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EFFECT OF KASNAZAN IMPOUNDMENT AND WELLWATER IN CHEMICAL PROPERTIES OF SOIL AND PLANT

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ABSTRACT

Soil, plant, and water (Kasnazan impoundment and well water) samples were monthly collected from Kasnazan (10 Km north east of Erbil city) during August 2004 to February 2005. Chemical and statistical analysis indicated that the irrigation with well water resulted to decreases EC from 0.87 $dS.m^{-1}$ to 0.49 $dS.m^{-1}$, because of leaching and dilution effects. Statistically there is a positive significant correlation ($P< 0.05$) between SAR value of well water and irrigated soil with it, whereas, a negative correlation of Mg^{+2} concentrations observed between well water and soil irrigated with it. On the other hand, there was high content of Mg^{+2} and low content of K^{+1} for eucalyptus plant irrigated by well water in comparison to that irrigated with impoundment water.

INTRODUCTION

Water plays an important role in soil productivity and plant growth, and it is regarded as a limiting factor in plant growth. Much natural water contains impurities that make them directly harmful for plant. Plants vary in their tolerate to poor water qualities, so the soil regards as an important factor in limiting water suitability for irrigation (Taiz and Zeiger, 2006).

The quality of irrigation water is depended on salt content, the nature of salts present in solution and proportion of Na^{+} to Ca^{+2} , Mg^{+2} and other cations (Shirokova *et al*., 2000).

Iraqi Kurdistan Region is rich in water resources like rivers, streams, spring, lake, and impoundment water. Many limnological and phycological studies were conducted in Kasnazan impoundment water a large lentic system within Erbil province (Rashhed, 1994; Al-Barazingy, 1995; Toma, 2000; Bapeer, 2004 and Goran, 2006), whereas, there is a shortage information about water quality for irrigation purposes. This study is the first attempt to reduce existing gap about Kasnazan water quality and its effect on each of soil's ionic component and their effect on *Eucalyptus camaldulensis* (Dehn), in addition to comparing it with the result of ground water of Kasnazan location.

According to United State Salinity laboratory Staff (1954) Classified irrigation water to sixteen classes depending on $dS.\ m^{-1}$ at 25 °C and SAR as follows:

Water Classes	Electrical Conductivity $dS.m^{-1}$ at 25 °C
C1 Low- salinity	$0<EC<0.25$
C2 Medium- salinity	$0.25<EC<0.75$
C3 High - salinity	$0.75<EC<2.25$
C4 Very high -salinity	$2.25<EC<5$

Continued

Water Classes	SAR
S1= Excellent	<10
S2= Good	10-18
S3= Fair	18-26

S4= Poor	>26

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MATERIALS AND METHODS

Kasnazan impoundment locates (10 Km east of Erbil city, Figure 1) at an altitude of 646m, latitude 38 °S 0423768, and longitude 40° 07776 UTM(Goran, 2006). Its artificial water basin instructed to collect water from the perennial Kahreez. The water is used for various purposes: drinking, domestic uses, irrigation, and swimming, whereas, orchard field is located at eastern side of Kasnazan village about 2 Km far from water impoundment, in which irrigated by well water.

Water, surface soil (0-30cm) and plant samples (*Eucalyptus* sp.) were collected during August 2004 to February 2005 from Kasnazan village (which irrigated by impoundment water), as well as, from orchard field. EC, pH and TDS were measured by using (pH-EC-TDS meter, HI 9812, Hanna Instrument). Phosphorus and total nitrogen were estimated by (Rayan *et al*., 2001). Nitrate was measured by using (Nitrachech 404, Q40 Med. Ltd Instument). Calcium, magnesium, Sodium, potassium, bicarbonate, carbonate, and chloride were estimated according to Page *et al*. (1982). Data were statistically analysis using SPSS program.

RESULTS AND DISCUSSION

Table(1) shows some chemical properties of Kasnazan impoundment water and well water, the pH values were range from 7.30 to 8.20 and 6.70 to 8.20 respectively, while the SAR values for Kasnazan impoundment water were range from 0.15 to 1.53 in comparing with 0.07 to 0.11 for well water, this may be attributed to high Na^{+} concentration and low Ca^{+2} and Mg^{+2} concentrations in Kasnazan impoundment water in comparing with low Na^{+1} concentration and high Ca^{+2} and Mg^{+2} concentrations in the well water (Shirokova *et al*., 2000). Depending on US Salinity Laboratory (1954) Kasnazan water impoundment and well water can be classified as C1S1 class according to values of SAR and EC. On the other hand, significant differences ($P<0.05$) were observed depending SAR value in soil irrigated by well water. The present results were relatively similar to that of Esmael *et al*. (2007) in Kasnazan water impoundment, with maximum Na^{+1} concentration 0.356 $Meq.l^{-1}$, they reported that the dominant cation was Na^{+1} while the dominant anion was Cl^{-1}, this was contrast to other studies conducted in the area with references to the dominance of Ca^{+2} and $HCO3^{-}$ in water (Esmael, 1986; Dohuki, 1997 and Goran, 2006). Although, the maximum concentrations of Ca^{+2} and Mg^{+2} for Kasnazan impoundment and well water were 0.14 and 6.40 $Meq.l^{-1}$ and 0.25 and 10.2 $Meq.l^{-1}$ respectively. Furthermore, the maximum concentrations of Cl^{-} were 0.53 and 0.52 $Meq.l^{-1}$ for Kasnazan water impoundment and well water respectively. According to Van Hoorn (1970) both analyzed water were suitable for irrigation of all types of plants. Meanwhile, the maximum SSPP value for Kasnazan water impoundment was 0.75, which was lower than that obtain by Esmael *et al*.(2007) in the same water impoundment.

Table (2) indicates the effect of irrigation with well water on some chemical properties of the soil comparison to non irrigated soil, it showed that the irrigation causes a decrease in EC value; this may be due to leaching and dilution effect (Page *et al*., 1982). Statistically there was a positive significant correlation between SAR value of well water and irrigated soil ($P<0.05$), this may be attributed to increasing in Na^{+1} concentration of soil after irrigation (Guo L, 2003). Whereas, a negative correlation of Mg^{+2} concentrations ($P< 0.05$) was observed between well water and irrigated soil.

Irrigation with impoundment water caused a reduction in EC from 1.27 to 0.80 $dS.m^{-1}$(as mean value); this may be due to leaching effect (table 3), (Page *et al*., 1982). The comparison test (paired t-test) between soil irrigated with impoundment water and well water showed a significant correlation between concentration of Mg^{+2} ion in both cases that may be due to water family which belong to (Mg-Cl) family.(Esmael, 1986).

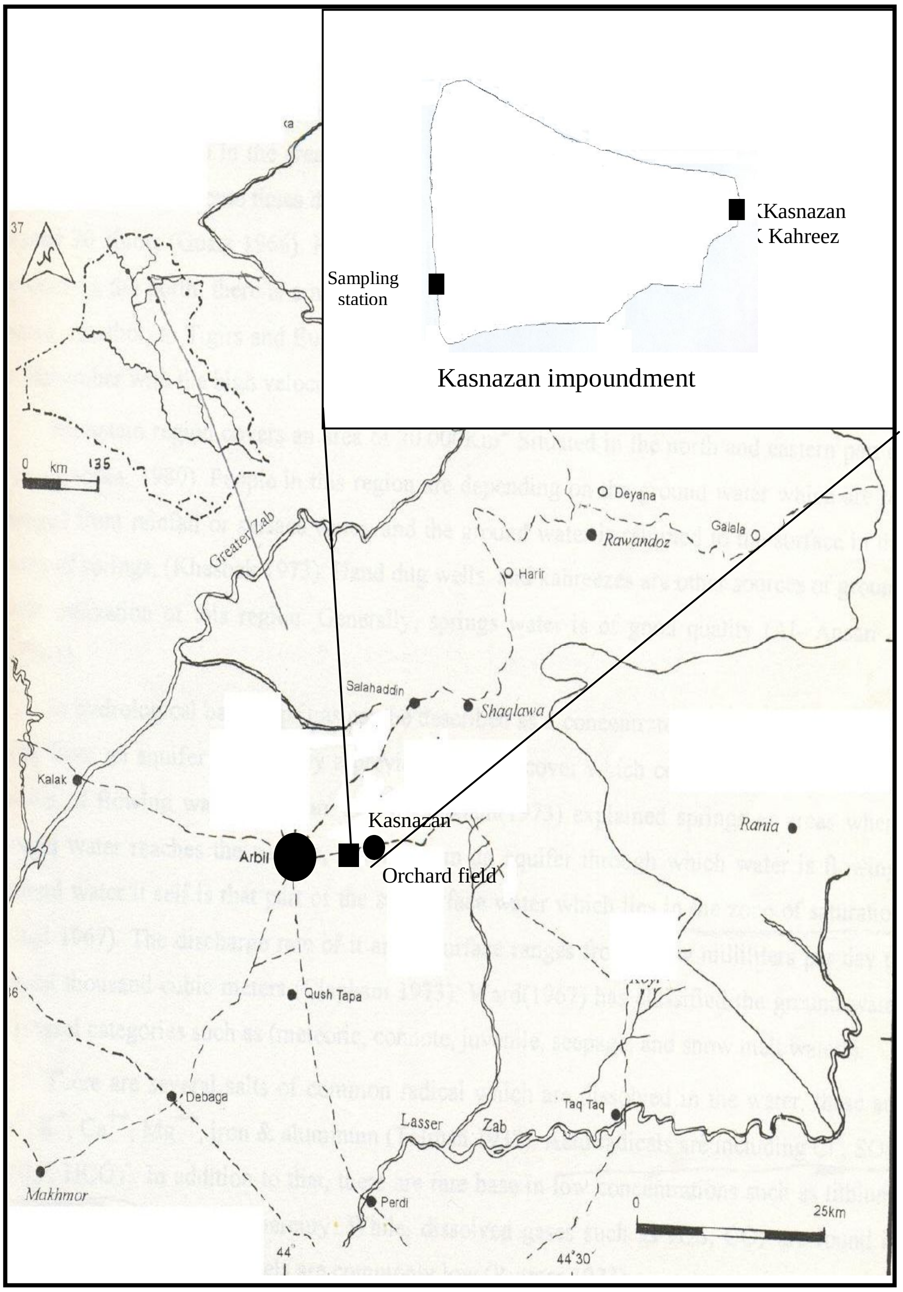

Table (1):Some chemical properties of Kasnazan water impoundment (upper numbers) and well water(between brackets) used for irrigation.

Date	pH	EC $dS.m^{-1}$	PO_4 $mg.l^{-1}$	NO_3 $mg.l^{-1}$	Na^+ $Meq.l^{-1}$	K^+ $Meq.l^{-1}$	Ca^{+2} $Meq.l^{-1}$	Mg^{+2} $Meq.l^{-1}$	HCO_3^- $Meq.l^{-1}$	CO_3^{-2} $Meq.l^{-1}$	Cl^- $Meq.l^{-1}$	SAR	SSPP
8-2004	7.3 (6.8)	0.36 (0.45)	0.17 (ND)	11 (12)	0.43 (0.25)	0.06 (0.02)	0.12 (5.55)	0.12 (5.92)	0.04 (0.04)	0 (0)	0.53 (0.41)	1.23 (0.11)	0.67 (0.02)
9-2004	8.0 (8.2)	0.33 (0.32)	0.36 (ND)	9.0 (11)	0.45 (0.26)	0.29 (0.04)	0.08 (5.05)	0.13 (5.42)	0.03 (0.03)	0 (0)	0.31 (0.34)	1.41 (0.11)	0.72 (0.02)
10-2004	8.0 (7.1)	0.25 (0.41)	0.34 (ND)	22 (13)	0.44 (0.27)	0.06 (0.02)	0.04 (5.30)	0.13 (6.90)	0.02 (0.04)	0 (0)	0.41 (0.41)	1.53 (0.11)	0.75 (0.02)
11-2004	8.2 (7.1)	0.36 (0.45)	0.00 (ND)	13 (9.0)	0.190 (0.15)	0.06 (0.04)	0.06 (2.34)	0.13 (8.05)	0.02 (0.05)	0 (0)	0.33 (0.52)	0.64 (0.07)	0.54 (0.01)
12-2004	7.6 (6.7)	0.56 (0.44)	0.00 (ND)	11 (18)	0.31 (0.20)	0.06 (0.05)	0.06 (4.85)	0.25 (10.1)	0.04 (0.04)	0 (0)	0.36 (0.41)	0.78 (0.07)	0.53 (0.01)
1-2005	8.1 (7.5)	0.64 (0.45)	0.02 (ND)	8.0 (7.0)	0.09 (0.20)	0.02 (0.05)	0.12 (6.40)	0.18 (8.14)	0.04 (0.04)	0 (0)	0.30 (0.25)	0.24 (0.08)	0.26 (0.01)
2-2005	7.9 (7.5)	0.66 (0.43)	0.02 (ND)	17 (25)	0.28 (0.21)	0.06 (0.04)	0.14 (6.15)	0.16 (10.2)	0.04 (0.04)	0 (0)	0.33 (0.36)	0.15 (0.07)	0.51 (0.01)

ND = non detected

Table (2):-Some chemical properties of non irrigated field soil (upper numbers) and irrigated soil (between brackets) by well water.

Date	pH	EC $dS.m^{-1}$	Total phosphorus %	Total nitrogen %	Na^{+} $Meq.l^{-1}$	K^{+} $Meq.l^{-1}$	Ca^{+2} $Meq.l^{-1}$	Mg^{+2} $Meq.l^{-1}$	HCO_3^{-} $Meq.l^{-1}$	CO_3^{-2} $Meq.l^{-1}$	Cl^{-} $Meq.l^{-1}$	SAR
8-2004	7.0 (7.4)	0.93 (0.40)	0.032 (0.022)	0.35 (0.28)	10.3 (8.45)	17.4 (17.3)	3.60 (2.80)	28.0 (27.4)	3.20 (4.60)	0 (0)	2.20 (2.40)	2.60 (2.17)
9-2004	7.1 (7.3)	0.58 (0.28)	0.029 (0.017)	0.27 (0.32)	8.45 (21.1)	18.3 (19.7)	2.40 (4.00)	25.2 (24.6)	3.20 (4.80)	0 (0)	2.20 (2.60)	2.27 (5.58)
10-2004	7.7 (7.5)	0.77 (0.40)	0.025 (0.017)	0.16 (0.20)	7.04 (7.51)	16.0 (19.3)	2.60 (3.60)	22.0 (21.2)	4.40 (4.00)	0 (0)	2.20 (2.60)	2.01 (2.13)
11-2004	7.4 (7.2)	0.50 (0.68)	0.026 (0.019)	0.25 (0.34)	9.86 (9.39)	18.3 (11.7)	2.60 (3.00)	18.0 (21.6)	4.60 (5.60)	0 (0)	1.40 (2.60)	3.07 (2.68)
12-2004	7.6 (7.4)	1.41 (0.45)	0.035 (0.025)	0.25 (0.36)	12.2 (15.0)	17.9 (18.8)	3.60 (2.60)	19.2 (21.6)	4.40 (4.58)	0 (0)	2.00 (1.40)	3.62 (4.32)
1-2005	7.2 (7.1)	0.82 (0.66)	0.034 (0.026)	0.16 (0.24)	9.39 (17.8)	16.0 (18.8)	3.60 (1.60)	21.8 (22.8)	4.80 (4.80)	0 (0)	1.20 (1.00)	2.63 (5.11)
2-2005	7.4 (6.6)	1.09 (0.55)	0.027 (0.028)	0.17 (0.30)	11.7 (19.3)	15.5 (17.4)	2.60 (1.60)	17.8 (18.6)	4.80 (5.00)	0 (0)	2.20 (1.40)	3.68 (6.07)

Table (3):-Some chemical properties of non irrigated Kasnazan soil (upper numbers) and irrigated soil (between brackets) by Kasnazan water impoundment.

Date	pH	EC $dS.m^{-1}$	Total phosphorus %	Total nitrogen %	Na^{+} $Meq.l^{-1}$	K^{+} $Meq.l^{-1}$	Ca^{+2} $Meq.l^{-1}$	Mg^{+2} $Meq.l^{-1}$	HCO_3^{-} $Meq.l^{-1}$	CO_3^{-2} $Meq.l^{-1}$	Cl^{-} $Meq.l^{-1}$	SAR
8-2004	7.3 (7.8)	1.58 (1.27)	0.028 (0.026)	0.21 (0.23)	8.92 (18.3)	9.89 (11.7)	2.60 (1.60)	19.2 (20.8)	6.00 (6.00)	0 (0)	1.80 (1.60)	2.70 (5.48)
9-2004	7.2 (7.3)	3.09 (0.66)	0.027 (0.025)	0.24 (0.33)	11.3 (17.3)	20.3 (10.8)	3.60 (1.00)	19.0 (19.2)	8.40 (5.20)	0 (0)	2.00 (1.40)	2.36 (5.47)
10-2004	7.6 (7.2)	2.36 (1.05)	0.028 (0.022)	0.27 (0.35)	12.2 (20.1)	17.0 (11.7)	4.20 (3.00)	18.4 (13.2)	8.80 (5.20)	0 (0)	2.00 (1.40)	3.63 (7.10)
11-2004	7.4 (7.3)	0.47 (0.39)	0.031 (0.017)	0.25 (0.24)	10.3 (17.8)	11.8 (13.6)	4.00 (3.60)	25.6 (11.4)	7.60 (5.20)	0 (0)	2.60 (1.00)	2.69 (6.53)
12-2004	7.2 (7.0)	0.57 (1.26)	0.029 (0.020)	0.27 (0.45)	9.86 (19.7)	13.7 (8.48)	3.60 (3.60)	26.0 (12.6)	6.00 (4.80)	0 (0)	1.80 (1.60)	2.56 (6.94)
1-2005	7.3 (7.4)	0.45 (0.35)	0.020 (0.026)	0.25 (0.28)	7.51 (17.8)	8.48 (14.6)	3.60 (3.60)	19.0 (12.6)	4.80 (4.40)	0 (0)	2.60 (1.80)	2.23 (6.28)
2-2005	7.1 (7.4)	0.37 (0.63)	0.021 90.028)	0.31 (0.30)	8.45 (19.2)	16.5 (10.3)	3.60 (3.20)	23.2 (13.8)	4.40 (7.60)	0 (0)	2.20 (1.60)	2.30 (6.61)

As shown in table(4) , Mg^{+2} content of Eucalyptus plant irrigated with well water was higher than that irrigated with impoundment water, this may be due to high concentration of Mg^{+2} in well water in comparing with its concentration in impoundment water (table 1). But in the case of K^{+} content of plant the opposite result was recorded which may be due to the high K^{+} concentration in impoundment water comparing with well water (Abu-Thahe, 1989).

Although, negative correlation of phosphorus concentration were observed between non-irrigated soil by impoundment water and than that irrigated by impoundment water, which may resulted in increasing of phosphorus content of Eucalyptos plant irrigated by impoundment water. Esmael (1986) Stated that increasing of Mg^{+2} concentrations in soil solution exceeded phosphorus absorption by plant. On the other hand, Na^{+} concentration followed the same pattern of phosphorus, in which significant differences ($P<0.05$) were observed between plant irrigated either by water impoundment than well water, as well as, for K^{+} plant content. Dohuki (1997) noticed that increase in Na^{+} concentration causes increase in phosphorus availability leading to increase in phosphorus content of plant.

Finally, additional researches using different plants for longer periods are needed to obtain more results and information.

Table (4):Ionic and nutrient contents of Eucalyptus tree irrigated by Kasnazan Impoundment water (upper numbers) and well water(between brackets).

Date	Total phosphorus $mg.g^{-1}$	Total nitrogen %	Na^{+} $mg.g^{-1}$	K^{+} $mg.g^{-1}$	Ca^{+2} $mg.g^{-1}$	Mg^{+2} $mg.g^{-1}$	Cl^{-} $mg.g^{-1}$
8-2004	0.22 (0.29)	1.06 (0.73)	0.54 (0.60)	1.34 (0.31)	0.07 (0.06)	0.14 (0.07)	0.07 (0.06)
9-2004	0.28 (0.30)	1.23 (1.15)	0.44 (0.84)	1.51 (0.83)	0.05 (0.06)	0.18 (0.16)	0.06 (0.07)
10-2004	0.28 (0.30)	1.27 (1.24)	0.47 (0.84)	1.29 (0.98)	0.06 (0.08)	0.17 (0.17)	0.05 (0.04)
11-2004	0.26 (0.25)	1.07 (1.05)	0.43 (0.79)	1.47 (0.81)	0.08 (0.08)	0.03 (0.15)	0.04 (0.04)
12-2004	0.19 (0.25)	0.82 (1.01)	0.43 (0.79)	1.16 (0.72)	0.06 (0.06)	0.04 (0.20)	0.06 (0.06)
1-2005	0.78 (0.25)	1.01 (0.84)	0.42 (0.55)	1.07 (0.59)	0.07 (0.08)	0.04 (0.15)	0.07 (0.07)
2-2005	0.26 (0.30)	1.09 (1.35)	0.45 (0.58)	1.12 (0.68)	0.07 (0.08)	0.05 (0.14)	0.06 (0.06)

تأثير مياه مسطح كسنزان و أحد ألابار في المحتوى الكيميائي للتربة والنبات

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الخلاصة

تم جمع العينات الشهرية من منطقة كسنزان لكل من التربة السطحية ونبات اليوكالبتوس و نوعين من المياه (مسطح كسنزان و بئر حقل فواكه) لمدة سبعة اشهر ابتداءاًًًًًًًً من اب ٢٠٠٤ و لغاية شباط ٢٠٠٥. اظهرت نتائج التحليل الكيميائي والاحصائي بان الارواء بماء البئر ادى الى أنخفاض في قيمة التوصيل الكهربائي للتربة المروية بها من ٠.٨٧ الى ٠.٤٩ دسيسمنز لكل متر، بسبب عاملي التخفيف والغسل. كما سجلت علاقة معنوية موجبة (P<0.05) بين نسبة أمتزاز الصوديوم لماء البئر والتربة المروية بها، وعلى العكس من ذلك ظهرت، علاقة معنوية سالبة لتركيز المغنسيوم بين ماء البئر والتربة المروية بها. ومن جهة اخرى لوحظ المحتوى العالي لتركيز المغنسيوم والمحتوى الواطيء لتركيز البوتاسيوم في نبات اليوكالبتوس المروي بماء البئر مقارنة بماء مسطح كسنزان.

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