

EFFECT OF WATER QUALITY ON THE GROWTH AND YIELD OF DATE PALM (*Phoenix dactylifera*, L.)

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ABSTRACT

A study was carried out on four varieties of date palm trees in Kubaisa-Hit area, North West of Mesopotamian plain. The trees were irrigated with saline and fresh water for a long period. The study includes vegetative growth measurements as well as fruits yield.

Results showed that irrigation with saline water (5-6 ds m⁻¹), caused salt accumulation in soil, which caused a reduction in tree growth and give low yield as well as low quality of fruits. Different varieties were affected differently in this respect.

Additional Index words: Date palm, Water quality, Salt accumulation

INTRODUCTION

Palm tree (*Phoenix dactylifera* L.), is one of the most important fruit tree in Iraq as well as in the Arab world. Its fruit is used in human as well as animal nutrition. The seeds are also used for animal nutrition. Nearly all parts of this scarce tree have beneficial uses. Date palm tree is considered to be resistance to adverse conditions including flooding and salinity. Nevertheless, it has been reported that increasing soil salinity cause a reduction in date palm growth and yield (1,3,6,7). Due to the spread and expansion of the area affected by salinity in the middle and southern parts of Iraq, where palm trees are grown, it is expected that the growth and yield of that important fruit tree would be affected. The quality of irrigation water in the country is becoming worse due to the construction of great dams upstream in Turkey, Syria as well as inside the country. The salinity of irrigation water is increasing down stream in the rivers of Tigris and Euphrates. Irrigation with saline water usually cause salt accumulation in soil which resulted in a reduction in the growth of most cops.

The aim of this work was to investigate the effect of irrigation with saline water for a long period (40years) on the growth and fruit characters of four date cultivars.

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MATERIAL AND METHODS

Two locations were chosen in the north –western part of the Mesopotamian plain where palm trees are irrigated with different quality of irrigation water. Hit and Kubaisa Tables 1a & b shows the soil properties in the two locations, while table2 shows some properties of the water used for irrigation in the two locations. Four date palm cultivars were studied in both locations. They are Zahdi (Z), Khestawi (K), Maktoom (M) and Barban (B) in the stage of fruit maturity.

Five trees from each cultivar in each location were taken as replicates in complete randomize design measurements includes tree height girth of trunk at one meter height number of bunches per tree and average fruit yield per tree Physical properties of fruits were also taken on 20 fruits taken at random The properties include average fruit length average fruit girth ,average fruit weight average seed weight and flesh percent. Leaflets were taken from full expanded leaves and analyzed for their elements content according to Mohr method (4). The results were statistically analyzed according to Al-Rawi and Khalaf-Allah(2).

RESULTS AND DISSCUSSION

From Table 1, it is obvious that irrigation with saline water caused accumulation of salts in the soil although the trainability of the soil is very good generally there was an increase in soil salinity with depth in both locations Sodium was the dominant cation while chloride was the dominant anion Table 3,showed the mean square values for the effect of water quality on the growth yield as well as fruit physical properties It can be seen that all characters were significantly affected with salinity changes variety differences and their interaction were also observed. Table 4, showed the mean effect of water quality on some growth characters of different date palm cultivars It can be seen that tree height trunk girth bunches number as well as fruit yield were significantly reduced when trees were irrigated with saline water. Different cultivars were affected differently. The average fruit yield was highly affected since it was reduced by about 85%. These results were in agreement with what was reported by many workers.(6, 7, and 8).It should be outlined here ,that this effect is not wholly due to salinity changes but it is

probably due to differences in agricultural management also. The trees in Hit location received better agricultural practices concerning fertilization and irrigation. Concerning fruit physical properties, table 5, showed that all physical properties were adversely affected with the use of saline water in irrigation including fruit length fruit girth and flesh percent Seeds weight however was not affected.

The phenological characters of the fruit were also affected (plate 1). Different cultivars were affected differently. Barban gave the largest fruit while Zahdi gave the smallest one. It also gave the highest flesh / fruit ratio. Table 6. showed the effect of water quality on the concentration of some elements in the leaves of date palms cultivars under study. It can be seen that there were variations between different cultivars. In Zahdi, there was an increase in sodium content and a reduction in potassium with the increase in soil and water salinity. In Kestawi, however, Nitrogen and phosphorus and potassium concentrations in leaves were decreased and sodium concentration was increased with the increase in soil salinity. In Maktoom the concentration of N and K were increased while phosphorus and sodium were decreased with the increase in soil salinity. In Barban, however, the concentration of N and k were decreased and P and Cl were increased with salinity increase. In general the variation in elements concentration due to salinity changes were limited. Furr and Armstrong 1962, (6) showed that the rate of leaves growth and chloride content inside the leaves in two varieties of date palms tree grow under different salinity levels were not affected.

It can be concluded that irrigation with saline water for a long period cause a great reduction in the growth and yield of date palm trees as well as reduction in fruit quality. Certain management practices including the addition of fertilizers to maintain nutrients balance as well as watching soil salinity are needed when you have to irrigate with saline water.

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Table 1a. Some properties of the soil in the two locations used in the study.

Location	Salinity level	Soil depth (cm)	ECe dS.m-1	pH	Soluble ions mmole L ⁻¹									Exch. Na C. mole kg ⁻¹	% ESP
					Ca ⁺⁺	Mg ⁺⁺	K ⁺	Na ⁺	SO ₄ ⁻	Cl ⁻	HCO ₃ ⁻	CO ₃ ⁻	NO ₃ ⁻		
Hit.	S1	0-30	1.7	8.1	4.1	1.4	11.3	7.7	4.5	5.3	4.8	--	12.4	0.4	3.5
		31-60	1.7	7.8	4.0	1.4	5.5	8.5	5.4	5.4	2.5	--	13.5	0.4	4.6
		31-120	3.3	7.8	8.0	5.1	8.3	13.1	9.6	15.3	2.5	--	2.0	0.7	4.6
Kubaisa	S2	0-30	5.6	7.9	6.5	4.6	58.0	38.9	6.4	43.5	3.4	--	13.7	2.7	13.3
		31-60	6.2	7.8	6.6	6.8	56.0	41.2	9.7	46.7	2.9	--	1.1	2.6	13.1
		31-120	11.0	7.6	15.4	17.1	83.0	73.3	23.8	82.8	3.0	--	0.8	1.8	9.5

Table 1b. Some properties of the soil in the two locations used in the study.

Location	Salinity level	Soil depth (cm)	Texture				Lime	Gypsum	CEC	O.M.	Avail.P	Avail.K
			gkg ⁻¹			Text. class	gkg ⁻¹	g.kg ⁻¹	C. mole kg ⁻¹	gkg ⁻¹	mgkg ⁻¹	mgkg ⁻¹
			S	Si	C							
Hit.	S1	0-30	720	230	50	Sl.	189.0	0.8	11.1	6.0	4.5	120.9
		31-60	890	90	20	Si.	181.0	0.8	7.7	1.0	3.9	58.5
		31-120	490	410	100	L.	215.5	1.1	15.2	--	--	--
Kubaisa	S2	0-30	150	550	300	SiCl	568.5	0.9	20.1	15.6	3.6	526.5
		31-60	160	550	290	SiCl	566.5	1.7	20.1	13.1	3.5	808.7
		31-120	210	560	230	SiL	600.0	0.0	19.3	--	--	--

Table 2. Some properties of the water used in irrigation.

Treatment	EC. dS.m ⁻¹	pH	Soluble ions m.mole.L ⁻¹				
			Ca ⁺⁺	Mg ⁺⁺	Na ⁺	Cl ⁻	SO ₄ ⁻
S1	1.2	8.1	2.0	2.8	4.3	3.8	2.7
S2	6.0	7.7	10.0	5.6	38.0	50.8	9.0

Table 3. Mean square values for the effect of water quality on growth, yield and fruit quality of four varieties of date palms.

S.V.	d.f.	Trunk girth	tree ht.	Bunches No.	Fr. yield	Fr. girth	Fr. length	Fr. wt.	Seed wt.	% flesh
Sal.	1	2.85**	567.00**	435.60	103184.96**	8.9**	6.6**	331.8**	0.002	177.6**
Var.	3	0.26**	51.50**	8.67**	2818.04**	5.4**	1.4**	112.2**	0.194**	50.5**
S x V.	3	0.03	39.58**	24.80**	1272.11**	1.3**	0.3**	14.6**	0.143**	9.1**
Error	32	0.02	2.13	3.57	184.21	0.06	0.05	0.16	0.016	2.1
Total	39									

*, ** Significant at 0.05 and 0.01 level respectively.

Table 4. Mean effect of water quality on the growth and yield of four varieties of date palms.

variety	Salinity of irrigation water							
	S1 (1.1 dS.m ⁻¹)				S2 (6.0 dS.m ⁻¹)			
	Trunk girth (m)	Tree height (m)	Bunches No/tree	Fruit yield Kg/tree	Trunk girth (m)	Tree height (m)	Bunches No/tree	Fruit yield kg/tree
Zahdi	1.46	15.3	14.6	132.32	0.85	3.10	4.00	11.60
Kestawi	1.45	14.9	10.0	115.00	1.06	5.50	7.00	24.60
Mactoom	1.46	7.0	10.0	84.800	0.84	3.20	4.20	9.60
Barban	1.75	11.5	11.4	148.00	1.25	6.80	4.40	28.00
mean	1.53	12.175	11.5	120.02	1.0	4.65	4.9	18.45
% mean reduction	--	--	--	--	34.6	61.8	57.4	84.6

Table 5. Mean effect of water quality on the fruit characters of four varieties of date palms.

variety	Salinity of irrigation water									
	S1 (1.1 dS.m ⁻¹)					S2 (6.0 dS.m ⁻¹)				
	Fruit characters									
	Fr. girth (cm)	Fr. length (cm)	Fr. wt (g)	Seed wt. (g)	Flesh ratio %	Fr. girth (cm)	Fr. length (cm)	Fr. wt (g)	Seed wt. (g)	Flesh ratio %
Zahdi	8.1	4.2	10.6	1.26	88.0	8.1	3.5	7.9	1.2	84.8
Kestawi	9.3	4.9	13.2	1.14	91.3	8.4	3.6	7.8	0.8	89.2
Mactoom	9.9	4.7	17.6	1.18	93.3	8.2	3.9	9.2	1.2	86.8
Barban	10.5	5.0	20.0	1.18	94.1	9.3	4.5	13.5	1.5	89.2
mean	9.45	4.7	15.35	1.19	91.67	8.5	3.9	9.6	1.175	87.5

LSD 0.05

For salinity 0.16 0.14 0.26 NS 0.94

LSD for variety 0.23 0.20 0.36 0.11 1.33

Table 6. Mean effect of water quality on mineral content in the leaves of four varieties of date palms.

variety	Salinity of irrigation water									
	S1 (1.1 dS.m ⁻¹)					S2 (6.0 dS.m ⁻¹)				
	% dry weight					% dry weight				
	N	P	K	Na	Cl	N	P	K	Na	Cl
Zahdi	1.60	0.10	0.49	0.02	0.53	1.6	0.10	0.04	0.04	0.53
Kestawi	2.10	0.16	0.92	0.02	0.73	1.4	0.10	0.03	0.03	0.63
Maktoom	1.24	0.14	0.30	0.03	0.56	1.4	0.12	0.55	0.01	0.33
Barban	1.60	0.12	0.68	0.02	0.56	0.72	0.14	0.66	0.02	0.61
mean	1.635	0.130	0.598	0.022	0.595	1.280	0.115	0.458	0.025	0.525

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