$$

Where F is the dilution factor of the distilled water: soil-extract ratio in each dilution. The value of  $EC_w$  was 0.003 dSm<sup>-1</sup>.

Electrical conductivity of the saturation extracts and their respective dilutions were measured with a conductivity meter with a standard conductivity cell. Calcium, magnesium, carbonates & bicarbonates, and chlorides were titrated by Na<sub>2</sub>-EDTA, H<sub>2</sub>SO<sub>4</sub> and AgNO<sub>3</sub>, respectively. Potassium and sodium were determined by usinflame photometry, and sulphates were precipitated as BaSO<sub>4</sub> (Black *et al.*, 1965). The values of total salts (S) were derived from these data by multiplication in equivalent weight and summation. Obtained data of chemical analysis of the saturation extracts were presented in Table (1).

	Soil	EC			lonic co	omposit	ion (mn	nol₀dm⁻³)			Total salts	
No.         I <thi< th="">         I         I         I</thi<>	sample	(dSm <sup>-1</sup> )	Na ⁺	K⁺	Ca <sup>2+</sup>	Ma <sup>2+</sup>	CO32-	HCO <sub>3</sub>	CI.	SO42-	(S)(gdm <sup>-3</sup> )	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	No. '	` '							•		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1	0.74	2.38	0.06	2.0	1.00	0.00	1.38	3.09	2.87	0.44	
3         7.20         35.1         6.81         20.0         25.00         0.00         2.59         29.7         60.6         5.89           4         81.1         1980         17.00         290         30.00         0.000         1.11         1910         415.9         140.2           5         2.86         12.4         0.95         8.00         8.00         0.00         1.85         3.96         28.5         2.13           7         2.88         12.00         0.35         12.0         6.00         0.00         1.40         70         19.4         2.17           8         6.60         41.00         2.30         27.0         12.00         0.00         2.59         3.93         6.42         2.32           9         2.80         12.30         0.64         1.60         0.000         2.59         4.59         33.1         2.58           11         37.1         2.30         0.65         0.17         6.00         0.000         1.48         3.96         5.93         3.1         2.58           14         1.39         6.50         0.17         6.00         0.00         0.05         3.30         3.01         3.01	2	1.27	2.20	0.12	3.0	4.00	0.00	3.10	3.09	4.13	0.66	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	3	7.20	35.1	6.81	20.0	25.00	0.00	2.59	29.7	60.6	5.89	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	4	81.1	1980	17.10	290	30.00	0.00	1.11	1910	415.9	140.2	
	5	2.86	12.4	0.95	8.00	8.00	0.00	1.85	3.96	28.5	2.19	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6	1.96	6.00	0.23	6.00	8.00	0.00	1.48	6.93	17.5	1.54	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	7	2.88	12 00	0.35	12.0	6.00	0.00	4 07	10.9	19.4	2 17	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	8	6.60	41 00	2.30	27.0	12 00	0.00	2.59	39.6	48.2	5 59	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ğ	2.80	12.90	0.64	10.0	7 00	0.00	2.00	9 90	16.4	1.88	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	10	3 71	6.00	1 07	14.0	20.00	0.00	2.59	6.93	36.6	2.86	
12         4.90         9.80         0.202         120         18.00         0.002         1.48         3.96         59.9         4.21           13         3.57         7.40         1.18         15.0         13.00         0.00         2.59         4.59         33.1         2.58           14         1.39         6.50         0.17         6.00         4.00         0.00         1.48         3.96         59.9         4.21           15         40.0         597.3         3.40         39.0         8.50         0.00         1.65         566.5         8.91         11.3         1.27           16         5.60         49.00         0.80         11.00         5.00         0.00         0.55         33.6         6.33           19         1.38         40.21         1.05         2.00         4.00         0.00         1.10         4.42         6.43         0.83           20         1.10         7.80         0.35         1.00         3.00         0.00         1.10         1.44         39.6         6.33         0.83           21         1.22         7.67         62.50         0.14         10.0         2.00         0.00         1.10	11	3 71	22 30	0.66	15.0	5 00	0.00	2.00	2 97	42.4	3.20	
13         3.57         7.40         1.13         15.00         0.00         1.40         5.03         33.1         2.58           14         1.39         6.50         0.17         6.00         4.00         0.00         1.48         8.91         11.3         1.27           15         40.0         597.3         3.40         39.0         8.50         0.00         1.65         566.5         86.1         39.1           16         5.60         49.00         0.80         11.0         5.00         0.00         0.55         30.9         36.6         4.33           17         9.53         89.3         0.90         5.00         4.00         0.00         1.65         4.90         6.43         0.80           20         1.10         7.80         0.35         1.00         3.00         0.00         0.05         51.00         2.60         0.76           21         1.02         7.10         0.42         1.00         2.00         0.00         1.10         4.14         39.7         3.75           24         7.67         62.50         0.14         10.0         20.00         0.00         1.55         49.4         41.8         5.68 </th <th>12</th> <th>4 90</th> <th>9.80</th> <th>0.50</th> <th>32.0</th> <th>18.00</th> <th>0.00</th> <th>1.48</th> <th>3.96</th> <th>50.0</th> <th>4 21</th>	12	4 90	9.80	0.50	32.0	18.00	0.00	1.48	3.96	50.0	4 21	
14         1.39         6.50         1.10         6.00         1.30         6.130         1.30         1.13         1.27           15         40.0         597.3         3.40         39.0         8.50         0.00         1.48         8.91         11.3         1.27           15         56.0         49.00         0.80         11.0         5.00         0.00         1.65         566.5         86.1         39.1         39.3         6.6         4.33           17         9.53         89.3         0.90         5.00         4.00         0.00         1.55         4532         60.35         30.7.3           19         1.38         4.02         1.05         2.00         4.00         0.00         1.55         4532         60.35         30.7.3           20         1.10         7.80         0.35         1.00         3.00         0.00         0.55         10.0         2.60         0.76           21         1.02         7.10         0.42         1.00         2.00         0.00         1.10         1.41         39.7         3.75           24         7.67         6.25         0.14         1.00         2.00         0.00         1.10	13	3.57	7.40	1 18	15.0	13.00	0.00	2.59	4 59	33.1	2.58	
15         140.0         597.3         3.40         39.0         1.01         1.13         3.03         0.00         1.00         1.00         1.01         1.13         4.18         5.68         2.27         1.0.4         2.66         1.01         1.01         4.12         3.55         4.86           25         15.0         100         3.00         1.00         1.0	14	1 30	6.50	0.17	6.00	4 00	0.00	1.48	8 01	11 3	1 27	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	15	40.0	5073	3.40	30.00	8.50	0.00	1.40	566 5	86.1	30.1	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	16	5 60	10 00	0.80	11 0	5.00	0.00	0.55	30 0.5	36.6	/ 33	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	17	0.53	80.3	0.00	5.00	4.00	0.00	1 10	65.0	34.6	6.30	
	19	19/ 9	5000	19 20	20.0	4.00	0.00	0.55	4522	602 F	207.2	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	10	1 38	4 02	1 05	2 00	4 00	0.00	1.65	4002	6 43	0.80	
21       1.02       7.10       0.42       1.00       2.00       0.00       1.10       6.13       5.24       0.76         22       0.92       8.60       0.30       1.00       1.00       0.00       1.10       4.12       6.41       0.76         23       4.98       30.30       6.00       12.0       8.00       0.00       1.10       4.12       6.41       0.76         24       7.67       62.50       0.14       10.0       20.00       0.00       1.65       14.4       39.7       3.75         24       7.67       62.50       0.14       10.0       20.00       0.00       1.65       154.5       22.7       10.4         26       6.65       28.0       3.80       32.0       16.00       0.00       1.10       41.2       35.5       4.86         Table (1). Cont:       Total salts       5.00       0.00       1.10       379       48.9       24.8         38       4.98       34.5       1.24       9.00       5.00       0.00       0.55       951       138       64.4         31       27.7       248       7.50       65.0       19.0       0.55       111.0	20	1.50	7.80	0.35	2.00	3.00	0.00	0.55	10.0	2.60	0.00	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	20	1.10	7.00	0.33	1.00	2.00	0.00	1 1 0	6 1 9	5.24	0.76	
22         0.32         0.00         0.30         0.00         0.00         1.10         1.44         39.7         3.75           24         7.67         62.50         0.14         10.0         20.00         0.00         1.55         49.4         41.8         5.68           25         15.0         100         3.70         45.0         31.00         0.00         1.65         154.5         22.7         10.4           26         6.65         28.0         38.0         32.0         16.00         0.00         1.10         41.2         35.5         4.86           Total salts           sample         (dSm <sup>1</sup> )         Na *         K*         Ca**         Mg**         CO3*         HCO3*         CI         SO(2*         (S)(gdm³)           No.         27         32.0         260         4.60         107         56.6         0.00         1.10         379         48.9         24.8           30         75.4         266         4.60         40.9         20.0         0.00         1.55         951         138         64.4           31         27.7         248         7.50         65.0 <t< th=""><th>22</th><th>0.02</th><th>8.60</th><th>0.42</th><th>1.00</th><th>2.00</th><th>0.00</th><th>1.10</th><th>1 12</th><th>6.41</th><th>0.76</th></t<>	22	0.02	8.60	0.42	1.00	2.00	0.00	1.10	1 12	6.41	0.76	
23         4.30         50.30         0.00         12.0         0.00         1.00         10.00         1.10         14.4         41.8         5.68           25         15.0         100         3.70         45.0         31.00         0.00         1.65         154.5         22.7         10.4           26         6.65         28.0         3.80         32.0         16.00         0.00         1.10         41.2         35.5         4.86           Table (1). Cont.           Soil         Total salts           Soil         Total salts           Soil         Total salts           Soil         Total salts           Soil         Soil         Soil           Soil         Soil         Soil         Soil           Soil         Soil         Soil           Soil         Soil         Soil         Soil           Soil         Soil         Soil         Soil           Soil <th colsp<="" th=""><th>22</th><th>4.92</th><th>30.30</th><th>6.00</th><th>12.0</th><th>8.00</th><th>0.00</th><th>1.10</th><th>1//</th><th>30.7</th><th>3.75</th></th>	<th>22</th> <th>4.92</th> <th>30.30</th> <th>6.00</th> <th>12.0</th> <th>8.00</th> <th>0.00</th> <th>1.10</th> <th>1//</th> <th>30.7</th> <th>3.75</th>	22	4.92	30.30	6.00	12.0	8.00	0.00	1.10	1//	30.7	3.75
24         15.0         10.0         20.00         0.00         1.65         15.4.5         22.7         10.4           26         6.65         28.0         3.80         32.0         16.00         0.00         1.65         154.5         22.7         10.4           26         6.65         28.0         3.80         32.0         16.00         0.00         1.10         41.2         35.5         4.86           Total salts           Soil         EC         Incide composition (mmoledm <sup>3</sup> )         Total salts           Soil          Total salts	23	7.67	62 50	0.00	10.0	20.00	0.00	0.55	14.4	11 0	5.75	
26         16.0         17.0         17.0         17.0         17.4         22.7         10.4           26         6.65         28.0         32.0         16.00         0.00         1.10         41.2         35.5         4.86           Table (1). Cont.         EC         Ionic composition (mmol_cdm <sup>3</sup> )         Total salts           Soil         EC         Ionic composition (mmol_cdm <sup>3</sup> )         Total salts           No.         Na *         K*         Ca <sup>2+</sup> Mg <sup>2+</sup> CO <sub>3</sub> <sup>2-</sup> HCO <sub>3</sub> Cl         SO <sub>4</sub> 27         32.0         260         4.60         107         56.6         0.00         1.10         379         48.9         24.8           28         4.98         34.5         1.24         9.00         5.00         0.00         0.55         28.8         24.8         3.33           29         25.4         266         4.60         40.9         22.0         0.00         0.55         951         138         64.4           31         27.7         248         7.50         65.0         58.0         0.00         0.55         412         110         31.4           34         15.2         13.0	24	15.0	100	3 70	10.0	20.00	0.00	1.65	49.4	22.7	10.4	
Zor         10.00         12.00         10.00         10.00         11.10         11.2         13.05         14.00           Table (1). Cont.         Econ         Ionic composition (mmol.dm <sup>3</sup> )         Total salts           Sample         (dSm <sup>-1</sup> )         Na *         K*         Ca <sup>2*</sup> Mg <sup>2*</sup> CO <sub>3</sub> <sup>2</sup> HCO <sub>3</sub> Cl         SO.4 <sup>2*</sup> (S)(gdm <sup>3</sup> )           27         32.0         260         4.60         107         56.6         0.00         1.10         379         48.9         24.8           28         4.98         34.5         1.24         9.00         5.00         0.00         0.55         28.8         24.8         3.33           29         25.4         266         4.60         40.9         .20.0         0.00         0.55         951         138         64.4           31         27.7         248         7.50         65.0         58.0         0.00         0.55         105         22.1         11.1           33         49.8         446         4.20         21.0         19.0         0.00         0.55         142         110         31.4           34         15.2         130         5.00	25	6.65	28.0	3.80	32.0	16.00	0.00	1.05	/1 2	35.5	1 86	
Soil Sample No.EC (dSm <sup>-1</sup> )Ionic composition (mmol <sub>c</sub> dm <sup>-3</sup> )Total salts (S)(gdm <sup>-3</sup> )2732.02604.6010756.60.001.1037948.924.8284.9834.51.249.005.000.000.5528.824.83.332925.42664.6040.9.20.00.000.5595113864.43127.72487.5065.058.00.000.5539170.925.33215.01404.4025.019.00.000.5514646.211.13349.84464.2021.048.00.00.5541211031.43415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5512838.710.1375.0426.81.3916.014.00.001.1040.514.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.009.0026.914.03.27409.7178.91.8411.726.62.0010.037.72.084.494220.01801.2042.032.80.005.00 <td< th=""><th></th><th>1) Con</th><th>±</th><th>0.00</th><th>02.0</th><th>10.00</th><th>0.00</th><th>1.10</th><th>71.2</th><th>00.0</th><th>4.00</th></td<>		1) Con	±	0.00	02.0	10.00	0.00	1.10	71.2	00.0	4.00	
Soil sample No.EC (dSm <sup>-1</sup> )Ionic composition (mm0cdm <sup>-2</sup> ) Na *Iotal saits (G2*2732.02604.6010756.60.001.1037948.924.8284.9834.51.249.005.000.000.5528.824.83.332925.42664.6040.9.20.00.001.1035644.922.23075.487016.512080.00.000.5595113864.43127.72487.5065.058.00.000.5516522.111.13349.84464.2021.048.00.00.5541211031.43415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5514646.211.6375.0426.81.3916.014.00.001.1040.541.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.009.0026.914.03.27409.7178.91.8411.726.62.0010.064.740.37.40416.3543.91.109.5414.92.0010.03			-									
Sample         (GSIII -)         Na         K         Ca <sup></sup> Mg <sup></sup> CO <sub>3</sub> <sup></sup> HCO <sub>3</sub> CI         SO <sub>4</sub> <sup></sup> (S)(gdin -)           27         32.0         260         4.60         107         56.6         0.00         1.10         379         48.9         24.8           28         4.98         34.5         1.24         9.00         5.00         0.00         0.55         28.8         24.8         3.33           29         25.4         266         4.60         40.9         .20.0         0.00         1.10         356         44.9         22.2           30         75.4         870         16.5         120         80.0         0.00         0.55         391         70.9         25.3           32         15.0         140         4.40         25.0         19.0         0.00         0.55         142         110         31.4           34         15.2         130         5.00         40.0         16.0         0.00         0.55         412         110         31.4           35         6.43         36.0         4.20         21.0         19.0         0.00         0.55         128         38.					lan'a a							
NO.32.02604.6010756.60.001.1037948.924.8284.9834.51.249.005.000.000.5528.824.83.332925.42664.6040.9.20.00.001.1035644.922.23075.487016.512080.00.000.5595113864.43127.72487.5065.058.00.000.5539170.925.33215.01404.4025.019.00.000.5514646.211.13349.84464.2021.048.00.00.5541211031.43415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5512838.710.13612.31183.1035.012.00.001.1040.541.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.009.0026.914.03.27409.7178.91.8411.726.62.0010.064.740.37.40416.3543.91.009.5414.92.0010.0	Soil				lonic c	omposi	tion (mr	nol <sub>c</sub> dm <sup>-3</sup>	)	<b>CO</b> 2:	Total salts	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Soil sample	EC (dSm <sup>-1</sup> )	Na *	K⁺	lonic c Ca²⁺	omposi Mg²⁺	tion (mr CO <sub>3</sub> <sup>2-</sup>	nol₀dm⁻³ HCO₃⁻	) Cl <sup>-</sup>	SO42-	Total salts (S)(gdm⁻³)	
26 $4.96$ $34.5$ $1.24$ $9.00$ $5.00$ $0.00$ $0.53$ $22.6$ $24.8$ $3.33$ $29$ $25.4$ $266$ $4.60$ $40.9$ $20.0$ $0.00$ $1.10$ $356$ $44.9$ $22.2$ $30$ $75.4$ $870$ $16.5$ $120$ $80.0$ $0.00$ $0.55$ $951$ $138$ $64.4$ $31$ $27.7$ $248$ $7.50$ $65.0$ $58.0$ $0.00$ $0.55$ $391$ $70.9$ $25.3$ $32$ $15.0$ $140$ $4.40$ $25.0$ $19.0$ $0.00$ $0.55$ $1412$ $110$ $31.4$ $34$ $45.2$ $130$ $5.00$ $40.0$ $16.0$ $0.00$ $0.55$ $146$ $46.2$ $11.6$ $35$ $6.43$ $36.0$ $4.20$ $21.0$ $19.0$ $0.00$ $0.55$ $142$ $110$ $31.4$ $34$ $15.2$ $130$ $5.00$ $40.0$ $16.0$ $0.00$ $0.55$ $412$ $110$ $31.4$ $36$ $12.3$ $118$ $3.10$ $35.0$ $12.0$ $0.00$ $0.55$ $128$ $38.7$ $10.1$ $37$ $5.04$ $26.8$ $1.39$ $16.0$ $14.0$ $0.00$ $1.10$ $40.5$ $41.5$ $4.66$ $38$ $1.98$ $15.1$ $0.70$ $2.12$ $3.18$ $0.00$ $4.50$ $13.4$ $4.80$ $1.44$ $39$ $4.70$ $38.4$ $1.52$ $4.20$ $20.0$ $10.0$ $37.7$ $20.8$ $4.49$ <th< th=""><th>Soil sample No.</th><th>EC (dSm<sup>-1</sup>)</th><th>Na +</th><th><b>K</b>⁺</th><th>lonic c Ca<sup>2+</sup></th><th>omposit Mg²+</th><th>tion (mr CO<sub>3</sub><sup>2-</sup></th><th>nol₀dm<sup>-3</sup> HCO₃<sup>-</sup></th><th>) Cl<sup>-</sup></th><th><b>SO</b>4<sup>2-</sup></th><th>Total salts (S)(gdm<sup>-3</sup>)</th></th<>	Soil sample No.	EC (dSm <sup>-1</sup> )	Na +	<b>K</b> ⁺	lonic c Ca <sup>2+</sup>	omposit Mg²+	tion (mr CO <sub>3</sub> <sup>2-</sup>	nol₀dm <sup>-3</sup> HCO₃ <sup>-</sup>	) Cl <sup>-</sup>	<b>SO</b> 4 <sup>2-</sup>	Total salts (S)(gdm <sup>-3</sup> )	
2923.42004.0040.92.0.00.001.1033044.922.23075.487016.512080.00.000.5595113864.43127.72487.5065.058.00.000.5539170.925.33215.01404.4025.019.00.000.5516522.111.13349.84464.2021.048.00.00.5541211031.43415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5514846.211.63612.31183.1035.012.00.000.5512838.710.1375.0426.81.3916.014.00.001.1040.541.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.009.0026.914.03.27409.7178.91.8411.726.62.0010.037.720.84.494220.01801.2042.032.80.005.0037.720.84.494220.01801.2042.032.80.005.00<	Soil sample No. 27	EC (dSm <sup>-1</sup> )	Na ⁺ 260	<b>K</b> <sup>+</sup> 4.60	lonic c Ca²+	omposit Mg <sup>2+</sup> 56.6	tion (mr CO <sub>3</sub> <sup>2-</sup>	nol <sub>c</sub> dm <sup>-3</sup> HCO₃ <sup>-</sup>	) Cl <sup>-</sup> 379	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9	Total salts (S)(gdm <sup>-3</sup> ) 24.8	
3013.413.010.012.010.010.010.013.013.013.013.013.014.43127.724.87.5065.058.00.000.5539.170.925.33215.01404.4025.019.00.000.5516522.111.13349.84464.2021.048.00.00.5541211031.43415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5514846.211.63612.31183.1035.012.00.000.5514838.710.1375.0426.81.3916.014.00.001.1040.541.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.0010.064.740.37.40416.3543.91.109.5414.92.0010.037.720.84.494220.01801.2042.032.80.005.0026.216.13.14434.8034.00.5011.04.008.005.0037.025.24.27449.4359.80.9028	Soil sample No. 27 28	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4	Na <sup>+</sup> 260 34.5	<b>K</b> <sup>+</sup> 4.60 1.24	lonic c Ca <sup>2+</sup> 107 9.00	omposit Mg <sup>2+</sup> 56.6 5.00	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00	nol₀dm <sup>-3</sup> HCO <sub>3</sub> - 1.10 0.55	<b>CI</b> <sup>-</sup> 379 28.8	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8	Total salts (S)(gdm <sup>3</sup> ) 24.8 3.33 22.2	
3124.07.3063.063.060.063.565.510.525.33215.01404.4025.019.00.000.5516522.111.13349.84464.2021.048.00.00.5541211031.43415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5514835.14.973612.31183.1035.012.00.000.5512838.710.1375.0426.81.3916.014.00.001.1040.541.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.009.0026.914.03.27409.7178.91.8411.726.62.0010.064.740.37.40416.3543.91.109.5414.92.0010.037.720.84.494220.01801.2042.032.80.005.0012412516.1434.8034.00.5011.04.008.0048.539.56.50455.9046.24.524.229.560.005.0037.025.2	Soil sample No. 27 28 29 20	<b>EC</b> (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75 4	Na * 260 34.5 266 870	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5	Ionic c Ca <sup>2+</sup> 107 9.00 40.9	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55	CI 379 28.8 356	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 128	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64 4	
3213.014.014.023.015.015.00.000.5510522.111.1 $34$ 15.21305.0040.016.00.000.5514646.211.6 $35$ 6.4336.04.2021.019.00.000.5514646.211.6 $35$ 6.4336.04.2021.019.00.000.5512838.710.1 $36$ 12.31183.1035.012.00.000.5512838.710.1 $37$ 5.0426.81.3916.014.00.001.1040.541.54.66 $38$ 1.9815.10.702.123.180.004.5013.44.801.44 $39$ 4.7038.41.505.264.240.009.0026.914.03.27 $40$ 9.7178.91.8411.726.62.0010.064.740.37.40 $41$ 6.3543.91.109.5414.92.0010.037.720.84.49 $42$ 20.01801.2042.032.80.005.0012412516.1 $43$ 4.8034.00.5011.04.008.0048.539.56.50 $45$ 5.9046.24.524.229.560.005.0037.025.24.27 $46$ 8.6647.22.2031.8 <t< th=""><th>Soil sample No. 27 28 29 30 21</th><th>EC (dSm<sup>-1</sup>) 32.0 4.98 25.4 75.4 27.7</th><th>Na * 260 34.5 266 870 248</th><th><b>K</b><sup>+</sup> 4.60 1.24 4.60 16.5 7.50</th><th>Ionic c Ca<sup>2+</sup> 107 9.00 40.9 120 65 0</th><th>omposit Mg<sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0</th><th>tion (mr CO<sub>3</sub><sup>2-</sup> 0.00 0.00 0.00 0.00</th><th>nol₀dm<sup>-3</sup> HCO<sub>3</sub>- 1.10 0.55 1.10 0.55 0.55</th><th>CI 379 28.8 356 951 201</th><th><b>SO</b><sub>4</sub><sup>2-</sup> 48.9 24.8 44.9 138 70.0</th><th>Total salts (S)(gdm<sup>-3</sup>) 24.8 3.33 22.2 64.4 25 2</th></t<>	Soil sample No. 27 28 29 30 21	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7	Na * 260 34.5 266 870 248	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50	Ionic c Ca <sup>2+</sup> 107 9.00 40.9 120 65 0	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00	nol₀dm <sup>-3</sup> HCO <sub>3</sub> - 1.10 0.55 1.10 0.55 0.55	CI 379 28.8 356 951 201	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.0	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25 2	
334404404404404606006006006006103415.21305.0040.016.00.000.5514646.211.6356.4336.04.2021.019.00.000.5514646.211.63612.31183.1035.012.00.000.5512838.710.1375.0426.81.3916.014.00.001.1040.541.54.66381.9815.10.702.123.180.004.5013.44.801.44394.7038.41.505.264.240.009.0026.914.03.27409.7178.91.8411.726.62.0010.064.740.37.40416.3543.91.109.5414.92.0010.037.720.84.494220.01801.2042.032.80.005.0012412516.1434.8034.00.5011.04.008.0048.539.56.50455.9046.24.524.229.560.005.0037.025.24.27468.6647.22.2031.831.80.005.0057.070.08.22499.0139.61.3031.135.00.005.0057.0 <th>Soil sample <u>No.</u> 27 28 29 30 31 22</th> <th>EC (dSm<sup>-1</sup>) 32.0 4.98 25.4 75.4 27.7 15 0</th> <th>Na * 260 34.5 266 870 248</th> <th><b>K</b><sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40</th> <th>Ionic c Ca<sup>2+</sup> 107 9.00 40.9 120 65.0 25.0</th> <th>omposit Mg<sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0</th> <th>tion (mr CO<sub>3</sub><sup>2-</sup> 0.00 0.00 0.00 0.00 0.00</th> <th>nol₀dm<sup>-3</sup> HCO<sub>3</sub> 1.10 0.55 1.10 0.55 0.55</th> <th>CI<sup>-</sup> 379 28.8 356 951 391</th> <th><b>SO</b><sub>4</sub><sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1</th> <th>Total salts (S)(gdm<sup>-3</sup>) 24.8 3.33 22.2 64.4 25.3 11 1</th>	Soil sample <u>No.</u> 27 28 29 30 31 22	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15 0	Na * 260 34.5 266 870 248	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40	Ionic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55	CI <sup>-</sup> 379 28.8 356 951 391	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11 1	
34         15.2         15.0         15.0         16.0         1	Soil sample No. 27 28 29 30 31 32 22	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 40.8	Na * 260 34.5 266 870 248 140	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00	nol₀dm <sup>-3</sup> HCO <sub>3</sub> <sup>-</sup> 1.10 0.55 1.10 0.55 0.55 0.55 55	CI <sup>-</sup> 379 28.8 356 951 391 165 412	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 21.4	
35       0.43       30.0       4.20       21.0       13.0       0.00       0.55       12.3       30.1       4.57         36       12.3       118       3.10       35.0       12.0       0.00       0.55       128       38.7       10.1         37       5.04       26.8       1.39       16.0       14.0       0.00       1.10       40.5       41.5       4.66         38       1.98       15.1       0.70       2.12       3.18       0.00       4.50       13.4       4.80       1.44         39       4.70       38.4       1.50       5.26       4.24       0.00       9.00       26.9       14.0       3.27         40       9.71       78.9       1.84       11.7       26.6       2.00       10.0       64.7       40.3       7.40         41       6.35       43.9       1.10       9.54       14.9       2.00       10.0       37.7       20.8       4.49         42       20.0       180       1.20       42.0       32.8       0.00       5.00       124       125       16.1         43       4.80       34.0       0.50       11.0       4.00       8.00 </th <th>Soil sample No. 27 28 29 30 31 32 33 24</th> <th>EC (dSm<sup>-1</sup>) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 45.2</th> <th>Na * 260 34.5 266 870 248 140 446 120</th> <th><b>K</b><sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00</th> <th>Ionic c Ca<sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0</th> <th>omposit Mg<sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0 16.0</th> <th>tion (mr CO<sub>3</sub><sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.</th> <th>nol₀dm<sup>-3</sup> HCO<sub>3</sub><sup>-</sup> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55</th> <th><b>CI</b> 379 28.8 356 951 391 165 412</th> <th><b>SO</b><sub>4</sub><sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2</th> <th>Total salts (S)(gdm<sup>-3</sup>) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6</th>	Soil sample No. 27 28 29 30 31 32 33 24	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 45.2	Na * 260 34.5 266 870 248 140 446 120	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00	Ionic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0 16.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol₀dm <sup>-3</sup> HCO <sub>3</sub> <sup>-</sup> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	<b>CI</b> 379 28.8 356 951 391 165 412	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Soil sample No. 27 28 29 30 31 32 33 34 35	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43	Na * 260 34.5 266 870 248 140 446 130 260	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 4.20	Ionic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0 16.0 19.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	<b>CI</b> 379 28.8 356 951 391 165 412 146 45 3	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35 1	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4 97	
37         3.04         20.0         1.33         10.0         14.0         10.0         4.00         4.03         4.13         4.80         1.44           38         1.93         1.00         2.12         3.18         0.00         4.50         13.4         4.80         1.44           39         4.70         38.4         1.50         5.26         4.24         0.00         9.00         26.9         14.0         3.27           40         9.71         78.9         1.84         11.7         26.6         2.00         10.0         64.7         40.3         7.40           41         6.35         43.9         1.10         9.54         14.9         2.00         10.0         64.7         40.3         7.40           42         20.0         180         1.20         42.0         32.8         0.00         5.00         124         125         16.1           43         4.80         34.0         0.50         11.0         9.54         14.8         2.00         10.0         37.7         20.8         4.49           42         20.0         180         1.20         42.0         32.8         0.00         5.00         124         <	Soil sample No. 27 28 29 30 31 32 33 34 35 26	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 75.4 75.4 15.0 49.8 15.2 6.43 12.2	Na * 260 34.5 266 870 248 140 446 130 36.0 118	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 4.20 2.10	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 25.0	omposit           Mg²+           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           16.0           19.0           12.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	379 28.8 356 951 391 165 412 146 45.3 128	<b>SO</b> ₄ <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 28.7	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1	
30         1.30         13.1         0.70         2.12         3.10         0.00         9.00         26.9         14.0         3.27           40         9.71         78.9         1.84         11.7         26.6         2.00         10.0         64.7         40.3         7.40           41         6.35         43.9         1.10         9.54         14.9         2.00         10.0         64.7         40.3         7.40           42         20.0         180         1.20         42.0         32.8         0.00         5.00         124         125         16.1           43         4.80         34.0         0.50         11.0         4.00         8.00         6.00         26.2         16.1         3.14           44         9.43         59.8         0.90         28.5         14.8         4.00         8.00         48.5         39.5         6.50           45         5.90         46.2         4.52         4.22         9.56         0.00         5.00         37.0         25.2         4.27           46         8.66         47.2         2.20         31.8         31.8         0.00         5.00         37.0         25.2	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 75.4 75.4 15.0 49.8 15.2 6.43 12.3 5.04	Na * 260 34.5 266 870 248 140 446 130 36.0 118 26 8	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 4.20 3.10 1.39	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 16.0	ompositi Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0 16.0 19.0 12.0 14.0	tion (mr CO3 <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CF 379 28.8 356 951 391 165 412 146 45.3 128	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5	Total         salts           (S)(gdm <sup>-3</sup> )         24.8           3.33         22.2           64.4         25.3           11.1         31.4           11.6         4.97           10.1         4.66	
<b>33 4</b> ,70 <b>36</b> ,4 <b>1</b> ,30 <b>3</b> ,20 <b>4</b> ,24 <b>0</b> ,00 <b>5</b> ,00 <b>20</b> ,5 <b>3</b> ,27 <b>40 9</b> ,71 <b>78</b> ,9 <b>1.84 11</b> ,7 <b>26</b> ,6 <b>200 10.0 64</b> ,7 <b>40.3 7</b> ,40 <b>41 6.35 43.9 1.10 9.54 14.9 2.00 10.0 37</b> ,7 <b>20.8 4.49 42 20.0 180 1.20 42.0 32.8 0.00 5.00 124 125 16.1 43 4.80 34.0 0.50 11.0 4.00 0.00 6.00 26.2 16.1 3.14 44 9.43 59.8 0.90 28.5 14.8 4.00 8.00 48.5 39.5 6.50 45 5.90 46.2 4.52 4.22 9.56 0.00 5.00 37.0 25.2 4.27 46 8.66 47.2 2.20 31.8 31.8 0.00 5.00 37.0 25.2 4.27</b> <th>Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 29</th> <th>EC (dSm<sup>-1</sup>) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.09</th> <th>Na *           260           34.5           266           870           248           140           36.0           118           26.8</th> <th>K+           4.60           1.24           4.60           16.5           7.50           4.40           5.00           4.20           5.00           4.20           3.10           1.39</th> <th>lonic c Ca<sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 16.0 2.12</th> <th>omposii Mg<sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0 16.0 19.0 12.0 14.0 2.18</th> <th>tion (mr CO<sub>3</sub><sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.</th> <th>nol₀dm<sup>-3</sup> HCO<sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55</th> <th>CI 379 28.8 356 951 391 165 412 146 45.3 128 40.5 12.4</th> <th><b>SO</b><sub>4</sub><sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4 90</th> <th>Total salts (S)(gdm<sup>-3</sup>) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44</th>	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 29	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.09	Na *           260           34.5           266           870           248           140           36.0           118           26.8	K+           4.60           1.24           4.60           16.5           7.50           4.40           5.00           4.20           5.00           4.20           3.10           1.39	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 16.0 2.12	omposii Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 58.0 19.0 48.0 16.0 19.0 12.0 14.0 2.18	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 146 45.3 128 40.5 12.4	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4 90	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44	
40       6.37       70.3       1.10       9.54       14.9       2.00       10.0       37.7       20.8       4.49         42       20.0       180       1.20       9.54       14.9       2.00       10.0       37.7       20.8       4.49         43       4.80       34.0       0.50       11.0       4.00       0.00       6.00       26.2       16.1       3.14         44       9.43       59.8       0.90       28.5       14.8       4.00       8.00       48.5       39.5       6.50         45       5.90       46.2       4.52       4.22       9.56       0.00       5.00       32.3       72.7       7.13         46       8.66       47.2       2.20       31.8       31.8       0.00       5.00       32.3       72.7       7.13         47       30.6       190       3.20       84.8       94.0       0.00       5.00       57.0       70.0       8.22         48       10.7       57.0       2.00       38.2       31.8       0.00       5.00       51.6       52.4       6.66         50       4.13       28.3       0.84       6.36       12.7       0.0	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 20	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70	Na * 260 34.5 266 870 248 140 446 130 36.0 36.0 118 26.8 15.1 28.4	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 4.20 3.10 1.39 0.70	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 21.0 21.0 35.0 16.0 2.12 5 26	omposit Mg <sup>2+</sup> 56.6 5.00 80.0 19.0 48.0 16.0 19.0 12.0 14.0 3.18 4 24	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 165 412 146 45.3 128 40.5 13.4 26 9	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 2.27	
41       0.55       45.5       1.16       5.47       14.5       2.00       10.5       17.7       20.6       4.49         42       20.0       18.0       1.20       42.0       32.8       0.00       50.0       124       125       16.1         43       4.80       34.0       0.50       11.0       4.00       0.00       6.00       26.2       16.1       3.14         44       9.43       59.8       0.90       28.5       14.8       4.00       8.00       48.5       39.5       6.50         45       5.90       46.2       4.52       4.22       9.56       0.00       5.00       37.0       25.2       4.27         46       8.66       47.2       2.20       31.8       31.8       0.00       5.00       32.3       72.7       7.13         47       30.6       190       3.20       84.8       94.0       0.00       5.00       25.6       114       22.2         48       10.7       57.0       2.00       38.2       31.8       0.00       5.00       57.0       70.0       8.22         49       9.01       39.6       1.30       31.1       35.0       0.00<	Soil Soil Some for the second	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71	Na * 260 34.5 266 870 248 140 446 130 36.0 36.0 118 26.8 15.1 38.4 78.9	<b>K</b> <sup>+</sup> 4.60 1.24 4.60 16.55 7.50 4.40 4.20 5.00 4.20 3.10 1.39 0.70 1.39 0.70	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 21.0 35.0 21.0 35.0 21.2 5.26	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 19.0 48.0 19.0 19.0 19.0 12.0 14.0 3.18 4.24 26.6	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 165 412 146 45.3 128 40.5 13.4 26.9 64.7	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 3.27 7 40	
42       20.0       100       1.20       42.0       32.5       0.00       5.00       124       125       10.1         43       4.80       34.00       0.50       11.0       4.00       8.00       26.2       16.1       3.14         44       9.43       59.8       0.90       28.5       14.8       4.00       8.00       48.5       39.5       6.50         45       5.90       46.2       4.52       4.22       9.56       0.00       5.00       37.0       25.2       4.27         46       8.66       47.2       2.20       31.8       31.8       0.00       5.00       37.0       25.2       4.27         48       10.7       57.0       2.00       38.2       31.8       0.00       5.00       57.0       70.0       8.22         49       9.01       39.6       1.30       31.1       35.0       0.00       5.00       57.0       70.0       8.22         49       9.01       39.6       1.30       31.1       35.0       0.00       5.00       51.6       52.4       6.66         50       4.13       28.3       0.84       6.36       12.7       0.00       6.0	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.25	Na * 260 34.5 266 870 248 140 446 130 36.0 118 26.8 15.1 38.4 78.9	K <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 3.10 1.30 0.70 1.50 1.84 1.10	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 21.0 40.0 21.0 35.0 21.0 35.0 16.0 2.12 5.26 11.7	Mg²*           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           19.0           48.0           19.0           48.0           19.0           48.0           19.0           48.0           19.0           48.0           19.0           14.0           3.18           4.24           26.6           14.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 146 45.3 128 40.5 13.4 26.9 64.7 27 7	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8	Total         salts           (S)(gdm <sup>-3</sup> )         24.8           3.33         22.2           64.4         25.3           11.1         31.4           11.6         4.97           10.1         4.66           1.44         3.27           7.40         4.40	
44         9.43         59.8         0.90         11.0         4.00         6.00         20.2         10.1         51.4           45         5.90         46.2         4.52         14.8         4.00         5.00         37.0         25.2         4.27           46         8.66         47.2         2.20         31.8         31.8         0.00         5.00         37.0         25.2         4.27           46         8.66         47.2         2.20         31.8         31.8         0.00         5.00         32.3         72.7         7.13           47         30.6         190         3.20         84.8         94.0         0.00         5.00         32.3         72.7         7.13           48         10.7         57.0         2.00         38.2         31.8         0.00         5.00         57.0         70.0         8.22           49         9.01         39.6         1.30         31.1         35.0         0.00         5.00         51.6         52.4         6.66           50         4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.00         3.18	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0	Na * 260 34.5 266 870 248 140 446 130 36.0 118 26.8 15.1 38.4 78.9 43.9	K⁺ 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 5.00 3.10 1.39 0.70 1.50 1.84 1.10	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54	omposit           Mg²*           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           16.0           19.0           44.0           3.18           4.24           26.6           14.9	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 45.3 128 40.5 13.4 26.9 64.7 37.7 124	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 40.3 20.8 14.0 40.3 20.5	Total         salts           (S)(gdm <sup>-3</sup> )         24.8           3.33         22.2           64.4         25.3           11.1         31.4           11.6         4.97           10.1         4.66           1.44         3.27           7.40         4.49           16         1	
45         5.90         46.2         4.52         4.22         9.56         0.00         5.00         37.0         25.2         4.27           46         8.66         47.2         2.20         31.8         31.8         0.00         5.00         37.0         25.2         4.27           47         30.6         190         3.20         84.8         94.0         0.00         5.00         25.6         114         22.2           48         10.7         57.0         2.00         38.2         31.8         0.00         5.00         25.6         114         22.2           48         10.7         57.0         2.00         38.2         31.8         0.00         5.00         57.0         70.0         8.22           49         9.01         39.6         1.30         31.1         35.0         0.00         5.00         51.6         52.4         6.66           50         4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.0         3.18           51         13.0         52.9         3.20         33.9         44.0         3.00         10.0         12.3         6.00	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 42	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0 4.80	Na * 260 34.5 266 870 248 140 446 130.0 118 26.8 15.1 38.4 78.9 43.9 180 240 240 248 260 248 248 248 248 260 248 248 248 260 248 248 260 248 248 260 248 248 260 248 248 260 248 248 248 260 248 248 260 248 260 248 260 248 248 260 248 260 248 260 248 260 248 260 248 260 248 260 248 260 248 260 248 260 248 260 248 260 248 260 260 248 260 248 260 248 260 260 260 248 260 260 248 260 260 260 248 260 260 260 260 260 260 260 260	K <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 3.10 1.39 0.70 1.39 0.70 1.84 1.10 1.20	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0	omposit           Mg <sup>2+</sup> 56.6           5.00           .20.0           80.0           19.0           48.0           19.0           12.0           14.0           3.18           4.24           26.6           14.9           32.8           4.00	$\begin{array}{c} \text{tion (mr}\\ \textbf{CO}_3^{2^*}\\ \hline 0.00\\$	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8 125 161	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 3.27 7.40 4.49 16.1 3.14	
46         8.66         47.2         2.20         31.8         31.8         0.00         5.00         32.3         72.7         7.13           47         30.6         190         3.20         84.8         94.0         0.00         5.00         57.0         22.7         7.13           48         10.7         57.0         2.00         38.2         31.8         0.00         5.00         57.0         70.0         8.22           49         9.01         39.6         1.30         31.1         35.0         0.00         5.00         57.0         70.0         8.22           49         9.01         39.6         1.30         31.1         35.0         0.00         5.00         51.6         52.4         6.66           50         4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.0         3.18           51         13.0         52.9         3.20         33.9         44.0         3.00         6.00         64.0         63.0         8.39           52         2.64         15.0         0.52.7         7.38         4.20         0.00         10.0         12.3         6.00	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0 4.80 9.43	Na * 260 34.5 266 870 248 140 446 130 36.0 36.0 3118 26.8 15.1 38.4 78.9 43.9 180 34.0 59.8	K+ 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 4.20 3.10 1.39 0.70 1.39 0.70 1.84 1.10 1.20 0.90	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 25.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5	omposit           Mg²+           56.6           5.00           .20.0           80.0           19.0           48.0           16.0           19.0           48.0           16.0           19.0           42.0           14.0           3.18           4.26.6           14.9           32.8           4.00           14.0	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 262.5	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8 125 16.1 39.5	Total         salts           (S)(gdm <sup>-3</sup> )         24.8           3.33         22.2           64.4         25.3           11.1         31.4           11.6         4.97           10.1         4.66           1.44         3.27           7.40         4.49           16.1         3.14           6.50         50	
47         30.6         17.2         2.20         31.6         31.6         0.00         5.00         22.3         72.7         7.13           47         30.6         190         3.20         84.8         94.0         0.00         5.00         256         114         22.2           48         10.7         57.0         2.00         31.1         35.0         0.00         5.00         256         114         22.2           49         9.01         39.6         1.30         31.1         35.0         0.00         5.00         51.6         52.4         6.66           50         4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.0         3.18           51         13.0         52.9         3.20         33.9         44.0         3.00         6.00         64.0         63.0         8.39           52         2.64         15.0         0.72.8         7.38         4.20         0.00         10.0         12.3         6.00         1.90	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44	Image: bit is a constraint of the constrain	Na * 260 34.5 266 870 248 140 446 130 36.0 3118 26.8 15.1 38.4 78.9 43.9 43.9 180 34.0 59.8 2	<b>K⁺</b> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 4.20 3.10 1.39 0.70 1.50 1.50 1.50 1.50 1.50 1.50 1.24 4.20 5.00 4.20 5.50 4.20 5.50 4.20 5.50 5.50 5.50 5.50 5.50 5.50 5.50 5	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 25.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5 4 220	omposit Mg <sup>2+</sup> 56.6 5.00 80.0 19.0 48.0 16.0 19.0 48.0 14.0 3.18 4.24 26.6 14.9 32.8 4.00 14.9 32.8 4.00	tion (mr CO <sub>3</sub> <sup>2-</sup> 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2 48.5 37.0	<b>SO</b> ₄ <sup>2</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8 125 16.1 39.5 25.2	<b>Total salts</b> (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 3.27 7.40 4.49 16.1 3.14 6.50 4.27	
48         10.7         57.0         2.00         38.2         31.8         0.00         5.00         57.0         70.0         8.22           49         9.01         39.6         1.30         31.1         35.0         0.00         5.00         57.0         70.0         8.22           50         4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.0         3.18           51         13.0         52.9         3.20         33.9         44.0         3.00         6.00         19.8         24.0         3.18           52         2.64         15.0         0.52         3.20         33.9         44.0         3.00         10.0         12.3         6.00         1.90	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 6	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0 4.80 9.43 5.90 8.66	Na *           260           34.5           266           870           248           140           446           130           36.0           118           26.8           15.1           38.4           78.9           43.0           59.8           46.2	K⁺           4.60           1.24           4.60           16.5           7.50           4.40           4.20           3.10           1.50           1.84           1.10           0.50           0.90           4.20	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 21.0 35.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5 4.22 31.8	mgst           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           19.0           48.0           12.0           14.0           3.18           4.24           26.6           14.9           32.8           4.00           14.8           9.56	$\begin{array}{c} \text{tion (mr}\\ \hline CO_3^{2^*}\\ \hline 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 2.00\\ 0.00\\ 2.00\\ 0.00\\ 0.00\\ 4.00\\ 0.00\\ $	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI           379           28.8           356           951           391           165           412           146           45.3           128           40.5           13.4           26.9           64.7           37.7           124           26.2           48.5           37.0	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 40.3 20.8 14.0 40.3 20.8 16.1 39.5 25.2 72 7	Total         salts           (S)(gdm <sup>3</sup> )         24.8           3.33         22.2           64.4         25.3           11.1         31.4           11.6         4.97           10.1         4.66           1.44         3.27           7.40         4.49           16.1         3.14           6.50         4.27           7.13         7.40	
<b>49</b> 9.01         39.6         1.30         31.1         35.0         0.00         5.00         57.0         70.0         8.22 <b>50</b> 4.13         28.3         0.84         6.36         12.7         0.00         5.00         57.6         52.4         6.66 <b>50</b> 4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.0         3.18 <b>51</b> 13.0         52.9         32.0         33.9         44.0         3.00         6.00         64.0         63.0         8.39 <b>52</b> 2.64         15.0         0.52.7         7.38         4.20         0.00         10.0         12.3         6.00         1.90	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 44 45 46	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0 4.80 9.43 5.90 8.66 30.6	Na *           260           34.5           266           870           248           140           446           130           36.0           118           26.8           15.9           43.9           180           34.0           59.8           46.2           47.20	K <sup>+</sup> 4.60 1.24 4.60 16.5 7.50 4.40 4.20 3.10 1.39 0.70 1.50 1.50 1.50 1.84 1.10 1.20 0.90 4.52 2.20	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5 4.22 31.8 84.8	omposit           Mg²*           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           16.0           12.0           14.0           3.18           4.24           26.6           14.9           32.8           4.00           14.8           9.56           31.8	$\begin{array}{c} \text{iion (mr}\\ \textbf{CO}_3^{2^*}\\ \hline 0.00\\$	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2 48.5 37.0 32.3 256	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 40.3 20.8 125 16.1 39.5 25.2 72.7 27.27	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 3.27 7.40 4.49 16.1 3.14 6.50 4.27 7.13 22.2	
<b>50</b> 4.13         28.3         0.84         6.36         12.7         0.00         6.00         19.8         24.0         3.18 <b>51</b> 13.0         52.9         3.20         33.9         44.0         3.00         6.00         64.0         63.0         8.39 <b>52</b> 2.64         150         0.52         7.38         4.20         0.00         10.0         12.3         6.00         1.90	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 47	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0 4.80 9.43 5.90 8.66 30.6 10.7	Na *           260           34.5           266           870           248           140           446           130.0           118           26.8           15.1           38.0           43.9           180           34.9           43.9           180           35.8           46.2           47.2           190           57.6	K+           4.60           1.24           4.60           16.5           7.50           4.40           4.20           5.00           4.20           3.10           1.39           0.70           1.84           1.10           1.20           0.90           4.52           2.20           3.20	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5 4.22 31.8 84.8 38.2	omposit Mg <sup>2+</sup> 56.6 5.00 .20.0 80.0 19.0 48.0 19.0 19.0 19.0 12.0 14.0 3.18 4.24 26.6 14.9 32.8 4.00 14.8 9.56 31.8 94.0 31.8	$\begin{array}{c} \text{iion (mr}\\ \textbf{CO}_3^{2^*}\\ \hline 0.00\\$	nol₀dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2 48.5 37.0 32.3 256	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8 125 16.1 39.5 25.2 72.7 114 20.5	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 3.27 7.40 4.49 16.1 3.14 6.50 4.27 7.13 22.2 8 22	
50         7.15         22.5         0.64         0.50         12.7         0.00         6.00         19.6         24.0         5.16           51         13.0         52.9         32.0         33.9         44.0         3.00         6.00         64.0         63.0         8.39           52         2.64         15.0         0.52         7.38         4.20         0.00         10.0         12.3         6.00         1.90	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Image: bit is a constraint of the constrain	Na * 260 34.5 266 870 248 140 446 130 36.0 36.0 36.0 31.8 26.8 15.1 38.4 78.9 180 34.0 59.8 43.9 180 34.0 59.6	K*           4.60           1.24           4.60           16.5           7.50           4.40           5.00           4.20           5.00           3.10           1.39           0.70           1.84           1.10           1.20           0.50           0.50           3.20           2.20           3.20           2.30	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 25.0 21.0 40.0 25.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5 4.22 31.8 84.8 38.2 31.1	omposit           Mg²*           56.6           5.00           .20.0           80.0           19.0           48.0           16.0           19.0           42.0           14.0           3.18           4.24           26.6           14.9           32.8           4.00           14.8           9.56           31.8           94.0           31.8           94.0           31.8           35.0	$\begin{array}{c} \text{iion (mr}\\ \textbf{CO}_3^{2^*}\\ \hline 0.00\\$	nol <sub>c</sub> dm <sup>-3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2 48.5 37.0 32.3 256 57.0	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8 125 16.1 39.5 25.2 72.7 114 70.0 52.4	Total salts (S)(gdm <sup>-3</sup> ) 24.8 3.33 22.2 64.4 25.3 11.1 31.4 11.6 4.97 10.1 4.66 1.44 3.27 7.40 4.49 16.1 3.14 6.50 4.27 7.13 22.2 8.22 6.66	
<b>51</b> 13.6 $32.9$ $3.20$ $33.9$ $44.0$ $3.00$ $0.00$ $0.00$ $04.0$ $03.0$ $0.39$	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	EC           (dSm <sup>-1</sup> )           32.0           4.98           25.4           75.4           27.7           15.0           49.8           15.2           6.43           12.3           5.04           1.98           4.70           9.71           6.35           20.0           4.80           9.43           5.90           8.66           30.6           10.7           9.01           4.13	Na *           260           34.5           266           870           248           140           446           130           36.0           118           265.1           38.4           78.9           43.0           59.8           46.2           47.2           190           57.0           39.8           28.3	K⁺           4.60           1.24           4.60           16.5           7.50           4.40           4.20           3.10           1.30           0.70           1.84           1.10           1.20           0.500           4.20           3.10           1.50           1.84           1.20           0.50           0.90           4.52           2.200           3.20           2.000           1.30	lonic c Ca <sup>2+</sup> 107 9.00 40.9 120 65.0 21.0 35.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 28.5 4.22 31.8 84.8 38.2 31.1 6.36	Mg2*           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           12.0           14.0           3.18           95.6           31.8           94.0           31.8           35.0           12.0	$\begin{array}{c} \text{tion (mr}\\ \hline CO_3^{2^*}\\ \hline 0.00\\ $	nol₀dm <sup>3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 146 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2 48.5 37.0 32.3 256 57.0 51.6 8	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 14.0 40.3 20.8 14.0 40.3 20.8 16.1 39.5 25.2 72.7 114 70.0 52.4 9	Total         salts           24.8         3.33           22.2         64.4           25.3         11.1           31.4         11.6           4.97         10.1           4.66         1.44           3.27         7.40           4.49         16.1           3.14         6.50           4.27         7.13           22.2         8.22           6.66         3.18	
	Soil sample No. 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	EC (dSm <sup>-1</sup> ) 32.0 4.98 25.4 75.4 27.7 15.0 49.8 15.2 6.43 12.3 5.04 1.98 4.70 9.71 6.35 20.0 4.80 9.43 5.90 8.66 30.6 10.7 9.01 4.13 13.0	Na *           260           34.5           266           870           248           140           446           130           36.0           118           26.8           150.0           38.4           78.9           43.9           180           34.0           59.8           46.2           47.2           190           57.0           39.6           28.3	K⁺ 4.60 1.24 4.60 16.5 7.50 4.40 4.20 5.00 3.10 1.39 0.70 1.50 1.84 1.10 1.20 0.50 0.90 4.52 2.20 3.20 1.30 0.320 1.30 0.320	lonic c Ca <sup>2+</sup> 107 9.00 40.9 25.0 25.0 21.0 40.0 21.0 35.0 16.0 2.12 5.26 11.7 9.54 42.0 11.0 28.5 4.22 31.8 84.8 83.2 31.1 6.36 33.0	mg2*           56.6           5.00           .20.0           80.0           58.0           19.0           48.0           16.0           12.0           14.0           3.18           9.56           31.8           94.0           31.8           35.0           12.0	$\begin{array}{c} \text{ion (mr}\\ \hline \textbf{CO}_3^{2^*}\\ \hline 0.00\\ 0.00$	nol₅dm <sup>3</sup> HCO <sub>3</sub> 1.10 0.55 1.10 0.55 0.55 0.55 0.55 0.55	CI 379 28.8 356 951 391 165 412 45.3 128 40.5 13.4 26.9 64.7 37.7 124 26.2 48.5 37.0 32.3 256 57.0 51.6 19.8 4.0 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	<b>SO</b> <sub>4</sub> <sup>2-</sup> 48.9 24.8 44.9 138 70.9 22.1 110 46.2 35.1 38.7 41.5 4.80 40.3 20.8 125 16.1 39.5 25.2 72.7 114 70.0 52.4 24.0 63.0	Total         salts           (S)(gdm <sup>-3</sup> )         24.8           3.33         22.2           64.4         25.3           11.1         31.4           11.6         4.97           10.1         4.66           1.44         3.27           7.40         4.49           16.1         3.14           6.50         4.27           7.13         22.2           6.66         3.18           8.22         6.66           3.18         8.29	

 Table (1) Electrical conductivity (EC), ionic composition and total dissolved salts (S) of soil saturation extracts.

### **RESULTS AND DISSCUSSION**

The EC values obtained ranged from 0.74 to 185 dSm<sup>-1</sup>, and total salts (S) from 0.44 to 307 gdm<sup>-3</sup> (Table 1). The types of salts varied. In general, Na<sup>+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Cl<sup>-</sup> and SO<sub>4</sub><sup>2-</sup> were the predominant ions in the extracts, accounting for more than 80% of S. In the extracts where EC<10 dSm<sup>-1</sup>, Na<sup>+</sup>, Ca<sup>2+</sup> and SO<sub>4</sub><sup>2-</sup> were the predominant ions and ranged from 40.2 to 88.9% of S; and Na<sup>+</sup>: Ca<sup>2+</sup>, Na<sup>+</sup> : Mg<sup>2+</sup> and SO<sub>4</sub><sup>2-</sup>: Cl<sup>-</sup> ratios ranged from 0.32 to 20.5, 0.85 to 42.98 and 0.35 to 20.0, respectively. In the extracts where EC>10 dSm<sup>-1</sup>, Na<sup>+</sup>, Ca<sup>2+</sup> and Cl<sup>-</sup> were the predominant ions and ranged from 42.3 to 90.2% of S; Na<sup>+</sup>: Ca<sup>2+</sup>, Na<sup>+</sup>: Mg<sup>2+</sup> and Cl<sup>-</sup> :SO<sub>4</sub><sup>2-</sup> ratios were form 1.72 to 192, 2.31 to 135 and 0.6 to 5.87, respectively.

#### Relationship between EC and S:

When EC was regressed against S, the data corresponded reasonably well to a third order polynomial regression equation:

# $EC = -1.17 + 1.62 S - 0.011 S^{2} + 2.36 x 10^{-5} S^{3} (R^{2} = 0.990)$ (2)

Data presented in Fig (1) showed a non linear positive relationship between EC and S, and this could be attributed to ion pairing and decreased mobility of ions. A comparison of soil extracts either having EC less or greater than 10 dSm<sup>-1</sup> showed that Na<sup>+</sup> and Cl<sup>-1</sup> ions had more superior influence on EC values than the other ones, indicating that Mg<sup>2+</sup>, Ca<sup>2+</sup> and SO<sub>4</sub><sup>2-</sup> have a greater tendency to form ions pairs than Na<sup>+</sup> and Cl<sup>-</sup> (**Alzubairdi & Webster, 1983 and Simon** *et al.*, **1994**). This tendency was confirmed by a stepwise multiple regression between the EC values and the corresponding ion concentrations, in mmol<sub>6</sub>dm<sup>-3</sup>, of Na<sup>+</sup>, Mg<sup>2+</sup> and Ca<sup>2+</sup> in equations (3, 4, and 5) and Cl<sup>-</sup> and SO<sub>4</sub><sup>2-</sup> in equations (6 and 7). The partial correlation coefficient square of Na<sup>+</sup>, Mg<sup>2+</sup> and Ca<sup>2+</sup> ions with EC values as indicated in the equations was 0.9193, 0.0472 and 0.0037, respectively; and that of Cl<sup>-</sup> and SO<sub>4</sub><sup>2-</sup> ions was 0.9397 and 0.0019 respectively

	and 0.0013, respectively.
EC = 7.18 + 0.038 Na <sup>+</sup>	$(R^2 = 0.9193)$ (3)
EC = 1.35 + 0.032Na <sup>+</sup> + 0.346 Mg <sup>2+</sup>	$(R^2 = 0.9665)$ (4)
EC = 0.894 + 0.032Na <sup>+</sup> +0.046 Ca <sup>2+</sup>	+ 0.309 $Mg^{2+}(R^2 = 0.9702)$ (5)
$EC = 6.51 + 0.042CI^{-1}$	$(R^2 = 0.9397)$ (6)
$EC = 5.29 + 0.037CI^{-} + 0.043 SO_4^{2-}$	$(R^2 = 0.9416)$ (7)

#### **Relationship between EC**<sub>e</sub> and S:

When the saturation extracts were diluted with increasing quantities of distilled water the  $EC_e$  values rose steeply at first (Fig.2), and reached higher values as the EC value increased.



Fig (1). Relationship between the electrical conductivity (EC) and Total dissolved salts (S) in soil saturation extract.



Fig (2) Evolution of the electrical conductivity calculated from diluted soil-saturation extracts (EC<sub>e</sub>) with the dilution factor (F) for soilsaturation extracts with different electrical conductivities (EC<sub>e</sub>).\*, EC<sub>e</sub> (soil 18)= 179 + 67.7 In F, R<sup>2</sup>=0.969; ◆, EC<sub>e</sub>(soil4)=98.0+ 27.1 In F, R<sup>2</sup>=0.943; Δ, EC<sub>e</sub>(soil 27)= 21.9 + 3.17 In F, R<sup>2</sup>=0.482; x, EC<sub>e</sub> (soil12) = 3.77 + 1.12 In F, R<sup>2</sup>=0.604.

Furthermore, as the soil extracts were increasingly diluted, the slope of the curves relating  $EC_e$  values to S increased in slop and gradually straighten (Fig.3). This obvious tendency towards a linear relationship by increasing dilution indicated an advantage in diluting the saturation extracts.



Fig. (3). Relationship between the electrical conductivity of the soilsaturation extracts (EC) or the electrical conductivity calculated from diluted soil-saturation extracts (EC<sub>e</sub>) and concentration of the total dissolved salts (g dm<sup>-3</sup>)

- $EC_e(F=1000) = 6.79 + 2.54 \text{ S} - 1.2 \text{ x} 10^{-3} \text{ S}^2$	$(R^2 = 0.983)$
+, EC <sub>e</sub> (F=500) = $5.23 + 2.28 \text{ S} - 0.9 \text{ x}10^{-3} \text{ S}^2$	$(R^2 = 0.983)$
•, EC <sub>e</sub> (F=250) = $3.83 + 2.28 \text{ S} - 1.5 \times 10^{-3} \text{ S}^2$	(R <sup>2</sup> = 0.971)
*, $EC_e(F=100) = 2.33 + 2.22 \text{ S} - 1.9 \times 10^{-3} \text{ S}^2$	$(R^2 = 0.975)$
X, EC <sub>e</sub> (F=50) = $3.70 + 1.92 \text{ S} - 1.5 \times 10^{-3} \text{ S}^2$	(R <sup>2</sup> = 0.963)
$\Delta$ , EC <sub>e</sub> (F=25) = 1.92 + 1.83 S - 1.8 x10 <sup>-3</sup> S <sup>2</sup>	(R <sup>2</sup> = 0.979)
■, EC <sub>e</sub> (F=10) = $2.41 + 1.72 \text{ S} - 2.5 \times 10^{-3} \text{ S}^2$	(R <sup>2</sup> = 0.966)
•, EC = $2.95 + 0.906 \text{ S} - 1.1 \times 10^{-3} \text{ S}^2$	$(R^2 = 0.957)$

Another advantage in using calculated conductivities (EC<sub>e</sub>) was the reduction in the variation caused by the nature and behavior of the ions present in the solution. In fact, as noted above with respect to the relationship between EC and S (Fig.1), the scatter of the data point outside the curve seemed to be due to differences in the Na<sup>+</sup>: Ca<sup>2+</sup>, Na<sup>+</sup>: Mg<sup>2+</sup> and Cl<sup>-</sup>: SO<sub>4</sub><sup>2-</sup> ratios.

Data presented in Fig.(3) also showed that the correlation coefficient was, to a great extent, higher as the dilution increased. The multiple regression equations between EC<sub>e</sub> values for each dilution and the ion concentration, in mmol<sub>c</sub> dm<sup>-3</sup>, of Na<sup>+</sup>,Ca<sup>2+</sup>: and Mg<sup>2+</sup> (Equations 8-13), and Cl<sup>-</sup> and SO4<sup>2-</sup> (Equations 14-19) clearly showed that the regression coefficients of both Na<sup>+</sup> and Cl<sup>-</sup> tended to increase and to equalize with increased dilutions. Whereas that of Mg<sup>2+</sup>, Ca<sup>2+</sup> and SO4<sup>2-</sup> was not regular.

$EC_e(F=10) = 1.58 + 0.055Na^+ + 0.188Ca^{2+} + 0.302Mg^{2+}$	(R <sup>2</sup> =0.96) (8)
$EC_{e}(F=25) = 1.42 + 0.074Na^{+} + 0.148Ca^{2+} + 0.296Mg^{2+}$	(R <sup>2</sup> =0.98) (9)
$EC_e(F=50) = 1.45 + 0.084Na^+ + 0.086Ca^{2+} + 0.476Mg^{2+}$	(R <sup>2</sup> =0.97) (10)
$EC_e(F=100) = 1.54 + 0.096Na^+ + 0.152Ca^{2+} + 0.382Mg^2$	+ (R <sup>2</sup> =0.97) (11)
$EC_e(F=250) = 2.12 + 0.107Na^+ + 0.11Ca^{2+} + 0.468Mg^{2+}$	(R <sup>2</sup> =0.98) (12)
EC <sub>e</sub> (F=500) = 3.93 +0.117Na <sup>+</sup> + 0.111Ca <sup>2+</sup> + 0.394Mg <sup>2</sup>	+ (R <sup>2</sup> =0.98) (13)
EC <sub>e</sub> (F=1000)= 4.12 +0.126Na <sup>+</sup> + 0.12Ca <sup>2+</sup> + 0.534Mg <sup>2+</sup>	(R <sup>2</sup> =0.981) (14)
$EC_e(F=10) = 5.58 + 0.049Cl^{-} + 0.157 SO_4^{2-}$	(R <sup>2</sup> =0.94) (15)
$EC_{e}(F=25) = 5.04 + 0.073Cl^{-} + 0.125 SO_{4}^{2-}$	(R <sup>2</sup> =0.97) (16)
$EC_{e}(F=50) = 8.62 + 0.096Cl^{-} + 0.047 SO_{4}^{2-}$	(R <sup>2</sup> =0.96) (17)
$EC_{e}(F=100) = 7.18 + 0.103Cl^{-} + 0.093 SO_{4}^{2}$	(R <sup>2</sup> =0.97) (18)
$EC_{e}(F=250) = 9.02 + 0.120Cl^{-} + 0.059 SO_{4}^{2}$	(R <sup>2</sup> =0.97) (19)
$EC_{e}(F=500) = 8.78 + 0.126Cl^{-} + 0.084 SO_{4}^{2}$	(R <sup>2</sup> =0.98) (20)
$EC_e(F=1000) = 9.82 + 0.132Cl^{-} + 0.089 SO_4^{2-}$	(R <sup>2</sup> =0.98) (21)

Nevertheless, even at very high dilutions (F=1000), the relationship between S and EC<sub>e</sub> was not exactly linear (fig.3) and the data points consistently showed a curvature as ion-pair formation increased with salt concentration (Alzubaidi&Webster, 1988, and Simon *et al.*, 1994).

A linear relationship between EC<sub>e</sub> and S can be obtained if, instead of using fixed dilution ratios for all extracts, the dilution ratio was always selected in such a way that the final conductivity of the diluted extract (EC<sub>d</sub>) fell within a moderately narrow range. Optimum results (EC<sup>\*</sup><sub>e</sub>) were obtained when the conductivity of the diluted extracts ranged from 0.1 to 0.5 dSm<sup>-1</sup>. Under these conditions the relationship between EC<sub>e</sub><sup>\*</sup> and S (Fig.4) was, to a great extent, linear, the correlation coefficient was very high and errors did not increase with salt concentration (Equation 20):





### El-Sayed, M. H. and M.M.I. El-Kholy

The optimum  $EC_d$  range  $(0.1 - 0.5 \text{ dSm}^{-1})$ , though narrow, was nevertheless wide enough that the preparation of diluted extracts was quite simple. The values of EC could be used as a guide for selecting the dilution ratio (Table 2); however, if  $EC_e$  was higher than 40 dSm<sup>-1</sup>, the relation between  $EC_e$  and S was so uncertain (Fig.1) that the final conductivity of the diluted extracts was the only reliable guide.

Table (2).	Approximate dilution factors (distilled water: soil-extract
	ratios) necessary for reaching a conductivity of the diluted
	extract (EC <sub>d</sub> )within the range of 0.1 – 0.5 dSm <sup>-1</sup> .

EC(dSm <sup>-1</sup> )	Dilution factor
1-2	10
2-5	25
5-9	50
9-15	100
15-25	250
25-40	500
40-75	1000

These results provided a new equation for calculating the total salt content (S) of saturation extracts. Given that when  $EC_e^*$  was zero, S was also zero, the regression line should pass through the origin, and the regression equation would be:

#### $S = 425EC_{e}^{*}$

With  $R^2$ = 0.989, and S expressed in mg dm<sup>3</sup> and EC<sub>e</sub><sup>\*</sup> in dSm<sup>-1</sup>. This equation can be used in all saturation extracts, regardless of the concentration and type of ions present.

#### **Conclusions:**

In this study a new method to calculate the total soluble salt content, S, of soil saturated extracts, under Egyptian conditions, has been proposed. This method resulted in the most accurate results for EC by diluting the saturation extract until its electrical conductivity (EC<sub>d</sub>) has a value of between 0.1 and 0.5 dSm<sup>-1</sup>, from which EC<sub>e</sub><sup>\*</sup> could be calculated as follows:

# $EC_e^* = (EC_d - EC_w) F.$

Where  $EC_w$  was the electrical conductivity of the distilled water used for the dilutions, and F is the dilution factor.

For the saturation extract, S(mg dm<sup>-3</sup>) was then calculated using the equation:  $S = 425ECe^*$ 

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طريقة جديدة لتقدير الاملاح الكلية الذائبة في مستخلصات عجينة التربة المشبعة من التوصيل الكهربي تحت الظروف المصرية مصطفى حلمي السيد و محمد محسن ابراهيم الخولي معهد بحوث الاراضي والمياه والبيئة-مركز البحوث الزراعية-جيزة-مصر

اخذت ٥٢ عينة تربة مختلفة فى محتواها من الاملاح ونوعيتها من اماكن مختلفة فى مصر لتمثل معظم انواع الاراضى الموجودة. تم تحضير مستخلص عجينة التربة المشبعة لكل عينة وقياس التوصيل الكهربى فيها (EC) وكذلك تقدير الاملاح الكلية الذائبة(S). تراوحت قيم كل من الُ S، EC, من ٢٠٤ الى ١٨٥ ديسيسيمنز /متر (dSm<sup>-1</sup>) و ٢.٤٤، الى ٣٠٩ (جم/م<sup>٢</sup>) على الترتيب. لم تكن العلاقة بين الEC و S خطية وعندما أجرى تخفيف للمستخلصات المشبعة بكميات

لم على المعرف بين الحالي و كالمحمية وعدال الجري تعليف للمستخطئات المسبعة بعميات كبيرة متزايدة من الماء المقطر [١(مستخلص مشبع) : ١٠، ٥٠، ٥٠، ٢٥، ٢٥، ٥٠، ٢٠، ١٠٠ عيث (ماء مقطر)] وحسب لهم التوصيل الكهربي (ECe ) من المعادلة (ECd – ECw) = ECe حيث أن كل من ECd , ECw تعبر عن التوصيل الكهربي للمستخلص المخفف والماء المقطر على الترتيب، و F هو معامل التخفيف اتجهت العلاقة بين الECe و S لتكون خطية.

تم التوصل الى معامل ارتباط قوى بين الاملاح الكلية الذائبة (S) وقيم التوصيل الكهربى للتخفيفات (\*ECe) والتى حسبت من التوصيل الكهربى للتخفيفات (ECd) والتى تراوحت بين ١, • الى ٥, • ديسيسيمنز /متر (1-dSm) وكانت معادلة الانحدار التى تربط بينهما كالاتى:

( S= 425 ECe<sup>\*</sup>, R<sup>2</sup>=0.989)

ويمكن استخدام هذه العلاقة لكل المحاليل المشبعة بغض النظر عن تركيز ونوع الملح الموجود