USE DRAINAGE WATER F0R AGRICULTURAL PURPOSES

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Received 14 September 2014 Accepted 20 January 2015

ABSTRACT

In this study the samples of southern drainage water and Euphrates river water were taken from the north region of Al- Manadhra city [Najaf province-Iraq].Those samples were mixed with different ratios by adding drainage water to river water to get a new solution containing different salt. To find a standard indicator of water quality that sodium adsorption ratio (SAR) as well as examine electrical conductivity (E.C.).The results were (3.15, 3.9, 4.2, 4.8, 5, 5.2, 5.3, 5.4, 5.5, 5.6, 5.8) for (SAR), (1.58, 2.3, 3.06, 3.75, 4.35, 5.11, 5.85, 6.33, 7.2, 7.63, 8.2) for (E.C.) respectively.
Then, examine those samples of salt water where used as an irrigation water supplied to several types from of Oryza satival seeds (Al-forat class, Yassmin class, Amber Baraka class) to test germination of seeds**.** The results of germination of seeds with those samples of irrigation water at mixing drainage water ratios (0-100)% equal to (100-5)% for Al-forat class, (90-0)% for Yassmin and Amber Baraka class respectively.

KEY WORDS: saline waters, irrigation and drainage water, sea water

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الخلاصة

في هذا الدراسة, أخذت عينات من ماء البزل الجنوبي و ماء نهر الفرات من منطقة شمال مدينة المناذرة[محافظة النجف-العراق]. تلك العينات خلطت بنسب مختلفة بواسطة إضافة ماء البزل إلى ماء النهر للحصول على محلول جديد يحتوي على ملح مختلف. لإيجاد المعيار القياسي لنوعية المياه تلك نسبة إمتزاز الصوديوم (SAR) إضافة إلى فحص التوصيلة الكهربائية (E.C.). وكانت النتائج (3.15, 3.9, 4.2, 4.8, 5, 5.2, 5.3, 5.4, 5.5, 5.6, 5.8) بالنسبة (SAR) , (1.58, 2.3, 3.06, 3.75, 4.35, 5.11, 5.85, 6.33, 7.2, 7.63, 8.2) بالنسبة (E.C.) على التوالي. ثم اختبار تلك العينات من الماء المالح حيث استخدمت كماء ري جهز لعدة أصناف من بذور الرز(صنف الفرات, صنف الياسمين, صنف عنبر البركة) لفحص انبات البذور. نتائج أنبات البذور مع تلك عينات ماء الري عند نسب خلط ماء بزل (0-100)% تساوي (100-5)% لصنف الفرات , (90-0)% لصنف الياسمين وعنبر البركة على التوالي.

1- INTRODUCTION

Different crops require different irrigation water qualities. Therefore, testing the irrigation water prior to selecting the site and the crops to be grown is critical. The quality of some water sources may change significantly with time or during certain periods (such as in dry/rainy seasons), so it is recommended to have more than one sample taken, in different time periods. The chemical properties of the irrigation water are discussed. Which it refer to the content of salts in the water as well as to parameters derived from the composition of salts in the water; parameters such as EC,TDS (Electrical Conductivity, Total Dissolved Solids), SAR (Sodium Adsorption Ratio).

Substituted Colorado River water (900 mg/L total dissolved salts) after seedling establishment by percentages of Alamo River (drainage water of 3500 mg/L total dissolved salts). In the test were 76 in wheat, 82 in sugar beets, and 54 in cotton.**[Rhoades,(1984)].**

Results show that ratio 1:1 mixture of Caspian Sea and well water can be used for irrigation without a significant reduction in barley yield, provided this is applied at ear formation. However, when applied at stem elongation, significant yield reduction occurs. Soil analysis after harvest showed that the EC had increased significantly, especially with irrigation applied at stem elongation. **[Dordipour et al, (2004)]**.

Water drainage was tested and used agricultural purposes were used samples of water drainage and mixed with samples of river water at different ratios to get a new solution containing different salt proportions(drainage and river from region Dujaili/ Wasit Governorate). Tested (Ca, Na, mg) to find a standard indicator of water quality, labeled sodium adsorption ratio (SAR) as well as (EC, PH). And compare the results with the salinity laboratory system U.S. (USSL) and Food Agriculture Organization of the United Nations (FAO). Found the proportions of mix ratios (10%drainage + 90%River), (20%drainage + 80%River) are the ratios preferred and more E.C. increased salt concentration in the water and the pH values of this water was within normal limits.**[Al-Humairi,(2013)]**.

2- CHARACTERIZING SALINITY

There are two common water quality assessments that characterize the salinity of irrigation water. The salinity of irrigation water is sometimes reported as the total salt concentration or total dissolved solids (TDS). The units of TDS are usually expressed in milligrams of salt per liter (mg/L) of water. This term is still used by commercial analytical laboratories and represents the total number of milligrams of salt that would remain after 1 liter of water is evaporated to dryness. TDS is also often reported as parts per million (ppm) and is the same numerically as mg/L. The higher the TDS, the higher the salinity of the water the other measurement that is documented in water quality reports from commercial labs is specific conductance, also called electrical conductivity (EC). EC is a much more useful measurement than TDS because it can be made instantaneously and easily by irrigators or farm managers in the field. Salts that are dissolved in water conduct electricity, and, therefore, the salt content in the water is directly related to the EC. The EC can be reported based on the irrigation water source (ECw) or on the saturated soil extract (ECe). Units of EC reported by labs are usually in millimhos per centimeter (mmhos/cm) or decisiemens per meter (dS/m). One mmho/cm=1 dS/m. EC is also reported in micrommhos per centimeter(µmhos/cm), (1µmhos=1/1000). [**Stephen R. Grattan,(2002**)] .

3- CLASSIFICATION OF SALINE WATERS

For the purpose of identifying the levels of water salinities for which these guidelines are intended, it is useful to give a classification scheme. Such a classification is given in **table (1)** in terms of total salt concentration.[**Rhoades**, **et.al,(1992)]**

4- SODIUM HAZARD

Reductions in water infiltration can occur when irrigation water contains high sodium relative to the calcium and magnesium contents. This condition, termed "sodicity," results from excessive soil accumulation of sodium. Sodic water is not the same as saline water. Sodicity causes swelling and dispersion of soil clays, surface crusting and pore plugging. This degraded soil structure condition in turn obstructs infiltration and may increase runoff. Sodicity causes a decrease in the downward movement of water into and through the soil, and actively growing plants roots may not get adequate water, despite pooling of water on the soil surface after irrigation. The most common measure to assess sodicity in water and soil is called the Sodium Adsorption Ratio (SAR). Sodium adsorption ratio (SAR): is a measure of the suitability of water for use in agricultural irrigation, as determined by the concentrations of solids dissolved in the water. It is also a measure of the sodicity of soil, The SAR defines sodicity in terms of the relative concentration of sodium (Na) compared to the sum of calcium (Ca) and magnesium (Mg) ions in a sample, The SAR assesses the potential for infiltration problems due to a sodium imbalance in irrigation water. The SAR is mathematically written below by equation (1), where Na, Ca and Mg are the concentrations of these ions in milliequivalents per liter (meq/L). Concentrations of these ions in water samples are typically provided in milligrams per liter (mg/L). To convert Na, Ca, and Mg from mg/L to meq/L, you should divide the concentration by 22.9, 20, and 12.15 respectively. **[Bauder.et.al (2012)]**

$$SAR = \frac{Na}{\sqrt{\frac{(Ca + Mg)}{2}}} \qquad (1)$$

5- EXPERIMENTAL WORK

In this study the samples of southern drainage water and Euphrates river water were taken from the north region of Al- Manadhra city [Najaf province-Iraq].Those samples were mixed with different ratios by adding drainage water to river water to get a new solution containing different salt proportions. The mix ratios were 90% of river water to 10% of drainage water, 80% to 20% and so on until 10% to 90% by 10% decrements and increments pure river water and pure drainage water, **table (2)** show the results of the tests done on these mix ratios starting with pure river water (without addition of drainage water) and ended at 100% drainage water (without river water).

The mixing process was achieved in an enclosed containers and the tests were done in soil lab of Kufa technical institute. A flame photometer (CL738, British origin) and E.C. meter (USA origin) devices were used as an instruments to make the tests. The analysis of the mix composition was done to find out ions (Na, Ca, Mg). The calcium and magnesium were estimated using correction method while sodium ion was reached by flame photometer. The electrical conductivity (E.C.) was estimated and then the value of sodium adsorption ratio (SAR) was calculated using eq.(1).

The mix water ratios of samples governed from lab were used as an irrigation water supplied to several types of rice (Oryza sativa) seeds which was brough from (Abaa Center of Rice Researches) in Mushhab city (Al-forat class, Yassmin class and Amber Baraka class) to test the viability of seeds**.**

The vitality of seeds was tested by taking (100) seed of all varieties of rice, varieties used in the work had been soaked in water for 24 hours to ensure moisten the seeds. The seeds were placed in plastic sterile dishes under warn laboratory conditions of temperature of 26º ± 1. The irrigation with water was provided regularly to maintain the necessary moisture for seed germination for seven days. The percentage of germination was (90%) of the Amber 33 class, (100%) for the rest of the items by using eq. (2).

$$\textbf{percentage of germination} = \frac{\text{Number of germinated seeds}}{\text{The total number of seeds}} \times 100 \quad (2)$$

5.1- Applied Study For Different Levels Of Salinity On Seeds Germination Rice Varieties

The effect of different levels of salinity on seed germination was test by taking samples of each type of rice varieties used in the work and soaked in water for 24 hours to ensure moisten of the seeds. Each (50) seeds were kept in plastic sterile dishes at a rate of three replicates and kept at temperature of 26º ± 1 with regular irrigation to those samples of salt water concentrations under watching by providing the necessary moisture for seeds germination for seven days. The percentage of germination was calculated from equation(2).**Table(3)** show the results of the percentage of germination of the samples**.** The percentage of germination for seeds rice varieties are explained in **figures. (1, 2, 3**) taken.

6- ANALYSIS OF EXPERIMENTAL RESULTS

The results of the study applied to varieties of seed rice for those samples of salt water governed show a good percentage of germination of these seeds of different varieties of rice (Al-forat class, Yassmin class and Amber Baraka class). As salinity of water increased the percentage of germination was decreased as shown in **table (3)** where pure water gives 100% germination for Al-forat class and 90% for Yassmin class and Amber Baraka class. The10% increment of salinity shows a drop in germination of Yassmin class and Amber Baraka class. The surprise results faced is that when 100% drainage water used, the germination is Yassmin class was 0% while it was 5% for Al-forat class. So saline water can be used safely for irrigation purposes, especially when it is used to plants which need more water for irrigation. The current results were ensured by the comparison with an international standards [Rhoades, et.al] when the results are within the ratios given in this standard.

7- CONCLUSIONS

1. The salinity of water drainage that E.C (8.212) dS/m within the range (2-10) dS/m salinity as moderate condition, it can be used for irrigation for so many other plants if they are under adequate conditions and good management.
2. The ratios (90% of the river water +10% of the drainage water), (80% of the river water +20% of the water drainage) until (30% river water+70% of the drainage water), can be applied to different types of other plants successfully.
3. It is possible to get the high germination if the irrigation was controlled by alternative method in which the plants can be irrigated once by pure water and second time by drainage water .
4. Alternative method mentioned in point 3 can be replaced by low-cost drip irrigation with saline water especially ratio (10% river water+90% of the drainage water).

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Table (1): Classification of Saline Waters.[Rhoades, et.al,(1992)]

Water Class	Electrical Conductivity dS/m	Salt Concentration mg/l	Type of Water
Non-saline	**<0.7**	**<500**	**Drinking and irrigation water**
Slightly saline	**0.7 - 2**	**500-1500**	**Irrigation water**
Moderately saline	**2 - 10**	**1500-7000**	**Primary drainage water and groundwater**
Highly saline	**10-25**	**7000-15 000**	**Secondary drainage water and groundwater**
Very highly saline	**25 - 45**	**15000-35 000**	**Very saline groundwater**
Brine	**>45**	**>45 000**	**Seawater**

Table (2): drainage water & river water mix ratios, electrical conductivity and sodium adsorption ratio

No.	Mixing ratios (%)	Ca (meq/L)	Mg (meq/L)	Na (meq/L)	(E.C.) (mmoh/cm)	(SAR)
1	100 River water	7.2	1.6	6.6	1.58	3.15
2	90 river +10drainage	11	5	11	2.3	3.9
3	80 river+20 drainage	10.6	13.5	14.4	3.06	4.2
4	70 river+30 drainage	16.4	8.8	17	3.75	4.8
5	60 river+40 drainage	18	12	19.3	4.355	5
6	50 river+50 drainage	20	14	21.4	5.112	5.2
7	40 river+60 drainage	22	14.8	22.6	5.85	5.3
8	30 river+70 drainage	28	10	23.5	6.33	5.4
9	20 river+80 drainage	30	16	26.3	7.2	5.5
10	10 river+90 drainage	33	18.1	28.4	7.63	5.6
11	100 Drainage water	35	21	31	8.212	5.8

Table (3): percentage of germination for seven days

No.	*Mixing ratios (%)*	*Electrical Conductivity E.C.*	*Al-forat class*	*Yassmin class*	*Amber Baraka class*
1	100 river water	1.579	100%	90%	90%
2	90 river+10drainage	2.283	100%	90%	80%
3	80 river+20 drainage	3.06	90%	80%	60%
4	70 river+30 drainage	3.749	90%	70%	50%
5	60 river+40 drainage	4.355	70%	50%	40%
6	50 river+50 drainage	5.112	60%	50%	40%
7	40 river+60 drainage	5.846	60%	40%	35%
8	30 river+70 drainage	6.329	30%	30%	20%
9	20 river+80 drainage	7.19	25%	10%	10%
10	10 river+90 drainage	7.63	20%	5%	5%
11	100 drainage water	8.212	5%	0	0

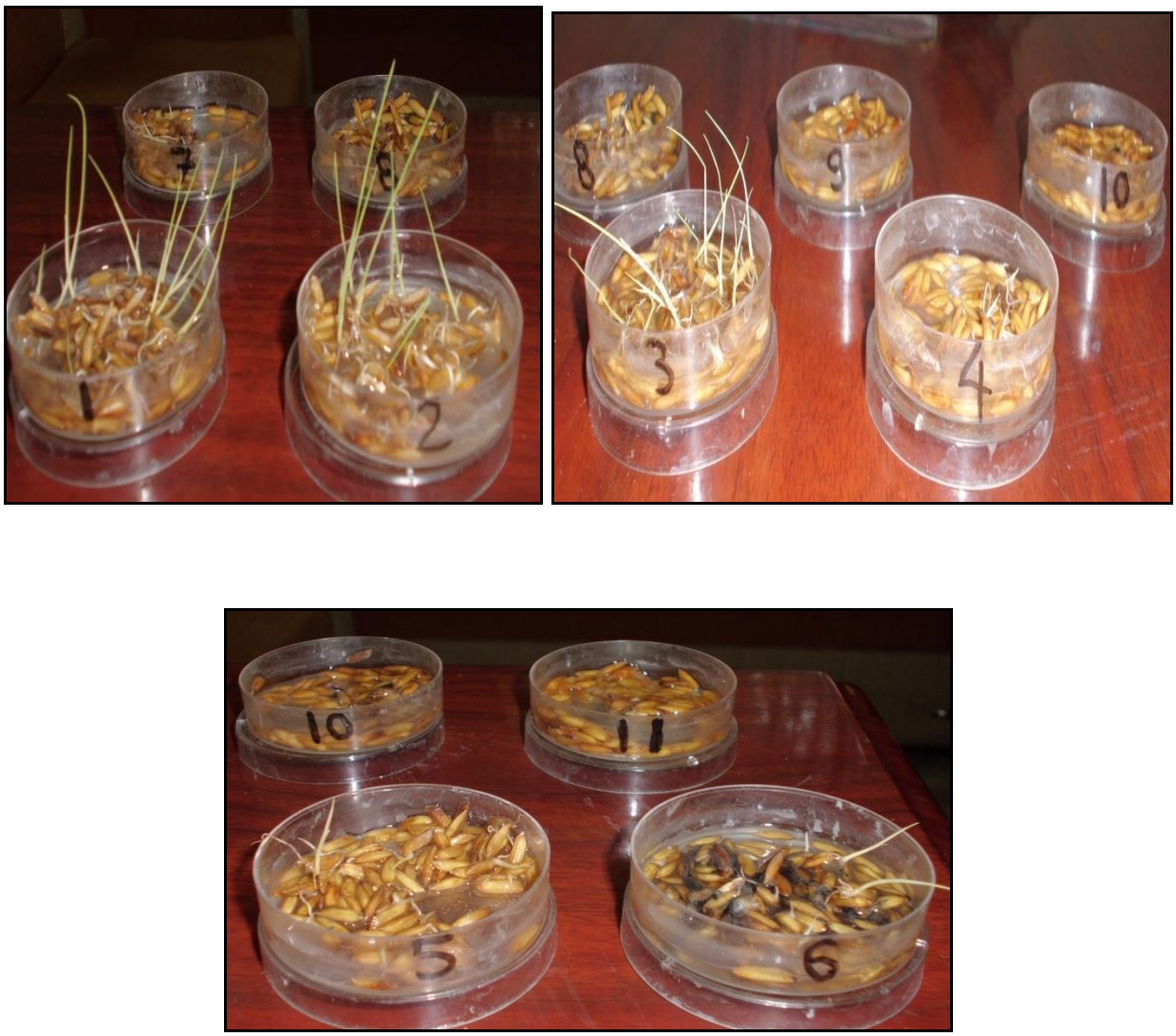

Figure (1): percentage of germination for Al-forat class for seven days

Figure (2): percentage of germination for Yassmin class for seven days

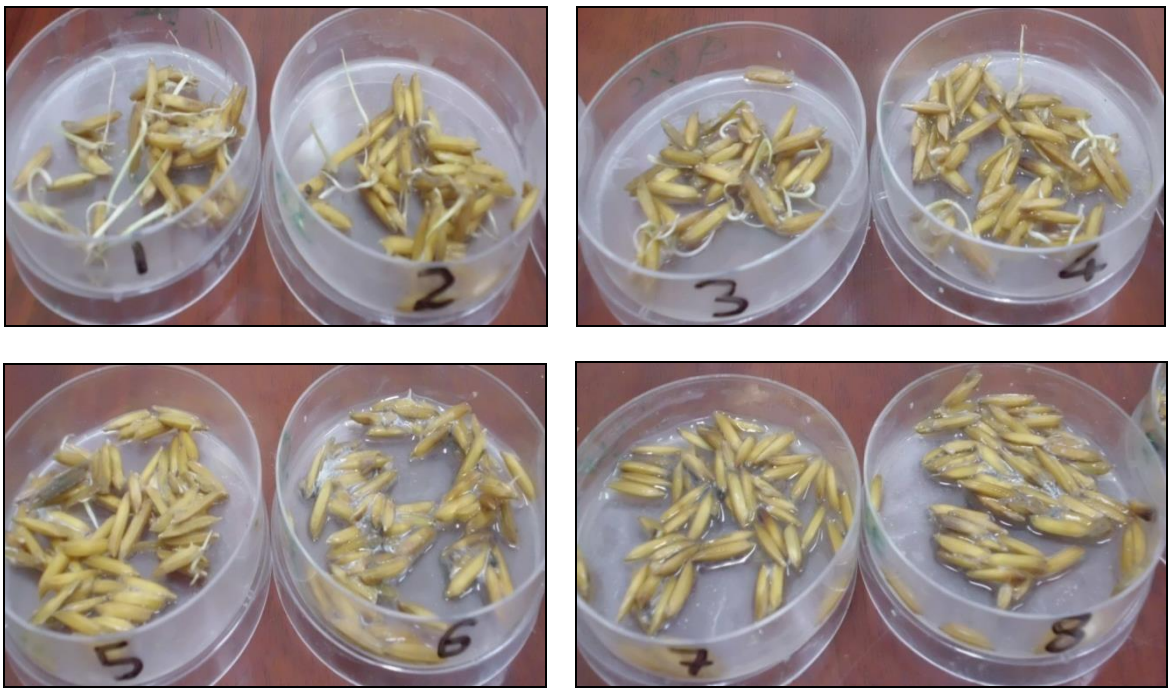

Figure (3): percentage of germination for Amber Baraka Class for seven days