MODERN LAND RECLAMATION AREA QLAPSHO AND ZIAN, EGYPT

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Abstract:

Background: *Water resources management should be concerned with careful and intensive use of relatively water supplies.*

The aim of the present work *was to suggest the best and optimum method of utilization and conservation of soil and water for the future development in the area.*

Materials and Methods: *the present work was carried out on fifty samples collected from Zian and Qalabshu, Bilqas district- Dakahlia Governorate****.*** *Analyses were carried out of selected ten drainage and four subsoil water samples represent the water resources of the study area.*

The results *showed that samples of El-Nil canal may be suitable for plants of moderate salt tolerance. There were some samples falls in very high saline class which is of doubtful quality for irrigation. Other samples fall in the excessive saline water class which is of unsuitable quality for irrigation.*

Conclusions: *to avoid the serious problem of salinity, the subsoil water have to be lowered either horizontally by relatively deep surface drains or vertically dewatering from the wells.*

Keywords: *drainage water samples; subsoil water samples; Boron*

INTRODUCTION

Dakahlia governorate is one of the most highly populated governorates in the Nile Delta. Damietta Nile branch crosses the governorate from Mit-ghamr to Shirbin (Fig. 1). The total population of Dakahlia governorate is about 5 million inhabitants. Its area is about 825,000 acres, where the total agricultural land is about 785,000 acres. The increase rate of population, feeding, housing and employment entails increase demand for the existing agricultural areas, reclamation of new lands and intensified water use. More attention must be given for conserving soil and water resources. The study area Zian – Qalabshu, Bilqas district is located at the western north part of Dakahlia governorate; where number of ten agricultural associations of the area of each association five thousand acres except university Association four thousand acres with a total area of 49 thousand acres, under the supervision of the general control of the land reclamation Dakahlia, Lashin (2011). Ramadan et al (2008) stated that the laser technology was used to smooth the ground level at certain values. Land preparation and precision land leveling are considered the main factors affect the irrigation efficiencies of surface irrigation systems. Hassan (1988) said that the use of gated pipe system is claimed to be one of the ways to improve the efficiency of surface irrigation method.

Aim of the work is to suggest the best and scientific methods of utilization and conservation for soil and water of the future development area.

Hydrology of the study area:

The subsoil section consist mainly of sands, silt and clay lenses. The depth to water in the boreholes dug in the area ranges from 75 to 175 cm, the variation in depth to water of the subsoil zone is possibly attributed to the surface relief, the mis-use of irrigation water and the inadequate drainage system. Moreover, the piezometric surface of the groundwater in this zone is governed by the hydrostatic pressure, due to the presence or absence of the impervious hard sticky clays at the bottom of the subsoil section. Certainly, the relation between the subsoil water and the deep groundwater is very important for future studies.

MATERIALS AND METHODS

Water sampling

The present work was carried out on fifty samples collected from Zian and Qalabshu, Bilqas district- Dakahlia Governorate. Concerning on the analyses of ten drainage and four subsoil water samples represent the water resources in the area of study, (Fig 1). The water samples are subjected for chemical analysis. The analysis includes the determination of; TDS, pH, EC, the concentration of major ions (K^+, Na^+, Mg^{++}, Ca^{++}, Cl^-, CO_3^{--}, HCO_3^{--} and $SO4^{--}$). The minor component of Boron is also required for studying the nature of this area. The obtained chemical data are expressed in parts per million (ppm), mill equivalent per million (epm), and percentage reacting values (%).

Results

Concerning on analysis of ten drainage and four subsoil water samples represent the water resources in the study area. pH for drainage-subsoil samples ranges from7.5 to 8.5; slightly alkaline to alkaline.

Electrical Conductivities (E.C) were ranged from 1590.32 µm/cm at 25 ^{0}C at (sample No 1) to 47135.456 µm /cm at 25 ^{0}C at (sample No 12). The high E.C. value is consequent to the high sodium and chloride ions contents.

Salinity

Total Dissolved Salts (TDS) values obtained are found to range from 956.4 ppm (sample No 1) to 28564.48 ppm (sample No 12). Samples No (1, 2) reflect a fresh water type and other samples reflect a brackish to a brine water type. The brackish water reflects the impact of leaching and solubility of the marine aquifer sediments**,** (Table1).

Major cations

Potassium

It is generally lower than Sodium content and represents the least dominant cations. It ranges between 5.60 ppm (sample No 1) to 610 ppm (sample No 5)**,** (Table1).

Sodium

Sodium is the most predominant ion in water samples. In our study, it ranges from 49 ppm (sample No 1) to 5167.67 ppm (sample No 5). However, the Sodium content is very important in assessing water for domestic and irrigation purposes**,** (Table 1).

Magnesium

It occurs mainly in the ionic form in water. In the studied samples, concentration of magnesium varies from 17.68 ppm (sample No 10) to 2381.9 ppm (sample No 12), (Table 1).

Calcium

It is easily dissolved in water; however carbonate rocks are the principal source for Ca^{++}. In the present study, Ca^{++} is more common than other ions and detected in values ranging between 45 ppm (sample No 2) to 1082.2 ppm **(**sample No 12)**,** (Table 1).

Major anions

Chloride

Chlorides are generally the most common ions he earths crust. The occurrence of chlorides depends on the type of environment during deposition. The chloride content is very important in assessing water for domestic and irrigation purposes. In the present study, chlorides vary from 65.9 ppm (samples No 1 and 2) and 21027 ppm (sample No 12), (Table1).

Sulphate

It is considered the second predominant anion after chloride; it varies in content from 78 ppm (sample No 1) and 2600 ppm (sample No 13)**,** (Table 1).

Carbonates and Bicarbonates

They are the less dominant anions. Solubility of carbonate increases markedly in the presence of CO_2 in water, forming the highly soluble bicarbonate. In this study, bicarbonate is found to range between 465 ppm (sample No 10) and 2376.45ppm (sample No 3)**,** (Table1).

DISCUSSION

Due to the vicinity of the study area to the Mediterranean Sea, sea water intrusion is marking the soil area where in some places salt patches were noticed accumulated on soil surface. The relation between some ions in water affects to great extent, its quality and the physical properties of the irrigated soil. The increase of salinity in irrigation water may cause salinization of soil, which damage the growth and the yield of plants. The quality requirements of irrigation water vary according to types of crops, drain ability of soils and climatic conditions" (Bower, 1978). The depth to subsoil water in the area ranges between 75 cm and 175 cm. The closeness of the subsoil water to the ground surface is harmful to the crops yield in the cultivated areas. To avoid this serious problem, the subsoil water has to be lowered either horizontally by relatively deep surface drains or vertically by dewatering from wells. Certainly, the relationship of the subsoil water to the deep groundwater is very important for future development of this area. Such type of study needs not only shallow to moderate drilling, but also deep boring to penetrate subsurface zones in the surrounding localities. Classification and standards which help for the evaluation of the examined drainage-subsoil water samples as in (Tables 2, 3 and 4). Samples No (1, 2) fall in the high saline water class, which is permissible for irrigation limit (due to E.C) may cause a slight harmful effect. They may be suitable for plants of moderate tolerance. Samples No (4, 6, 7, 8, 9) are fall in the very high saline class, which is of doubtful quality for irrigation. Samples No (3, 5, 10, 11, 12, 13, 14) fall in the excessive saline water class, which is unsuitable for irrigation. The classification of the U.S salinity lab. (1954), (Fig. 2) is based on the Sodium Adsorption Ratio (SAR) and the specific conductivity (EC) in µ mhos /cm. The ratio between Na^+ and (Mg^{++} + Ca^{++}) contents from the following equation, affects greatly the physical properties and use of soil. It is important to follow the distribution of SAR as indicative of the probable extent to which the soil adsorbs ions from water. SAR is important for the assessment of the suitability of groundwater for irrigation purposes. Generally, irrigation water with low SAR is much desirable.

$$SAR = Na \Big/ \sqrt{\frac{(Ca^{++} + Mg^{++})}{2}} \quad epm$$

According to U.S. Salinity Laboratory Staff (1954), all subsoil samples show high E.C. which indicate that this water is not satisfactory for irrigation purposes, although SAR is (7.8 and 12.76) for subsoil samples No (11, 13), this is in accordance with Ramadan et al (2008) who indicated that SAR values were high; more than 3 .

Distribution of Boron

The natural sources of boron in water are igneous and volcanic rocks. Boron in groundwater mostly occurred at concentration of less than 1 mg/l (Sallouma, *et al.,* 1998). Traces of boron are needed for all plants; many plants are harmed by the concentration of more than 1ppm (Wilber, 1969). Sodium tetra borate is widely used in detergent formulations for bleaching and cleaning. As a consequence, boron is commonly found in domestic sewage and natural waters. Boron is nutrient, but it is toxic at higher concentrations. For this reason, irrigation water should not contain more than 2 ppm of boron depending on crops and soil. In the drainage-subsoil samples, the concentration of boron within permissible limit (sensitive crops) according to, NAS and NAE (1972) ranges from 0.145 ppm to 0.398 ppm (Table 5).

CONCLUSIONS

Samples of el-Nil canal fall in the high saline water class which is permissible for irrigation and may cause a slight harmful effect. It may be suitable for plants of moderate salt tolerance. Samples of el-Sokar canal at the front of factory gate, rejection area of drain-2-station, and suction area of drain-2-station, el-Gamaiat canal, and subsoil-1 are fall in the very high saline class, which is of doubtful quality for irrigation. Samples of el-Sokar canal away 1km from factory gate, immersed area by water, el-Moheet drain and subsoil samples are fall in the excessive saline water class, which is of unsuitable quality for irrigation.

RECOMMENDATIONS

On the light of the results obtained through the study made on the area, it is recommended that:

1. Drilling and preparing some of observation wells with 20 m depth.
   (PVC, 2 inch in diameter) to determine:
   A - Type of water.
   B - Efficiency of using drainage system.
2. Using gated pipes, perforated pipes as well as the siphon pipes to improve the irrigation system and compensate for the huge amount of leaching requirements.
3. Lowering of the groundwater table by excessive withdrawal under controlled and pre-estimated management to reduce salinity damage of the cultivated soil.

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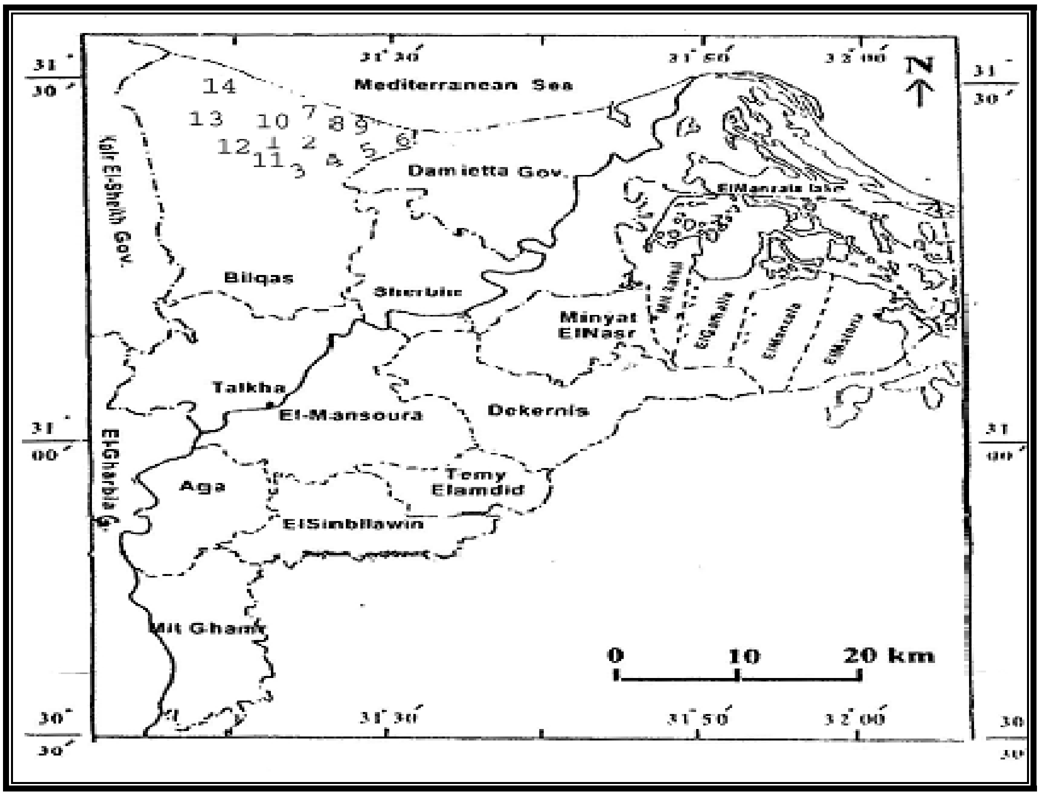

Figure (1) Location map for the drainage subsoil water samples in the study area of Dakahlyia Governorate

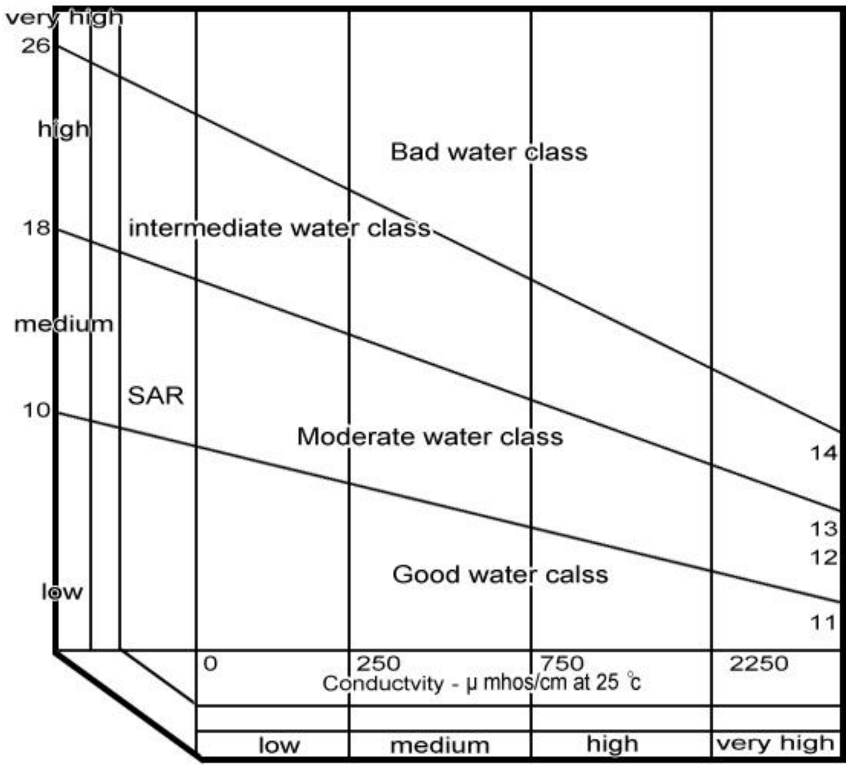

Figure (2) U.S. Salinity diagram for classifying irrigation water of Zian – Qalabshu district (U.S. salinity laboratory stuffs, 1954)

Table (1) Results of chemical analysis of the study samples in (ppm)

No	TDS mg/l	K^+	Na^+	Mg^{++}	Ca++	Cl^-	$SO4^{--}$	$HCO3^-$
1	956.4	5.60	49	57.6	56	65.9	78	644.3
2	983.54	6	50	60.12	45	65.9	89	667.52
3	9320.65	107.5	820	1895.8	480.9	1640	2000	2376.45
4	2105.8	12.5	315.56	102.1	72.14	567.4	100	936.1
5	12738.56	610	5167.67	1895.79	801.6	1242.50	2000	1021
6	2707.28	12	440	247.9	72.14	937	215	783.24
7	2981.25	12	390	297.2	80.1	760	225	1216.95
8	2731.11	13	586.73	121.5	80.16	914.125	270	745.6
9	3040.16	20	667.69	177.43	68.14	1331.25	266	509.65
10	5517.04	80	1607.93	17.68	220.44	2025.99	1100	465
11	3217.01	18	680.34	150.7	112.22	1153.75	322	780
12	28564.48	150	2013.74	2381.9	1082.2	21027	1200	710
13	8830.7	50	1756.97	315.97	681.36	2662.5	2600	763.9
14	6631.07	230	1702	167.64	64.13	1773	1000	1604.3

Table (2) U.S. Salinity Laboratory classification according to salt concentration

Water class quality	TDS (ppm)	E.C. µ mhos/cm at 25 °C	No of sample
Low saline water	<160	0-250	-
Medium saline water	160 – 480	250- 750	-
High saline water	480 – 1440	750 – 2250	1, 2
Very high saline water	1440 – 3200	2250 – 5000	4, 6,7, 8, 9
Excessive saline water	>3200	>5000	3, 5, 10, 11, 12, 13, 14

Table (3) Classification according to E.C. (Hammad, 1985)

E.C (µ mohs/cm at 25 ºC	No of sample	Water class
Less than 250	-	Excellent
250 – 750	-	Good
750 – 2000	1, 2	Permissible
2000 – 3000	4	Doubtful
More than 3000	3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Unsuitable

Table (4) Results of SAR & EC for subsoil samples

No of sample	EC µm/cm	SAR
11	5343.97	7.8
12	47135.456	11.38
13	14586.987	12.76
14	10987.563	21.98

Table (5) Result of Boron (B) of some drainage – subsoil samples

NO / sample name	B (ppm)	NAS and NAE for concentration of Boron, 1972	
1 El-Nil canal	0.154	0.75 ppm	Sensitive crops
2 El-Nil canal	0.145	1 ppm	Semi-tolerant crops
8 El-Gamaiat canal	0.265	2 ppm	Tolerant crops
9 El-Gamaiat canal	0.343		
11 Subsoil 1	0.398		