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SOIL PHYSICAL AND CHEMICAL PROPERTIES AS INFLUENSED BY DRAINAGE AND TILLAGE IN ELSALAM CANAL AREA.

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ABSTRACT

A field study was conducted in heavy clay salt affected soil at 83km along El-Salam canal (North plain Husseiniya) to evaluate suitability open drainage system with 30-m space between the drains with two tillage depths 15 and 25-cm for improving some physical and chemical properties of soil and to improve its productivity. The data were collected through two growing season (Berseem, winter of 2000/2001 and Corn summer of 2001).

Soil contents of total and available N.P.K. and some chemical properties (EC, pH, SAR and ESP) were studies. The soil samples were taken from four sites between the drains and the distances 10-m between all samples along the mid- way at depths 0-15, 15-30, 30-60 and 60-90cm.

The obtained results showed that, the content of soluble salts EC, pH, SAR and ESP increased with the increase of soil depth and decreased with the increase of tillage depths. Also this decrease was clear in the surface layers compared with the decrease occurred in the down layers.

Data show that, both total and available N, P and K decreased with increasing soil depth before and after drained and tillage treatment. This decreased in the N.P.K. values was more clear in the soil profile with drained and tillage depth 25-cm than with tillage depth 15-cm. This decreased may by due to the low content of organic matter and high soil pH values in the lower layers of soil profiles. The high loss of available N and P resulted from down movement of available and organic matter with leaching water.

Data also show that, the available (N) increase with tillage treatments. The calculated relative increases of N. were 7.4 and 20 % with tillage depth 25 and 15-cm of the soil before tillage and drained. While, the values of the available (P and K) decrease with tillage treatments, the relative decrease of (P and K) were 18.9 and22.3 %, 71.9 and 52.5% in the soil profile with drained and tillage depth 25-cm and 15-cm.

The bulk density of the deeper layers is relatively higher than those of the upper ones. The lowest bulk density is obtained in the soils provided with open drainage and tillage depth 25-cm. With respect to the porosity, it was found out that, the total porosity (E %) increases with decreasing of the bulk density. The open drainage system with tillage deep 25-cm is more efficient in increasing soil hydraulic conductivity comparing with the other process. Also, hydraulic conductivity increased with increasing electrolyte concentration but decreased with increasing SAR. The lowering of $CaCO_3$ % content under open drained and tillage conditions may by due to the high leaching and movement efficiency than before drained and tillage. The organic matter's content decreases with increasing soil depth and tillage depth. The drainage condition appears no effect on texture class because this soil parameter is considered as initial, but the tillage operation one of the most treatments to be changed.

The regression equations and correlation coefficients (r) between the hydraulic conductivity and each of EC, CaCO3, clay, ESP and ASR. Also, between the vavailable content of N, P and K and each of EC, ASR, and ESP were computed.Results , also show that the yields obtained from the soil provided by

drainage and tillage are higher than those obtained from the non- drained and tillage soils.
Key words : open drainge, tillage depth ,soil chemical and physical properties

INTRODUCTION

Land drainage is a tool for the removal of excess surface and subsurface water from the land to enhance crop growth, including the removal of soluble salts form the soil. Recently, Bos and Boers (1994) added to the above definition that it is an effective method to maintain a sustainable agricultural system. Oosterbaan (1994) stated that the objectives of agricultural drainage systems are: reclaim and conserve land for agriculture increase crop yields, permit the cultivation of more valuable crops, allow the cultivation of more than one crop a year, and/or reduce the costs of crop production in otherwise water logged land. Baily (1978) and Takahashi *et al.* (1978) showed that the drainage systems improved the physical and hydrological properties of soil especially with wider spacing between tiles. Abdel-Dayem (1990) found that the drainage is an important factor in the reclamation process of heavy clay soils and affected by salinity and Alkaline hazards. Other practices such as gypsum application subsoiling, deep ploughing, precision land leveling and leaching of salts are equally important practices. Often open ditch drainage is practiced in the beginning until the soils physical and chemical properties improve and their productivity increases. Deeper subsurface drainage is then introduced to bring the soils to their maximum production level. Hydraulic conductivity is one of the most important soil properties which is related to drainage improvement. The drainability of the soil is characterized by the hydraulic conductivity and the thickness of the soil layers and by their position relative to be the drained level, (Ochs and Bishay, 1992). Ibrahim *et al.* (1989) stated that the slight increase in soil hydraulic conductivity obtained under the spacing of 15 and 30-m between tiles may be due to the lowering of ground water table which results in a better structure of the top soil, increasing the infiltration rate and porosity, and consequently reducing the surface drainage problems. The use of tile drains with subsoiling had a better effect on hydraulic conductivity and porosity. Smedema (1990) stated that adequate aeration in the zone is of primary importance for plant growth. The expulsion of soil air from the pores by water leads to unaerobic conditions, which have well known diverse effects on plants.

The aeration requirements of crop and physical soil conditions relative to soil water determine the desirable water depth during the various growth stages of the crops. Zaslavsky (1979) showed that the movement of water through the saline alkali soils during leaching enables it to changes the chemical and physical properties with in the soil profiles. Therefore, the removal of salts by leaching increases the hydrolysis of the sodic clay so, the pH increases. The extent to which these changes take place is dependent on the nature of the soil quality, the efficiency of the drainage system, the period of land drainage, and the move-ability of soil constituents.

Richard *et al.* (1989) reported that one of the main objective of field drainage is to promote favorable soil water-air relations. Subsurface drainage achieves this by promoting aeration of the most zone lowering the water table and increasing percolation. For this reason it also tends to increase the leaching of nutrients particularly nitrate, the formation of which requires aerated conditions and which is readily soluble and poorly adsorbed by the soil.

The objective of this investigation is to find out the best effective practice for management of saline alkali soils, found out the effect of this practice on the soil

MATERIALS AND METHODS

The studied area is located at 83km along El-Salam canal (North plain Husseiniya) the size of the experimental area is 15-fed. Some chemical and physical properties of the soil under investigation are presented in Table (1). The experimental area was served by surface (open) drainage system with 30-m spacing between each two ditches and 1.25-m drain depth from the soil surface with two tillage depths 15 and 25-cm .The experimental area was treated with organic manure at 30 m^3/fed. Two successive crop rotation was applied berseem 2000/2001 and Corn of winter 2001. After the first and second season at three depths namely 5-15, 15-30, 30-60 and 60-90 cm.

Table (1): Some soil physical properties before and after drained and tillage treatments.

Treatments	Soil depth (cm)	Bulk denesity (gm/cm)	Total porosity (%)	Hydraulic conductivity (cm/hr)	Partical size distribution				Soil texture
					C.S	FS	silt	Clay	
Soil before drained and tillage	0-15	1.33	48.9	2.6	1.47	5.88	50.8	41.85	silt clay
	15-30	1.34	48.85	0.38	1.5	9.22	32.1	57.14	clay
	30-60	1.36	48.28	0.26	1.95	12.3	18.4	67.4	clay
	60-90	1.38	47.9	0.07	2.15	14.7	6.93	76.26	clay
Soil after drained and tillage depth 25 cm	0-15	1.19	54.23	8.86	1.62	6.12	50.6	41.64	silt clay
	15-30	1.21	53.82	5.25	1.44	9.08	34.6	54.9	clay
	30-60	1.34	49.5	0.86	1.95	12.3	18.4	67.4	clay
	60-90	1.35	49.06	0.07	2.15	14.7	6.93	76.26	clay
Soil after drained and tillage depth1 5 cm	0-15	1.22	53.08	6.34	1.59	5.88	51.4	41.11	silty clay
	15-30	1.3	50.38	1,33	1.5	9.22	32.1	57.14	clay
	30-60	1.35	48.67	0.72	1.95	12.3	18.4	67.4	clay
	60-90	1.36	48.68	0.07	2.15	14.7	6.93	76.26	clay

The soil samples were taken between the drains and the distances 10 m between all samples, at distances 50-m along the drain length. The samples were air dried and prepared for dry sieving and the fractions below 2-mm were used to the chemical analysis. The sample were analyzed for total soluble salts, EC, pH, SAR, ESP and the contents of both total (%) and available ppm for N, P and K were determined according to Cottenie et al (1982). Total content of Fe, Mn, Zn, Cu, Co, Cd, Pb and Ni in soil were determined according to Hesse (1963), where the available from of these elements were extracted by using the extract solution of (DTPA).

Particle size distribution was determined before and after experiment according to Black (1965). Organic matter content was determined according to the method of walkley and black as described by Jackson (1967).

The objective of this investigation is to find out the best effective practice for management of saline alkali soil, found out the effect of this practice on the soil contents of both total and available forms of N, P, K, Fe, Mn, Zn, Cu, Co, Cd, and Pb through the soil profiles. Also, this paper aims to find the spatial distribution for soluble salt, pH, SAR and ESP with in the soil profile and their relations with the change occurring in the soil physical and chemical properties.

RESULT AND DISSCUSSION

4.1. Soil physical properties as related to drainage and tillage :

4. 1. 1. Soil bulk density:

Soil bulk density is one of the bEst values which indicate to the status of soil structure and consequently, soil water, air and heat flow (Richards, 1954). The data in Table 1 and fig 1 indicate that the bulk density of the deeper layers is relatively higher than those of the upper ones. This finding is expected, because most soil tillage and cultivation processes are intended on the surface soil layer, and the deeper soil layers are relatively compacted due to the effect of machinery imposed on soil by wheels and tracks. The values of bulk density in the soils provided with open drainage with tillage depth equal 25-cm range between 1.19 and 1.35 g/cm^3 in the different soil layers. At the same time, soil bulk density in the soils provided with open drainage and tillage depth 15-cm varies from 1.22 to 1.36 g/cm^3 in the different soil layers. Whereas, the values of soil bulk density before the open drained soils, range between 1.33 and 1.38 g/cm^3 in the different soil layers.It could be concluded that the lowest bulk density is obtained in the soils provided with open drainage and tillage depth 25-cm.

4.1.2. Total porosity

With respect to the porosity, it was found out that, the total porosity (E %) increases with decreasing the bulk density. It ranges between 54.23 % and 49.06 % in the soil provided by open drainage and tillage depth 25-cm. Whereas , they range between 53.08% and 48.68% under the tillage depth 15-cm. While the values of total porosity in the soil before drained range between48.9 and 47.9 %. So the open drainage and tillage increased the total porosity of soil.

4. 1.3. Hydraulic conductivity:

The hydraulic conductivity of soil represents its average water transmitting properties, which depend mainly on the number and diameter of the pores present, (Kessler and Oosterbaan, 1980). Table (1) show that, the low values of (K)was found in the soil before tillage and drainage processes. The average value is 0.83 cm/h. These low-values of (K) may be due to the reduce aeration pore size added to increase of soluble Na-cation. Which leads to disperse fine particles and reduce the movement of water and hydraulic conductivity.

Table (2) Some soil chemical properties before and after drained and tillage treatments.

Treatments	Soil depths (cm)	EC (dsm^{-1})	pH	O.M. (%)	Calcium carbonate %	Soluble cations meq/L					Soluble anions meq/L			SAR
						Ca	Mg	Na	K	Co_3	Hco_3	CL	So_4	
Soil before drained and tillage	0-15	7.83	8.72	1.18	4.47	11.2	10.87	62.8	0.2	1.05	4.78	55	38.1	19
	15-30	8.75	8.90	0.82	6.82	12.23	2.39	68.2	0.18	1.12	4.9	56	40.7	19
	30-60	9.18	8.95	0.75	2.4	12.50	14.12	74.8	0.24	1.52	5.2	59	45.7	21
	60-90	9.32	9.12	0.62	0.92	14.31	15.60	79.18	0.28	2.12	5.32	68	48.1	20
Soil after drained and tillage depth (25 cm)	0-15	5.65	8.15	1.08	4.42	8.40	6.22	28.9	0.09	1.02	4.62	8.5	14.8	11
	15-30	6.32	8.45	0.62	6.45	9.60	8.41	29.4	0.11	1.05	4.55	9.2	15.2	9.8
	30-60	6.42	8.65	0.65	2.5	15.80	16.20	30.8	0.17	1.24	4.85	12	25.4	7.7
	60-90	8.12	8.92	0.60	1.24	16.80	17.80	35.4	0.22	0.57	5.06	16	27.8	8.5
Soil after drained and tillage depth (15 cm)	0-15	6.25	8.32	1.08	4.45	9.16	8.34	36.5	0.16	0.96	4.85	15	16.8	12
	15-30	7.12	8.53	0.60	6.67	10.34	9.85	34.52	0.14	1.43	4.62	16	18.8	11
	30-60	7.38	8.78	0.72	2.55	14.80	16.63	37.48	0.22	1.85	5.32	22	32.6	9.5
	60-90	8.42	9.07	0.62	0.94	16.53	17.91	42.8	0.26	1.06	5.45	32	35.3	10

On the other hand the maximum average value of hydraulic conductivity(3.75 cm/h) is obtained with tillage depth 25 cm and drained process. This may be due to the high aeration and pore size. From the above mentioned results it can be concluded that the open drainage system with tillage deep 25-cm is more efficient in increasing soil hydraulic conductivity comparing with the other process..

4-1-4- Particle size-distribution:

The drainage condition as well as the tillage appear to have no effect on texture class Table (1) show that coarse sand,fine sand, silt and clay values were not changed after applying drainage or tillage treatment, the value of clay content range between 39.76 and 76.26, silt values fluctuated between 52.9at the top soil to 6.9 at the depth of 60-90 cm.

4. 2. Soil chemical properties as related to drainage and tillage:

4. 2. 1. Soil salinity:

Soil profiles under study could be considered high saline, where the EC values are more than $4dsm^{-1}$ (Richards, 1954). The salts are more concentrated in the surface layers than in the subsoil ones. However, the accumulation of salts in the surface zone of the soil is due to the higher evaporation process as well as to the abundance of both the sodium and chloride ions. Also, the high salinity of the area represented by these profiles is attributed to the absence of drainage practice. Table (2) show that, the values of EC increased with increasing soil depth where they ranged from 7.83 dsm^{-1} in the surface layer to $9.32dsm^{-1}$ in the deepest subsoil layer. While, after establishing the drainage and tillage treatment, it decreased particularly in the surface layer, relative decrease in EC values in the surface soil layer(0-15 cm) is higher than the other depths after the two season of establishing drainage system. This may be resulted from the high movement rate of leaching and irrigation water in the surface layer.

The relative decrease of soil EC values were 27.8 and 12.9 %, 20.2 and 9.7 % as a result of applying drainage with tillage 25 and 15 cm for depths of 0-15 and 60-90 cm, respectively. Comparing the results in Table (2) before and after drained and tillage it can be said that open drainage and tillage decreased soil salinity. This may be due to the slightly increase of water table depth and removing the soluble salts from the surface soil layers. Mohamed *et al.* (1997), Bolskaov *et al.* (1996) and El-Hamshary *et al.* (1996) had reported similar results.

It can be seen from the Table 2 also that at the same period of establishing the drainage and tillage the total soluble salts which had been removed from different layers of soil profile between drains with tillage at depth 25-cm were more than those removed from the soil profile with tillage at depth 15-cm.

4. 2. 2. Soil reaction (pH):

Data in table (2) show that, the values of soil reaction (pH) before drained soil and tillage treatment range between 8.72 and 9.12. Generally soil profiles under study could be considered alkali, where the pH values are higher than 8.5, (Richards, 1954). These high pH values may be due to the absence of drainage, the high level of water table and the dominance of soluble and exchangeable sodium in soil and ground water.

Data also show that, the pH values increased with increasing soil depth. This resulted from the relative high organic matter content in the surface layers compared with the lower layer which alts as buffering constituent. The open drainage system and tillage treatments resulted in a slight decrease of soil pH values. This effect may be accased from improving leaching of soluble sodium salts and calcium replacing exchangeable sodium.

It can be also noticed that, the pH values with tillage depth 25-cm were less than those with tillage depth 15-cm through the different layers of soil profile. Generally, pH values of different layers decreased with the. drained establishment. These results are in harmony with those obtained by Abou-Hussien *et al.* (1999), Ramadan *et al.* (1994) and Mohamed *et al.* (1992),.

4. 2. 3. Sodium adsorption ratio (SAR):

Table (2) show that, the sodium adsorption ratio (SAR),as calculated from the soluble Na,Ca and Mg of soil past extract, before provided with open drainage system and tillage treatment varies from 18.90 in the surface to 20.47 in the deeper soil layer. The data also show that, the SAR increased with increasing soil depth before treatment. This increase may by resulted from the down movement of the soluble sodium leached from the surface layers and its accumulation in the lower layers Habib *et al.*, 1994 and Abou Hussien *et al.*, 1999.

SAR values decreased with the open drained and tillage treatment. The relative decrease of SAR as affected by open drainage establishment and tillage depths in the surface layers were more than those occurred in down layers. The calculated relative decrease of SAR of soil profile drained with tillage at the depth of 25-cm were 38.15% and 34.49 % for surface and deeper layers respectively.

4. 2. 4. Calcium carbonate content:

The value of $CaCO_3$ % in surface and deeper layer before drained soils is about 4.47 and 0.92 %. While, the values in this soil after drained is about 4.45 and 0.94 % for tillage depth 25 cm.. The lowering of $CaCO_3$ % content under open drained and tillage conditions may by due to return distribution and the high movement efficiency than before drained and tillage. This result confirmed with Ibrahim 1976

4. 2 .5. Organic matter content:

Table (2) show that the organic matter content decreases with increasing soil depth and tillage depth. The minimum values of organic matter are obtained in the soil lower layers, but the maximum values are obtained in the soil surface layers due to the residual effect of cultivated crop and adding organic matter on the surface layers. Table (2) show that, the higher organic matter content is found in the soil before drained. The values of O.M. content of about 1.18% and 0.62% in surface and deeper layer but the lower organic matter content is found in the soil after drainage and tillage with depth 25 and 15-cm respectively. The values of O.M. content of about 1.08 %and o.6%.

These results retrain into high draining efficiency and higher growth of root plants under open drainage conditions than before the draine conditions.

4-2-6-Soluble cations and anions:

Table 2 show the values of soluble cations and anions in the profiles and after represent the drainage soil and tillage depths treatments. Data show that the values of soluble cations and anions increasing with increase of soil depth before and after treatments. Comparing Na contant before and after drainage with tillage at depths 25 and 15 cm shows the high decrease in soluble sodium content due to the use of open drainage and tillage at depths 25 and 15cm respectively. The relative decrease of sodium was 54 and 55%,41.9 and 45.9% of sodium before draining for surface and sub-surface layers with drainage soil and tillage at depth 25 and 15 cm respectively.

4-2-7- Exchangeable sodium and cation exchange capacity (C.E.C)

The Exchangeable sodium and cation exchange capacity (C.E.C) of the studied soil before and after treatments are given in table 3 . Data showed that the exchangeable sodium increasing with increasing of depth but decreased with tillage and draining soil .Also cation exchange capacity (C.E.C) was decreased with increasing of depth.

Table (3) Exchangeable sodium and cation exchange capacity (C.E.C)

Treatments	Soil depths (cm)	Exchangeable sodium	C.E.C	E.S.P
Soil before drained and tillage	0-15	8.62	47.36	18.2
	15-30	9.13	45.99	19.85
	30-60	10.47	49.39	21.2
	60-90	10.68	48.15	22.18
Soil after drained and tillage depth (25 cm)	0-15	5.75	62	9.28
	15-30	6.04	53.4	11.32
	30-60	6.62	51.13	12.95
	60-90	7.09	49.63	14.28
Soil after drained and tillage depth (15 cm)	0-15	5.88	51.82	11.34
	15-30	6.65	50.76	13.1
	30-60	7.22	49.18	14.68
	60-90	8.26	48.96	16.87

4-2-8- Exchangeable sodium percent (ESP)

Exchangeable sodium ranges between 18.2 and 22.18meq/100gm soil before drainage and tillage. While , ESP ranges between 9.28 and 14.28,11.34 and 16.87 meq/100gm soil after drained and tillage of depths 25 cm and 15 cm respectively . Data in table (3) show that, the ESP value increased with increasing soil depth under all treatments. This increase resulted from the high solubility of sodium salts and its downward movement with leaching and irrigation water compared with calcium and magnesium salts.

Tillage treatment and open drainage system establishment caused an improvement in the ESP. This decrease in the ESP values with tillage at depth 25cm was more than that with tillage depth 15cm. Also, the decrease in the ESP values in the surface layers was more than that in lower layers. This resulted from the downward movement of sodium ions compared with calcium and magnesium. The relative decrease of ESP of profile with drainage and tillage at depth, 25 cm was 49 % and 35.6%, while, this decrease with tillage depth 15 cm was 37.7% and 23.9% of the soil before drained for surface and lower layer, respectively.

It can be noticed that, the efficiency of the open drainage and tillage on the reduce of ESP through different layers of soil profile was more clear in the soil profile with tillage 25 cm compared with the soil profile with tillage depth 15 cm.

4-2-9- Macronutrients (N.P.K).

Data in Table (4) show, the total and available N. P.K and their vertical distribution within soil profile before and after drainage and tillage operation. Data show that, both total and available N, P and K decreased with increasing soil depth before and after drainage and tillage treatment. This decrease in the N.P.K values was more clear in the soil profile with drainAGE and tillage at depth 25 cm than with tillage at depth 15 cm. This decrease may be due to the low content of organic matter and high soil pH values in the lower layers of soil profiles.

Table (4): Total and available N, P and K before and after drained and tillage operations.

Soil treatments	Soil depth (cm)	N		P		K
		Total (%)	Avail. (ppm)	Total (%)	Avail. (ppm)	Total (%)
Soil before drained	0-15	0.012	69.420	0.075	8.480	1.068
	15-30	0.010	59.620	0.068	7.520	1.052
	30-60	0.009	53.210	0.056	5.720	1.038
	60-90	0.009	49.180	0.050	5.220	1.032
Soil after drained and tillage depth (25 cm)	0-15	0.010	72.800	0.067	6.560	1.050
	15-30	0.010	61.120	0.052	4.980	1.042
	30-60	0.008	58.350	0.048	4.850	0.066
	60-90	0.007	56.360	0.046	4.520	1.026
Soil after drained and tillage depth (15 cm)	0-15	0.010	77.870	0.055	5.890	1.032
	15-30	0.009	74.280	0.052	5.740	1.018
	30-60	0.008	70.120	0.048	5.650	0.992
	60-90	0.008	55.450	0.045	4.580	0.985

Data also show that, the available (N) increases with tillage treatments. The calculated relative increase of N. were 7.4% and 20%with tillage at depth 25 and 15 cm of the soil before tillage and drainage. While, the values of the available(P and K) decrease with tillage treatments, the relative decrease of (P and K) were 18.9% and22.3%, 71.9% and , 52.5% in the soil profile with drainage and tillage at depth 25cm and 15 cm, respectively .

Regression equations and correlation coefficients (r) between hydraulic conductivity and some soil chemical properties(EC, clay%,ESP and SAR), also between the available content of N, P, and K and each of (EC, SAR and ESP) under the present study conditions were presented in Table 5 .

Table (5): Regression equations and correlation coefficients (r) between soil properties and the Content of available N, P, and K

Treatments	Element (y)	Soil properties (x)	Linear regression equations	Correlation coefficients (r)
Soil with out drained	N	EC	N= -12.24 EC+ 166.87	0.721
		pH	$N = 79.72\ pH^{-0.159}$	0.753
		SAR	N =1.076 SAR + 10.39	0.907
		ESP	N = -5.39 ESP + 169.3	0.798
	P	EC	P = - 2.095 EC + 25.14	0.881
		pH	$P=10.29\ pH^{-0.229}$	0.833
		SAR	P = - 1.870 SAR + 43.85	0.933
		ESP	P = - 0.890 ESP + 24.90	0.942
	K	EC	K= - 19.62 EC + 29.39	0.822
		pH	$K= 1.O93\ pH^{-0.0205}$	0.676
		SAR	K= - 0.026 SAR + 1.577	0.751
		ESP	K= - 0.013 ESP + 1.314	0.775
	Hydraulic conductivity	EC	H.C= - 1.634 EC + 14.98	0.935
		ESP	H.C = -0.604 ESP + 13.13	0.88
		SAR	H.C = - 1.165 SAR = 23.92	0.8
		$CaCO_3$	H.C = 0.143CaCO3 + 0.31	0.308
		clay%	H.C = - 0.0684 clay + 4.94	0.91
Soil after drained and tillage depth 25 cm	N	EC	N= - 5.271 EC + 96.89	0.776
		pH	$N = 18533pH^{-2.062}$	0.921
		SAR	N = -0.690 SAR + 13.737	0.551
		ESP	N = - 3.171 ESP + 99.9	0.942
	P	EC	P = -0.677 EC + 9.712	0.734
		pH	$P= 25043\ pH^{-3.959}$	0.859
		SAR	P = 0.558 SAR + O.105	0.758
		ESP	P= -0.397 ESP + 9.976	0.868
	K	EC	K= 0.241 EC 6.436	0.11
		pH	$K= 6E+07\ pH^{-8.65}$	0.243
		SAR	K= 0.274 SAR - 1.74	0.748
		ESP	K= - 0.0209 ESP+ 1.305	0.463
	Hydraulic conductivity	EC	H.C = - 3.065EC + 24.075	0.793
		ESP	H.C =-1.874 ESP +26.188	0.979
		SAR	H.C = 2.881 SAR - 22.64	0.935
		$CaCO_3$	H.C = 1.298 CaCO3 - 0.982	0.725
		clay%	H.C = - 0.27 CLAY + 20.04	0.98
Soil after drained and tillage depth 15 cm	N	EC	N = - 10.305 EC + 144.58	0.942
		pH	$N= 204073\ pH^{-3.701}$	0.926
		SAR	N = -0.928 SAR + 17.51	0.681
		ESP	N= - 3.972 ESP + 124.45	0.872
	P	EC	P= - 0.687 EC + 10.455	0.853
		pH	$P= 2458.4\ pH^{-2.831}$	0.797
		SAR	P= 0.179 SAR + 3.549	0.321
		ESP	P= - 0.242 ESP + 8.866	0.827
	K	EC	K= - 36.906 EC + 44.451	0.913
		pH	$K= 3.387\ PH^{-0.562}$	0.957
		SAR	K= 0.0153 SAR + 0.843	0.843
		ESP	K= - 0.009 ESP + 1.134	0.952
	Hydraulic conductivity	EC	H.C = - 2.747 EC + 22.143	0.867
		ESP	HK= 39.156 ESP - 440.8	1
		SAR	H.C = 2.059 SAR - 20.008	0.886
		$CaCO_3$	H.C = 0.4424 CaCO3 + 0.497	0.382
		clay%	H.C = -0.2393 clay + 15.295	0.913

The data of statistical analysis indicate that there is a good relatiosip and high negative significant correlation coefficients between both hydraulic conductivity and either of clay ratio, SAR, ESP and EC, while the value of correlation coefficient of hydraulic conductivity with $CaCO^3$ was very low and insignificients. This change of the obtained correlation coefficients may be due to the high and rapid change occurs in the studied soil properties after the drainage and tillage tretments.Results also show that, there was a linear relationship and high significant correlation coefficients between both available N, P and K and either of EC, ASR, and ESP. These results are harmony with those obtained by EL-Gohary et al (1989), Chand and Tomer (1993) and Abou Hussien (1997).With exception the value of correlation coefficient of available (P with ASR at drained and tillage depth 15 cm), (K with ASR and ESP) at drainage and tillagev depth 25 cm was very low and insignificant.

4-3-Effect of drainage and tillage depth on yield.

Data in table 6 show the yields of corn and berseem (Mg/fed) as affected by drainage and tillage depth . It is obvious that the yields obtained from the soil provided by both tillage depth and drainage are higher than those obtained from the non- drained and tillage soils.Concerning the drained soil and tillage depth at 25 and 15 cm ,these increase percentage are 50.9, 29.4 % and 33.9, 15.2% for the yields of corn and berseem, respectively.

From the results, It can be noitded that, the increments in the productions of corn and berssem under drainage and tillage depth treatments can be attributed to the role of this treatments in improving different soil physical and chemical properties and lowering of water table, more available water , air, heat regines and consequently, more suitable conditions whih inhance the biological activity and nutritional balance.

Table (6): The average yield under different treatments (Mg/fed).

Treatments	Average yield of corn and barseem (Mg/fed)	
	Grain yield (corn)	Barseem
Soil without drained	1.02	4.22
Soil after drained and tillage depth 25 cm	1.54	5.65
Soil after drained and tillage depth 15 cm	1.32	4.86

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تأثير الصرف والحرث على الخواص الفيزيائية والكيمائية للآراضى فـــي منطقـــة ترعة السلام

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أجريت هذة الدراسة فى اراضى ثقيلة متأثرة بالاملاح بزمام ترعةالسلام الكيلو ٨٣ شمال ســـهل الحسينية وذلك لتقدير تأثير نظام الصرف المفتوح وأعماق الحرث علي بعض الخواص الفيزيائية والكيمائيـــة لهذة الاراضى وما مدى التحسين فى هذة الخواص وانعكاس ذلكعلى الانتاجية حيث كانتالمسافة بين المصارف ٣٠ متر بالاضافة الى اجراء عمليات حرث علي اعماق ١٥ و٣٠ سم ٠وقد تم أخذ العينات من أربع مواقـــع بين المصارف وكانت المسافة بين كل عينة والاخرى ١٠ متر وذلك بطول المصرف وعلي اعمـــاق ٠-١٥و ١٥-٣٠و ٣٠-٦٠و ٦٠-٩٠ سم٠

وأظهرت النتائج الاتي:

١- بزيادة عمق التربة يزيد قيم كلا من (EC- pH-SAR- ESP) ويقل بزيادة عمق الحرث٠ وهذا النقص يكون واضح فى الطبقات السطحية بالمقاربة بالطبقات التحتية٠

٢- بأجراء عمليات الحرث يزيد النيتروجين المتاح وكانت الزيادة٧%و ٢٠% عند الحرث علي اعمـــاق ٢٥ و١٥ سم وذلك بالمقاربة بالتربة بدون صرف وبدون حرث٠ بينما يقل مقدار P-Kبنسبة ١٨,٥ و٢٢,٥% للفوسفور وبمقدار ٧٢ و٥٢,٥% للبوتاسيوم وذلك عند الحرث علي اعماق ٢٥و١٥ سمز

٣- نظام الصرف المفتوح والحرث علي عمق ٢٥ سم يزيد معامل التوصيل الـــهيدروليكى ويقـــل معـــامل التوصيل بزيادةSAR٠

٤- قلة المحتوى من المادة العضوية ونسبة الكربونات بزيادة عمق الحـــرث وذلـــك لزيادكفـــاءة الحركـــة وعمليات الغسيل٠

٥- قوام التربة لايتأثر بأجراء المصارف ولكن قد يحدث أعادة توزيع للحبيبات مع عمليات الحرث٠

٦- زيادة الانتاجية مع نظام الصرف المفتوح بالمقارنة بالتربة بدون صرف٠