IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 1 Ver. I (Jan. 2015), PP 92-107
www.iosrjournals.org

Effect of Salt and Water Stresses on Jujube Trees under Ras Sudr Conditions

Abdel-Hameed, A. A. and Ali, F. Sahar
Desert Research Center, Cairo, Egypt

Abstract: *This investigation was carried out during two successive seasons (2010 and 2011) on 5 years old Nabq (Zizyphus spina christi) trees at Ras Suder Research Station, Desert Research Center- South Sinai Governorate, Egypt. This investigation aimed to study the effect of saline water treatments, water regulation and water irrigation levels on vegetative growth, some fruit parameters, leaf mineral contents, yield and fruit quality. The treatments contained the combination of three main factors: The first factor: two wells as a saline water source (well I and well II with EC values 3.68 and 6.80 dS/m, respectively). The second factor: water regulation method (WR): DI= deficit irrigation and RDI = regulated deficit irrigation by partial root zone drying (PRD). The third factor: irrigation levels of ETc = crop evapotranspiration 50, 75 and 100% (IL)). The obtained results showed that well I X deficit irrigation (DI) & regulated deficit irrigation (RDI) X 100% gave the highest values of tree circumference, Number shoots/tree, leaf area, yield/tree, fruit length, fruit diameter, fruit weight, fruit volume, fruit flesh weight, fruit moisture% and leaf contents of N, P, Mg beside TSS and total sugars. Moreover, treatments with well I X deficit irrigation (DI) recorded the highest values of shoot length, shoot diameter, fruit set, fruit retention, K and Fe. We can be recommended by treatment of trees with well I under stresses with regulated deficit irrigation under 100 % ETc to get the best results of fruit quality.*
Keywords: *deficit irrigation – crop evapotranspiration- regulated deficit irrigation- saline water -(Zizyphus spina christi).*

I. Introduction

Zizyphus spina christi is an evergreen tree or shrub belongs to the family *Rhamnaceae* and its common name is Jujube or Nabq. The cultivated area of Nabq in Egypt amounted 90 feddans produced about 94 tons of fruits according to the statistics of Ministry of Agriculture, Egypt (2012).

The assessment of the suitability of saline water for crop production is an imperative need along with practical guidelines, especially for the water uses in agriculture. The water of much higher salinities than those customarily classified as "unsuitable for irrigation" can, in fact, be used effectively for production of selected crops under the right conditions **(FAO 1992 & Sepaskhah and Ahmadi, 2010)**. The water quality assessment and guidelines for the use of saline waters assume vital importance. Available water resources are subjected to an ever-increasing pressure due to extensive agricultural water demand for irrigated lands. Expanding agricultural production in arid and semi-arid regions is faced by two main problems, water scarcity and water salinity. Agricultural activities in North Sinai mainly depend on groundwater which is brackish water because of its high level of salinity. Nabk are considered one of the best trees that successively grown under such conditions in North Sinai (especially at Ras Sudr) but its growth and yield depend on quantity and quality of water irrigation.

Lemon fruit and juice mean weight decreased significantly with increasing of soil salinity levels (1.67, 3.11, and 6.42 ds.m^{-1}). While this salinity caused an increase in fruits total soluble solids, and fruits total acidity, while it was not so for fruits juice percentage **(Al-Hayani *et al.*, 2009)**. High salinity levels induce ionic imbalance given higher Na^+ and Cl^- concentration in olive trees leaves and roots. As a result of the accumulation of these ions, the K^+ concentration decreased resulting in a low ratio of K^+/Na^+ **(Ruiz *et al.*, 2011)**.

Yield, fruit size and vegetative growth of olive trees were affected by salts. Shoot length was higher in plants treated with $CaCl_2$, although shoot growth was reduced at 50 mg L^{-1} NaCl **(Lolaei *et al.*, 2012)**. Increasing soil salinity levels (0, 50, 100, 200 and 400 mM NaCl) resulted in progressive decrease of K^+, K^+/Na^+ ratio and N content, along with increase in Na^+ levels of date palm. Increasing salinity levels also decreased the net photosynthesis and chlorophyll levels. Also, **Dejampour Lolaei *et al.*, (2012)** indicated that increasing salinity level had significant negative effects on leaf chlorophyll content, leaf area, dry and fresh weight of root and shoot of *Prunus* rootstocks **(Al-Abdoulhadi *et al.*, 2012)**.

Partial root-zone drying (PRD) is a modified form of deficit irrigation (DI) which involves irrigating only one part of the root zone in each irrigation event, leaving another part to dry to certain soil water content before rewetting by shifting irrigation to the dry side; therefore, PRD is a novel irrigation strategy since half of the roots is placed in drying soil and the other half is growing in irrigated soil **(Loveys *et al.*, 2000 & Ahmadi *et al.*, 2010)**.

Chaves *et al.*, (2007) decreased the amount of water applied by 50% (as in deficit irrigation, DI, and in partial root drying, PRD) in relation to full crop's evapotranspiration (ETc) with no negative effects on production and even get some gains of quality (in the case of PRD). **Aganchich *et al.*, (2007)** observed that compared with RDI, PRD consistently resulted in a larger reduction of olive vegetative growth, expressed as shoot elongation, leaf number and leaf area in lateral shoots. **Marsal *et al.*, (2008)** stated that PRD offered the possibility of slightly improving water conservation.

The aim of this investigation was studying the effect of two saline water sources, partial root-zone drying (PRD) and deficit irrigation on Nabq trees.

II. Materials and Methods

This study was conducted during two successive seasons of 2010 and 2011 on 5 years old Nabq (*Zizyphus spina christi***)** trees planted at 4x5 meters and subjected to the same agriculture practices apart at Ras Suder Research Station, Desert Research Center- South Sinai Governorate, Egypt. Seventy two trees, uniform in growth and in good physical condition were selected and grouped under twelve treatments.

A drip irrigation system was designed with two drip lines and every drip line placed 1m distance from trunk tree. For partial root-zone drying (PRD) treatments, this irrigation system kept one side of the tree root zone irrigated, while the other was kept dry and switching sides was done every irrigation time. While irrigation water was supplied to both the sides of the regulated deficit irrigation (RDI) root zone trees. Trees were irrigated with amount of water based on the crop evapotranspiration (ETc), estimated from the potential evapotranspiration (ETo), calculated using the Penman–Monteith crop coefficients (Kc = 0.846) proposed by **FAO (1992).**

ETc =Kc ETo

where ETc crop evapotranspiration [mm d^{-1}],

Kc crop coefficient,

ETo reference crop evapotranspiration [mm d^{-1}].

This investigation aimed to study the effect of water source (well 1 and well 2 with E.C of 3.68 and 6.80 dS/m, respectively), water regulation (DI= deficit irrigation and RDI= regulated deficit irrigation) and three irrigation levels (50, 75 and 100% of ETc).

Analysis of soil is tabulated in table 1. Also, Chemical analysis of water wells is in table 2.

1- Well 1 + DI + 100% ETc.
2- Well 1 + DI + 75% ETc.
3- Well 1 + DI + 50% ETc.
4- Well 1 + PDR + 100% ETc.
5- Well 1 + PDR + 75% ETc.
6- Well 1 + PDR + 50% ETc.
7- Well 2 + DI + 100% ETc.
8- Well 2 + DI + 75% ETc.
9- Well 2 + DI + 50% ETc.
10- Well 2 + PDR + 100% ETc.
11- Well 2 + PDR + 75% ETc.
12- Well 2 + PDR + 50% ETc

Table 1: Analysis of soil

Soil depth (cm)	Texture class	pH soil past	E.C (dS/m)	Organic matter %	Soluble cations (mequiv./l)				Soluble anions (mequiv./l)			
					Ca^{++}	K^{+}	Na^{+}	Mg^{++}	Cl^{-}	$So4^{--}$	$HCo3^{-}$	$Co3^{--}$
0-30	Sand	7.28	9.1	0.53	16.2	1.3	50.4	23.1	54.5	33.9	2.5	--
30-60	Sand	7.16	8.6	0.55	15.3	1.23	47.7	21.9	51.5	32.1	2.4	--

Table (2): Chemical analysis of wells water

Parameters	Well I	Well II
Total dissolved solids (mg/l)	1993.33	3989.00
Electric conductivity (dS/m)	3.68	6.80
pH	7.50	7.36
Sodium (Na^{+}, mg/l)	30.27	58.13
Potassium (K^{+}, mg/l)	0.22	0.27
Calcium (Ca^{++}, mg/l)	6.17	10.58
Magnesium (Mg^{++}, mg/l)	7.83	13.42
Carbonate (CO_3^{--}, mg/l)	0.33	0.26
Bicarbonate (HCO_3^{-}, mg/l)	2.73	2.87
Chloride (Cl^{-}, mg/l)	22.09	41.71

The experimental design was randomized complete block design split-split plots where irrigation source treatments (well I and well II with EC values 3.68 and 6.80 dS/m, respectively) represented in the main plots. Partial root-zone drying (PDR) and deficit irrigation (DI) methods represented in the sub-main plots. ETc levels (50, 75 and 100%) were in the sub-sub-main plots. Each treatment included three replicates and each replicate included two trees. This experiment contained 12 treatments as follows:

Shoot parameters: the following data were recorded:

Shoot length (cm), shoot diameter (cm), tree height (m), tree circumference (m), number shoots/tree, leaf area (cm^2).

Fruit set percentage: The percentage of fruit set was calculated using the following formula, four weeks after full bloom:

$$\text{The percentage of fruit set} = \frac{\text{Number of set fruit}}{\text{Number of flowers}} \times 100$$

Retained fruit percentage: The retained fruit percentage was calculated after June drop as follows:

$$\text{The retained fruit percentage} = \frac{\text{Total number of retained fruits}}{\text{Number of flowers}} \times 100$$

Yield: At harvest time of each season (2010&2011 years) the total yield was estimated as average weight of harvest mature fruits (kg/tree).

Fruit characters: Samples of forty fruits from each treated tree were collected randomly at harvest time and the following measurements were recorded:

Average fruit length (cm), average fruit diameter (cm), average fruit weight (g), average fruit volume (cm^3), average flesh weight (g) and average fruit moisture (%) and total soluble solids (T.S.S.) were determined by Hand refractometer.

Leaf mineral content: some leaf mineral elements (N, P, K, Ca, Mg, Na, Fe, and Zn), were determined. Nitrogen analyses were determined by MicroKjeldahl method (**Jakson, 1967**). Phosphorus was determined by the method of (**Trugo and Meyer, 1929)**. Potassium and sodium was determined by the method of the flame photometer according to the method of (**Brown and Lilleland, 1946)**. Calcium and magnesium were determined by titration against versente solution (Na EDTA) according to **Chapman and Pratt (1961)**. Iron and zinc were estimated by using Atomic Absorption spectrophotometer.

Statistical analysis: The obtained data were subjected to analysis of variance according to **Clarke and Kempson (1997)**. Means were differentiated using multiple Range test at the 0.05 level **(Duncan, 1955)**.

III. Result and Discussion

The following tables show the effect of water well source as a difference in salts content, water regulation method and irrigation level as a percentage on some parameters of Jujube trees as: shoot length, shoot diameter, tree height, tree circumference, number of shoot per tree, leaf area, fruit set, fruit retention yield, fruit length, fruit diameter, fruit weight, fruit volume, flesh weight, fruit moisture, leaf mineral contents and fruit quality. Data in table (3) showed the effect of well water source, water regulation, irrigation levels and their interaction on some vegetative parameters of Jujube trees (2010&2011) seasons**.**

Shoot length: concerning water source, there are insignificant differences between well I and well II in the first season but well I gave higher significant value than well II in the second season. Water regulation, there are insignificant differences between deficit irrigation (DI) and regulated deficit irrigation (RDI) in both seasons. Irrigation levels, the highest values in both seasons were found with 100% level.

The interaction between water source (WI & WII) and water regulation method (DI = deficit irrigation & RDI regulated deficit irrigation), in the first season, WI X DI and WI X RDI had higher significant shoot length values than WII X DI. The same results could be noticed in the second season. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant shoot length values. The interaction between water regulation and irrigation levels: in the first season, DI X 100% and RDI X 100% treatments gave highest significant shoot length values. In the second season, DI X 100% treatment showed higher significant shoot length value than all other treatments except RDI X 100% treatment.

The interaction among: the three studied factors: the treatments of WI X DI X 100% had higher significant shoot length values than all other treatments except WI X RDI X 100% treatments in both seasons.

Table (3) Effect of well water source, water regulation, irrigation levels and their interaction on some vegetative parameters of Jujube trees (2010&2011).

Treatments			Shoot length (cm)		Shoot diameter (cm)		Tree height (m)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
W		WI	36.64**A**	35.68 **A**	0.430 **A**	0.416 **A**	3.184 **A**	3.022 **A**
		WII	32.99**A**	30.84 **B**	0.364 **A**	0.364 **B**	2.937 **B**	2.973 **A**
WR		DI	34.38 **A**	32.82 **A**	0.393 **A**	0.383 **B**	3.039 **A**	2.954 **A**
		RDI	35.26 **A**	33.70 **A**	0.401 **A**	0.397 **A**	3.082 **A**	3.041 **A**
ETc		50%	30.98 **C**	28.28 **C**	0.321 **B**	0.299 **C**	2.708 **B**	2.722 **B**
		75%	34.46 **B**	33.38 **B**	0.423 **A**	0.419 **B**	3.188 **A**	3.154 **A**
		100%	39.02 **A**	38.12 **A**	0.447 **A**	0.453 **A**	3.286 **A**	3.117 **A**
Water source X Water regulation								
WI		DI	36.59 **A**	35.96 **A**	0.424 **A**	0.411 **A**	3.179 **A**	3.007 **A**
		RDI	36.70 **A**	35.41 **A**	0.436 **A**	0.421 **A**	3.189 **A**	3.038 **A**
WII		DI	32.17 **B**	29.69 **B**	0.361 **B**	0.356 **C**	2.900 **B**	2.902 **A**
		RDI	33.81**AB**	31.99**AB**	0.367 **B**	0.373 **B**	2.974**AB**	3.043**A**
Water source X Irrigation levels								
WI		50%	32.13 **C**	30.73 **C**	0.355 **D**	0.320 **D**	2.930 **B**	2.817**AB**
		75%	36.57 **B**	34.75 **B**	0.458**AB**	0.452**AB**	3.293 **A**	3.187 **A**
		100%	41.23 **A**	41.57 **A**	0.477 **A**	0.477 **A**	3.328 **A**	3.063**AB**
WII		50%	29.82 **C**	25.83 **D**	0.287 **E**	0.278 **E**	2.487 **C**	2.627 **B**
		75%	32.35 **C**	32.02 **BC**	0.388**CD**	0.387 **C**	3.082**AB**	3.122 **A**
		100%	36.80 **B**	34.67 **B**	0.417**BC**	0.428 B	3.243 **A**	3.170 **A**
Water regulation X Irrigation levels								
DI		50%	29.68 **C**	26.58 **E**	0.307 **B**	0.280 **E**	2.638 **B**	2.663 **B**
		75%	33.85 **B**	32.58**CD**	0.417 **A**	0.410 **C**	3.178 **A**	3.158**AB**
		100%	39.60 **A**	39.30 **A**	0.455 **A**	0.460 **A**	3.302 **A**	3.042**AB**
RDI		50%	32.27**BC**	29.98**DE**	0.335**B**	0.318**D**	2.778**B**	2.780**AB**
		75%	35.07**B**	34.18**BC**	0.430**A**	0.428**BC**	3.197**A**	3.150**AB**
		100%	38.43**A**	36.93**AB**	0.438**A**	0.445**AB**	3.270**A**	3.192**A**
Water source X Water regulation X Irrigation levels								
WI	DI	50%	31.13**DE**	29.33**CD**	0.333**EF**	0.300**FG**	2.913**CD**	2.927**AB**
		75%	36.33**BC**	34.73**BC**	0.453**ABC**	0.443**B**	3.287**ABC**	3.177**A**
		100%	42.30**A**	43.80**A**	0.487**A**	0.490**A**	3.337A	2.917**AB**
	RDI	50%	33.13**CD**	32.13**CD**	0.377**DE**	0.340**EF**	2.947**BCD**	2.707**AB**
		75%	36.80**BC**	34.77**BC**	0.463**AB**	0.460**AB**	3.300AB	3.197**A**
		100%	40.17**AB**	39.33**AB**	0.467**AB**	0.463**AB**	3.320AB	3.210**A**
WII	DI	50%	28.23**E**	23.83**E**	0.280**F**	0.260**G**	2.363E	2.400**B**
		75%	31.37**DE**	30.43**CD**	0.380**DE**	0.377**DE**	3.070**ABC**	3.140**A**
		100%	36.90**BC**	34.80**BC**	0.423**ABCD**	0.430**BC**	3.267**ABC**	3.167**A**
	RDI	50%	31.40**DE**	27.83**DE**	0.293F	0.297**FG**	2.610DE	2.853**AB**
		75%	33.33**CD**	33.60**BC**	0.397**CDE**	0.397**CD**	3.093**ABC**	3.103**AB**
		100%	36.70**BC**	34.53**BC**	0.410**BCD**	0.427**BC**	3.220**ABC**	3.173**A**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.
Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Shoot diameter: concerning water source, there are insignificant difference between well I and well II in the first season but well I gave higher significant value than well II in the second season. Water regulation, there are insignificant differences between (DI) and (RDI) in the first season but (RDI) gave higher significant value than (DI) in the second season. Irrigation levels, level 75% & 100% gave the highest value in first season but level (100%) gave the highest values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). In the first season, WI X DI and WI X RDI had higher significant shoot diameter values than WII X DI. The same results could be noticed in the second season. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded higher significant shoot diameter values than all other treatments except WI X 75% treatment.

The interaction between water regulation and irrigation levels: in the first season, DI X 75% &100% and RDI X (75% &100%) treatments gave highest significant shoot diameter values. In the second season, DI X 100% treatments showed higher significant shoot diameter value than all other treatments except RDI X 100% treatments. The interaction among: the treatments of WI X DI X 100% had higher significant shoot diameter values than most of other treatments.

Tree height: concerning water source, well I gave higher significant value than well II in the first season but there are insignificant difference between well I and well II in the second season. Water regulation, there are insignificant differences between DI and RDI in both season. Irrigation level 100% of ETc gave the highest significant values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI) in the first season, WI with DI & RDI highest significant values but there are insignificant differences among all treatments in the second season. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 75%, WI X 100% and WII X 100% in the first season recorded higher significant tree height values than all treatments except WII X 75% treatments, while in the second season WI X 75%, WII X 75% & 100% recorded higher significant value than WII X 50%. The interaction between water regulation and irrigation levels: in the first season, DI X 75%&100% and RDI X 75% &100% in the first season, gave highest significant tree height values. In the second season RDI X 100% had higher significant value than DI X 50% treatment. The interaction among: the three studied factors: the treatments of WI X DI X 100%, had higher significant value than WI X DI X 50% and WI X RDI X 50% treatments in the first season. In the second season WII X DI X 50% had lower significant tree height values than most of other treatments.

Data in table (4) showed the effect of well water source, water regulation, irrigation levels and their interaction on some vegetative parameters of Jujube trees (2010&2011) seasons.

Tree circumference: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant differences between (DI) and (RDI) in the first season but (RDI) gave higher significant value than (DI) in the second season. Irrigation levels, level (100%) gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI), the treatments of WI X DI and WI X RDI showed highest significant values in both seasons. The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant tree circumference values. The interaction between water regulation and irrigation levels: in in both seasons, the treatments of DI X 100% gave higher significant tree circumference values than all other treatments except RDI X 100% treatments. The interaction among: the three studies factor: in both seasons, the treatments of WI X DI X 100% and WI X RDI X 100% had higher significant tree circumference values than all other treatments except WI X RDI X 75% treatments.

Number shoots per tree: concerning water source, well I gave higher significant value than well II in the first season but there insignificant difference between well I and well II in the second season. Water regulation, RDI gave higher significant value than DI in both seasons. Irrigation levels, level 100% gave the highest significant values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI). WI X RDI recorded the highest significant values in both seasons.

The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant Number shoots per tree values. The interaction between water regulation and irrigation levels: in both seasons, the treatments of DI & RDI X 100% gave highest significant number shoots per tree values. The interaction among: water source, water regulation and irrigation levels: in both seasons, the treatments of WI X DI X 100% and WI X RDI X 100% had highest significant Number shoots per tree.

Leaf area: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant differences between DI and RDI in the first season but RDI gave higher significant value than (DI) in the second season. Irrigation levels, level 100% gave the highest significant values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI), WI X (DI & RDI) recorded the highest significant values in both seasons. The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant leaf area values. The interaction between water regulation and irrigation levels: in in both seasons, the treatments of (DI & RDI) X 100% gave higher significant leaf area values.

The interaction among: the three studied factors: in both seasons, the treatments of WI X DI X 100% and WI X RDI X 100% had highest significant leaf area values.

These results was agreement with **Lolaei *et al.*, (2012)** who showed that salt stress caused a significant reduction in plant growth and leaf number and weight.

Data in table (5) showed the effect of well water source, water regulation, irrigation levels and their interaction on some fruit parameters of Jujube trees (2010&2011) seasons.

Table (4) Effect of well water source, water regulation, irrigation levels and their interaction on some vegetative parameters of Jujube trees (2010&2011).

Treatments			Tree circumference (m)		Number shoots/tree		Leaf area (m^2)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
W		WI	7.686**A**	7.675**A**	99.61**A**	92.39**A**	7.437**A**	7.389**A**
		WII	6.658**B**	6.636**B**	83.17**B**	81.83**A**	6.794**B**	6.819**B**
WR		DI	7.046**A**	7.036**B**	86.67**B**	84.28**B**	7.052**A**	7.006**B**
		RDI	7.280**A**	7.275**A**	92.11**A**	89.94**A**	7.179**A**	7.202**A**
ETc		50%	6.039**C**	6.229**C**	70.50**C**	68.83**C**	6.441**C**	6.391**C**
		75%	7.485**B**	7.278**B**	92.75**B**	90.33**B**	7.215**B**	7.206**B**
		100%	7.992**A**	7.959**A**	104.9**A**	102.2**A**	7.692**A**	7.716**A**
Water source X Water regulation								
WI		DI	7.650**A**	7.597**A**	93.89**B**	90.00**B**	7.374**A**	7.359**A**
		RDI	7.722**A**	7.753**A**	97.33**A**	94.78**A**	7.500**A**	7.420**A**
WII		DI	6.479**B**	6.476**C**	79.44**D**	78.56**D**	6.730**B**	6.653**C**
		RDI	6.838**B**	6.797**B**	86.89**C**	85.11**C**	6.859**B**	6.984**B**
Water source X Irrigation levels								
WI		50%	6.230**E**	6.372**DE**	73.50**D**	70.67**D**	6.700**E**	6.492**E**
		75%	8.212**B**	8.075**B**	99.00**B**	97.17**B**	7.432**B**	7.505**B**
		100%	8.617**A**	8.578**A**	114.3**A**	109.3**A**	8.180**A**	8.172**A**
WII		50%	5.848**F**	6.087**E**	67.50**E**	67.00**D**	6.182**F**	6.290**F**
		75%	6.758**D**	6.482**D**	86.50**C**	83.50**C**	6.998**D**	6.907**D**
		100%	7.368**C**	7.340**C**	95.50**B**	95.00**B**	7.203**C**	7.260**C**
Water regulation X Irrigation levels								
DI		50%	5.903**D**	6.058**D**	65.67**E**	64.33**E**	6.273**D**	6.250**E**
		75%	7.212**C**	6.993**C**	87.83**C**	85.83**C**	7.163**B**	7.042**C**
		100%	8.078**A**	8.057**A**	106.5**A**	102.7**A**	7.720**A**	7.727**A**
RDI		50%	6.175**D**	6.400**D**	75.33**D**	73.33**D**	6.608**C**	6.532**D**
		75%	7.758**B**	7.563**B**	97.67**B**	94.83**B**	7.267**B**	7.370**B**
		100%	7.907**AB**	7.862**AB**	103.3**A**	101.7**A**	7.663**A**	7.705**A**
Water source X Water regulation X Irrigation levels								
WI	DI	50%	6.207**D**	6.223**GH**	70.33**F**	67.33**G**	6.530**F**	6.400**E**
		75%	8.033**B**	7.853**BC**	94.67**C**	92.67**CD**	7.367**BC**	7.493**BC**
		100%	8.710**A**	8.713**A**	116.7**A**	110.0**A**	8.227**A**	8.183**A**
	RDI	50%	6.253**D**	6.520**FG**	76.67**DE**	74.00**EF**	6.870**E**	6.583**E**
		75%	8.390**AB**	8.297**AB**	103.3**B**	101.7**B**	7.497**B**	7.517**B**
		100%	8.523**A**	8.443**A**	112.0**A**	108.7**A**	8.133**A**	8.160**A**
WII	DI	50%	5.600**E**	5.893**H**	61.00**G**	61.33**H**	6.017**G**	6.100**F**
		75%	6.390**D**	6.133**GH**	81.00**D**	79.00**E**	6.960**DE**	6.590**E**
		100%	7.447**C**	7.400**CD**	96.33**C**	95.33**C**	7.213**CD**	7.270**CD**
	RDI	50%	6.097**D**	6.280**GH**	74.00**EF**	72.67**FG**	6.347**F**	6.480**E**
		75%	7.127**C**	6.830**EF**	92.00**C**	88.00**D**	**7.037**F	7.223**D**
		100%	7.290**C**	7.280**DE**	94.67**C**	94.67**C**	**7.193**CD	7.250**D**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.
Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Fruit set: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant difference between DI and RDI in the first season but RDI gave higher significant value than (DI) in the second season. Irrigation levels, level (100%) gave the highest values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). In the first season the treatment of WI X DI and WI X RDI but WI X RDI only in the second season recorded the highest significant values. The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant fruit set values. The interaction between water regulation and irrigation levels: in the treatments of DI X 100% and RDI X 100% in the first season gave highest significant fruit set values but DI X 100% had highest significant value in the second season. The interaction among: the three studied factors: in both seasons, the treatments of WI X DI X 100% had higher significant fruit set values than most of other treatments.

Fruit retention: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, RDI gave higher significant value than (DI) in the first season but there are insignificant difference between DI and RDI in the second season. Irrigation levels, level (100%) gave the highest significant values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). The treatment of WI X DI and WI X RDI in both seasons recorded the highest significant values. The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in the first season the treatments of WI X 100% recorded highest significant fruit retention value in the first season but the same treatment had higher significant value than all treatments except the treatment of WI X 75% in the second season. The interaction between water regulation and irrigation levels: in both seasons, the treatments of DI X 100% and RDI X 100% in the first season gave highest significant fruit retention value in the first season DI X 100% showed higher significant value than all other treatments except the treatment of RDI X 100% in the second season. The interaction among: the three studied factors: in the first season, the treatments of WI X DI X 100% had higher significant fruit retention value. than most of other treatments while in the second season, the treatments of WI X (DI&RDI) X (75%&100%) and WII X (DI&RDI) X 100% had highest significant fruit retention values.

Table (5) Effect of well water source, water regulation, irrigation levels and their interaction on some fruit parameters of Jujube trees (2010&2011).

Treatments			Fruit set%		Fruit retention%		Yield (kg/tree)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
W		WI	6.591**A**	6.626**A**	4.637**A**	4.457**A**	16.19**A**	15.77**A**
		WII	5.855**B**	5.781**B**	4.058**B**	3.998**B**	12.42**B**	11.91**B**
WR		DI	6.225**A**	6.139**B**	4.296**B**	4.186**A**	13.81**B**	13.39**B**
		RDI	6.221**A**	6.267**A**	4.398**A**	4.269**A**	14.81**A**	14.29**A**
ETc		50%	4.931**C**	5.037**C**	3.516**C**	3.478**C**	11.20**C**	10.88**C**
		75%	6.496**B**	6.457**B**	4.517**B**	4.387**B**	15.16**B**	14.65**B**
		100%	7.242**A**	7.117**A**	5.008**A**	4.818**A**	16.57**A**	16.00**A**
Water source X Water regulation								
WI		DI	6.591**A**	6.574**B**	4.597**A**	4.433**A**	15.76**B**	15.37**B**
		RDI	6.590**A**	6.678**A**	4.677**A**	4.480**A**	16.63**A**	16.18**A**
WII		DI	5.859**B**	5.704**D**	3.996**C**	3.938**B**	11.86**D**	11.41**D**
		RDI	5.851**B**	5.857**C**	4.120**B**	4.059**B**	12.99**C**	12.41**C**
Water source X Irrigation levels								
WI		50%	5.110**D**	5.235**E**	3.658**E**	3.582**D**	12.37**D**	12.40**D**
		75%	7.130**B**	7.190**B**	5.018**B**	4.818**AB**	17.57**B**	16.92**B**
		100%	7.532**A**	7.453**A**	5.233**A**	4.970**A**	18.65**A**	18.00**A**
WII		50%	4.752**E**	4.838**F**	3.373**F**	3.375**D**	10.03**E**	9.350**E**
		75%	5.862**C**	5.723**D**	4.017**D**	3.955**C**	12.75**D**	12.38**D**
		100%	6.952**B**	6.780**C**	4.783**C**	4.665**B**	14.48**C**	14.00**C**
Water regulation X Irrigation levels								
DI		50%	4.847**C**	4.915**F**	3.430**D**	3.437**D**	10.28**E**	10.52**D**
		75%	6.487**B**	6.272**D**	4.413**C**	4.262**C**	14.93**C**	14.27**C**
		100%	7.342**A**	7.232**A**	5.045**A**	4.858**A**	16.20**B**	15.38**B**
RDI		50%	5.015**C**	5.158**E**	3.602**D**	3.520**D**	12.12**D**	11.23**D**
		75%	6.505**B**	6.642**C**	4.622**B**	4.512**BC**	15.38**C**	15.03**BC**
		100%	7.142**A**	7.002**B**	4.972**A**	4.777**AB**	16.93**A**	16.62**A**
Water source X Water regulation X Irrigation levels								
WI	DI	50%	5.067**E**	5.103**FG**	3.567**GH**	3.563**CD**	11.33**G**	12.07**E**
		75%	7.117**BC**	7.103**BC**	4970**BCD**	4.720**A**	17.53**B**	16.70**B**
		100%	7.590**A**	7.517**A**	5.253**A**	5.017**A**	18.40**A**	17.33**B**
	RDI	50%	5.153**E**	5.367**F**	3.750**FG**	3.600**CD**	13.40**DE**	12.73**DE**
		75%	7.143**BC**	7.277**ABC**	5.067**ABC**	4.917**A**	17.60**B**	17.13**B**
		100%	7.473**AB**	7.390**AB**	5.213**AB**	4.923**A**	18.90**A**	18.67**A**
WII	DI	50%	4.627**F**	4.727**H**	3.293**I**	3.310**D**	9.237**H**	8.967**F**
		75%	5.857**D**	5.440**F**	3.857**F**	3.803**BC**	12.33**F**	11.83**E**
		100%	7.093**BC**	6.947**C**	4.837**CD**	4.700**A**	14.00**D**	13.43**CD**
	RDI	50%	4.877**EF**	4.950**GH**	3.453**HI**	3.440**CD**	10.83**G**	9.733**F**
		75%	5.867**D**	6.007**E**	4.177**E**	4.107**B**	13.17**E**	12.93**DE**
		100%	6.810**C**	6.613**D**	4.730**D**	4.630**A**	14.97**C**	14.57**C**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Yield: concerning water source, well I gave highest significant value than well II in both seasons. Water regulation, RDI gave highest significant value in both seasons. Irrigation levels, level (100%) gave the highest values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). In both seasons the treatment of WI X RDI recorded the highest significant values. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant yield values. The interaction between water regulation and irrigation levels: in in both seasons, the treatments of RDI X 100% in both seasons gave highest significant yield values. The interaction among: the three studied factors: in the first season, the treatment of WI X DI X 100% and in both seasons the treatments of WI X RDI X 100% had highest significant yield values.

Data in table (6) showed the effect of well water source, water regulation, irrigation levels and their interaction on some fruit parameters of Jujube trees (2010&2011) seasons.

Fruit length: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, RDI gave higher significant value than (DI) in the first season, there are insignificant difference between DI and RDI in the second season. Irrigation levels, level (100%) gave the highest significant values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). In first season the treatments of WI X RDI recorded the highest significant values but in the second season WI X RDI showed higher significant value than all treatments except WI X DI treatment. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant fruit length values. The interaction between water regulation and irrigation levels: in the first season (DI X 100%), (RDI X 75%) in the second season and in both seasons, the treatments of (RDI X 100%) gave highest significant fruit length values than all other treatments except the treatments of DI X 100% in the second season and (RDI X 75%) in the first season. The interaction among: the three studied factors: in both seasons the treatments of WI X RDI X 100% had higher significant fruit length values than all other treatments except the treatments of WI X DI X 100% in both seasons and WI X RDI X 75% in the first season.

Table (6) Effect of well water source, water regulation, irrigation levels and their interaction on some fruit parameters of Jujube trees (2010&2011).

Treatments			Fruit length (cm)		Fruit diameter (cm)		Fruit weight (g)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
W	WI		1.983**A**	1.917**A**	1.894**A**	1.822**A**	2.517**A**	2.506**A**
	WII		1.794**B**	1.700**B**	1.694**A**	1.528**B**	1.756**B**	1.394**B**
WR	DI		1.861**B**	1.761**A**	1.767**A**	1.622**B**	2.044**A**	1.794**B**
	RDI		1.917**A**	1.856**A**	1.822**A**	1.728**A**	2.228**A**	2.106**A**
ETc	50%		1.683**C**	1.575**C**	1.708**B**	1.492**B**	1.533**C**	1.217**C**
	75%		1.942**B**	1.875**B**	1.808**A**	1.733**A**	2.200**B**	2.042**B**
	100%		2.042**A**	1.975**A**	1.867**A**	1.800**A**	2.675**A**	2.592**A**
Water source X Water regulation								
WI	DI		1.967**A**	1.856**AB**	1.856**A**	1.756**B**	2.400**A**	2.289**B**
	RDI		2.000**A**	1.978**A**	1.933**A**	1.889**A**	2.633**A**	2.722**A**
WII	DI		1.756**C**	1.667**C**	1.678**B**	1.489**C**	1.689**B**	1.300**C**
	RDI		1.833**B**	1.733**BC**	1.711**B**	1.567**C**	1.822**B**	1.489**C**
Water source X Irrigation levels								
WI	50%		1.750**D**	1.583**D**	1.783**B**	1.533**CD**	1.550**CD**	1.117**CD**
	75%		2.050**B**	1.983**B**	1.900**A**	1.850**B**	2.617**B**	2.033**B**
	100%		2.150**A**	2.183**A**	2.000**A**	2.083**A**	3.383**A**	3.117**A**
WII	50%		1.617**E**	1.567**D**	1.633**C**	1.450**D**	1.517**D**	0.933**D**
	75%		1.833**D**	1.767**C**	1.717**BC**	1.617**C**	1.783**CD**	1.267**C**
	100%		1.933**C**	1.767**C**	1.733**BC**	1.517**D**	1.967**C**	1.300**C**
Water regulation X Irrigation levels								
DI	50%		1.633**D**	1.567**C**	1.650**C**	1.450**C**	1.483**C**	1.133**C**
	75%		1.917**B**	1.800**B**	1.767**B**	1.633**B**	2.033**B**	1.717**B**
	100%		2.033**A**	1.917**AB**	1.883**A**	1.783**A**	2.617**A**	2.533**A**
RDI	50%		1.733**C**	1.583**C**	1.767**B**	1.533**C**	1.583**C**	1.300**C**
	75%		1.967**AB**	1.950**A**	1.850**AB**	1.833**A**	2.367**AB**	2.367**A**
	100%		2.050**A**	2.033**A**	1.850**AB**	1.817**A**	2.733**A**	2.650**A**
Water source X Water regulation X Irrigation levels								
WI	DI	50%	1.733**F**	1.567**F**	1.733**C**	1.533**BC**	1.567**D**	1.067**DE**
		75%	2.033**BC**	1.900**CD**	1.833**BC**	1.667**B**	2.333**BC**	1.567**C**
		100%	2.133**AB**	2.100**AB**	2.000**A**	2.067**A**	3.300**A**	3.000**A**
	RDI	50%	1.767**EF**	1.600**EF**	1.833**BC**	1.533**BC**	1.533**D**	1.167**DE**
		75%	2.067**AB**	2.067**BC**	1.967**AB**	2.033**A**	2.900**AB**	2.500**B**
		100%	2.167**A**	2.267**A**	2.000**A**	2.100**A**	3.467**A**	3.233**A**
WII	DI	50%	1.533**G**	1.567**F**	1.567**D**	1.367**D**	1.400**D**	0.8667**E**
		75%	1.800**EF**	1.700**DEF**	1.700**CD**	1.600**BC**	1.733**CD**	1.200**CDE**
		100%	1.933**CD**	1.733**DEF**	1.767**C**	1.500**CD**	1.933**CD**	1.267**CD**
	RDI	50%	1.700**F**	1.567**F**	1.700**CD**	1.533**BC**	1.633**D**	1.000**DE**
		75%	1.867**DE**	1.833**D**	1.733**C**	1.633**BC**	1.833**CD**	1.333**CD**
		100%	1.933**CD**	1.800**DE**	1.700**CD**	1.533**BC**	2.000**CD**	1.333**CD**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.
Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Fruit diameter: concerning water source, there are insignificant difference between well I and well II in the first season but well I gave higher significant value than well II in the second season. Water regulation, there are insignificant difference between DI and RDI in the first season but RDI gave higher significant value than DI in the second season. Irrigation levels, level 75% &100% gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI). In the first season the treatment of WI X DI and WI X RDI in both seasons recorded the highest significant values. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in the both seasons, the treatments of WI X 100% and in the second season, the treatments of WI X 75% recorded highest significant fruit diameter values. The interaction between water regulation and irrigation levels: in both seasons, the treatments of DI X 100% and RDI X (75%&100%) in the second season gave higher significant fruit diameter values than all other treatments.

The interaction among: the three studied factors: in the first season the treatments of WI X DI X100% and WI X RDI X 100% had higher significant fruit diameter values than all other treatments except WI X DI X 75%. In the second season seasons the treatments of WI X DI X 100%, WI X RDI X75% & 100% had highest significant value.

Fruit weight: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant difference between DI and RDI in the first season but RDI gave higher significant value than (DI) in the second season,. Irrigation levels, level (100%) gave the highest significant values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). In the first season the treatment of WI X DI and in both seasons the treatment of WI X RDI recorded the highest significant values. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant fruit weight values. The interaction between water regulation and irrigation levels: in both seasons, the treatments of DI X 100%, RDI X 75% in the second season and (RDI X 100%) in both seasons gave higher significant fruit weight values than all other treatments except the treatments of RDI X 75% in first season. The interaction among: the three studied factors: in both seasons the treatments of WI X DI X 100% and WI X RDI X 100% had higher significant fruit weight values than all other treatments except the treatment WI X RDI X 75% in the first season.

Data in table (7) showed the effect of well water source, water regulation, irrigation levels and their interaction on some fruit parameters of Jujube trees (2010&2011) seasons.

Fruit volume: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, RDI gave higher significant value than (DI) in both seasons, Irrigation levels, level (100%) gave the highest significant values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI). In both seasons the treatment of WI X RDI recorded the highest significant values.

The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant fruit volume values. The interaction between water regulation and irrigation levels: in the second season, the treatments of (DI X 100%), (RDI X 75%) in the second season and (RDI X 100%) in both seasons gave higher significant fruit volume values than all other treatments except the treatments of DI X 100% in first season. The interaction among: the three studied factors: in second season the treatments of WI X DI X 100%, WI X RDI X 75%, and in both seasons the treatments of WI X RDI X 100% had higher significant fruit volume values than all other treatments except the treatments of WI X DI X 100% in the first season.

Flesh weight: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant difference between DI and RDI in the first season but RDI gave higher significant value than DI in the second season. Irrigation levels, level 100% gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI). In the first season the highest significant values were found by WI X DI and WI X RDI treatments but in the second season the treatment of WI X RDI recorded the highest significant value. The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatment of WI X 100% recorded highest significant flesh weight values. The interaction between water regulation and irrigation levels: in both seasons, the treatments of RDI X 100% gave higher significant fruit weight values than all other treatments except DI X 100% in both seasons. The interaction among: the three studied factors: in the second season, the treatments of WI X DI X 100% and in both seasons, the treatments of WI X RDI X 100% had higher significant flesh weight values than all other treatments except WI X DI X 100% in the first season.

Fruit moisture: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, RDI gave higher significant value than DI in the first season while there are insignificant difference between DI and RDI in the second season. Irrigation levels, level (75%) in the second and 100% in both season gave higher significant than the other treatment.

The interaction between water source (WI & WII) and water regulation (DI & RDI). WI X RDI in the first season recorded higher significant value while there are insignificant difference between DI and RDI in the second season.

Table (7) Effect of well water source, water regulation, irrigation levels and their interaction on some fruit parameters of Jujube trees (2010&2011).

Treatments			Fruit volume(cm^3)		Flesh weight (g)		Fruit moisture (%)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
W		WI	3.066**A**	2.744**A**	2.139**A**	2.089**A**	69.38**A**	71.06**A**
		WII	2.267**B**	1.661**B**	1.461**B**	1.167**B**	65.45**B**	67.76**B**
WR		DI	2.500**B**	2.022**B**	1.711**A**	1.494**B**	66.67**B**	69.10**A**
		RDI	2.772**A**	2.383**A**	1.889**A**	1.761**A**	68.16**A**	69.72**A**
ETc		50%	2.125**C**	1.442**C**	1.250**C**	1.025**C**	63.56**C**	65.69**B**
		75%	2.683**B**	2.367**B**	1.833**B**	1.650**B**	68.03**B**	70.54**A**
		100%	3.100**A**	2.800**A**	2.317**A**	2.208**A**	70.65**A**	71.99**A**
Water source X Water regulation								
WI		DI	2.833**B**	2.500**B**	2.022**A**	1.878**B**	68.58**B**	70.90**A**
		RDI	3.178**A**	2.989**A**	2.256**A**	2.300**A**	70.18**A**	71.22**A**
WII		DI	2.167**C**	1.544**C**	1.400**B**	1.111**C**	64.76**C**	67.30**B**
		RDI	2.367**C**	1.778**C**	1.522**B**	1.222**C**	66.14**C**	68.21**B**
Water source X Irrigation levels								
WI		50%	2.367**CD**	1.567**CD**	1.283**CD**	1.350**CD**	64.95**D**	68.02**C**
		75%	3.067**B**	2.900**B**	2.150**B**	2.550**B**	70.55**B**	72.18**A**
		100%	3.583**A**	3.767**A**	2.983**A**	3.617**A**	72.63**A**	72.98**A**
WII		50%	1.883**E**	1.317**D**	1.217**D**	1.083**D**	62.17**E**	63.37**D**
		75%	2.300**D**	1.833**C**	1.517**CD**	1.533**C**	65.52**D**	68.90**BC**
		100%	2.617**C**	1.833**C**	1.650**C**	1.567**C**	68.67**C**	71.00**B**
Water regulation X Irrigation levels								
DI		50%	1.950**D**	1.350**C**	1.200**D**	0.967**D**	62.92**D**	65.23**B**
		75%	2.533**C**	22.000**B**	1.883**C**	1.383**C**	67.35**C**	70.30**A**
		100%	3.017**AB**	2.717**A**	2.250**AB**	2.133**AB**	69.73**AB**	71.77**A**
RDI		50%	2.300**C**	1.533**C**	1.300**D**	1.083**D**	64.20**D**	66.15**B**
		75%	2.833**B**	2.733**A**	1.983**BC**	1.917**B**	68.72**BC**	70.78**A**
		100%	3.183**A**	2.883**A**	2.383**A**	2.283**A**	71.57**A**	72.22**A**
Water source X Water regulation X Irrigation levels								
WI	DI	50%	2.167**F**	1.500**CD**	1.300**E**	1.300**DE**	64.23**EFG**	67.83**C**
		75%	2.867**C**	2.267**B**	1.900**CD**	2.000**C**	69.70**BC**	72.13**AB**
		100%	3.467**AB**	3.733**A**	2.867**AB**	3.567**A**	71.80**AB**	72.73**A**
	RDI	50%	2.567**CDE**	1.633**CD**	1.267**E**	1.400**DE**	65.67**DE**	68.20**BC**
		75%	3.267**B**	3.533**A**	2.400**BC**	3.100**B**	71.40**AB**	72.23**AB**
		100%	3.700**A**	3.800**A**	3.100**A**	3.667**A**	73.47**A**	73.23**A**
WII	DI	50%	1.733**G**	1.200**D**	1.100**E**	0.9667**E**	61.60**G**	62.63**D**
		75%	2.200**EF**	1.733**BCD**	1.467**DE**	1.433**DE**	65.00**DEF**	68.47**BC**
		100%	2.567**CDE**	1.700**CD**	1.633**DE**	1.500**D**	67.67**CD**	70.80**ABC**
	RDI	50%	2.033**FG**	1.433**CD**	1.333**E**	1.200**DE**	62.73**FG**	64.10**D**
		75%	2.400**DEF**	1.933**BC**	1.567**DE**	1.633**CD**	66.03**DE**	69.33**ABC**
		100%	2.667**CD**	1.967**BC**	1.667**DE**	1.633**CD**	69.67**BC**	71.20**ABC**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.
Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in second season, the treatments of (WI X 75%), in both seasons, the treatments of (WI X 75%) and in second season, the treatments of (WI X 100%) recorded higher significant fruit moisture values than all treatments. The interaction between water regulation and irrigation levels: in the second season, the treatments of (DI X 75%&100%), in the second season, the treatments of RDI X 75% and in both seasons (RDI X 100%) gave higher significant fruit moisture values than all treatments except (DI X 100%) in the first season. The interaction among: the three studied factors: in the second season the treatments of WI X DI X 100% and in both seasons WI X RDI X 100% had higher significant fruit moisture values than most other treatments.

Data in table (8) showed the effect of well water source, water regulation, irrigation levels and their interaction on leaf mineral content Jujube trees (2010&2011) seasons**.**

Nitrogen: concerning water source, there are insignificant differences between well I and well II in both seasons. Water regulation, there are insignificant difference between (DI) and (RDI) in the first season but

(RDI) gave higher significant value than (DI) in the second season. Irrigation levels, level (100%) gave the highest significant values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI), in both seasons, WI X DI and WI X RDI had higher significant nitrogen values than all other treatments except WII X RDI in the first season. The interaction between water source and irrigation levels, in the first season, the treatments of WI X 75% and in both seasons, the treatments of WI X 100% recorded highest significant nitrogen values than the other treatments except WI X 75% in the second season. The interaction between water regulation and irrigation levels, in both seasons, RDI X 100% treatments gave highest significant nitrogen values than all other treatments except (DI & RDI) X 100% treatments in both seasons. The interaction among: the three studied factors: in both seasons, the treatments of WI X DI X 100% and WI X DI X 100% had higher significant nitrogen values than all other treatments except WI X RDI X 75% and WII X RDI X 100% treatments.

Table (8) Effect of well water source, water regulation, irrigation levels and their interaction on leaf mineral contents of Jujube trees (2010&2011).

Treatments			N%		P%		K%		Ca%	
			1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
W		WI	1.406 **A**	1.373 **A**	0.1278 **A**	0.1306 **A**	0.1000 **B**	0.7256 **A**	0.4150 **A**	0.4089 **A**
		WII	1.290 **A**	1.248 **A**	0.0994 **B**	0.1022 **B**	0.1300 **A**	0.5650 **B**	0.3556 **B**	0.3278 **B**
WR		DI	1.323 **A**	1.295 **B**	0.1106 **A**	0.1122 **A**	0.6372 **A**	0.6372 **A**	0.3761 **B**	0.3539 **B**
		RDI	1.372 **A**	1.326 **A**	0.1167 **A**	0.1206 **A**	0.6228 **A**	0.6533 **A**	0.3944 **A**	0.3828 **A**
ETc		50%	1.194 **C**	1.160 **C**	0.0875 **C**	0.1000 **C**	0.4408 **C**	0.4792 **C**	0.4475 **A**	0.4025 **A**
		75%	1.403 **B**	1.357 **B**	0.1183 **B**	0.1300 **B**	0.6658 **B**	0.6667 **B**	0.3750 **B**	0.3742 **B**
		100%	1.446 **A**	1.414 **A**	0.1350 **A**	0.1600 **A**	0.7833 **A**	0.7900 **A**	0.3333 **C**	03283 **C**
Water source X Water regulation										
WI		DI	1.383 **A**	1.369 **A**	0.1244 **A**	0.1233 **B**	0.7167 **A**	0.7211 **A**	0.4056 **B**	0.3956 **B**
		RDI	1.428 **A**	1.378 **A**	0.1311 **A**	0.1378 **A**	0.6700**AB**	0.7300 **A**	0.4244 **A**	0.4222 **A**
WII		DI	1.263 **B**	1.221 **C**	0.0967 **B**	0.1011 **C**	0.5578 **B**	0.5533 **B**	0.3467 D	0.3122 **D**
		RDI	1.317**AB**	1.274 **B**	0.1022 **B**	0.1033 **C**	0.5756 **B**	0.5767 **B**	0.3644 **C**	0.3433 **C**
Water source X Irrigation levels										
WI		50%	1.263 **C**	1.240 **D**	0.0966 **D**	0.1050 **B**	0.4250 **D**	0.5050 **E**	0.4417 **A**	0.4333 **A**
		75%	1.460 **A**	1.412**AB**	0.1350 **B**	0.1417 **A**	0.7450 **B**	0.7500 **B**	0.4283 **A**	0.4250 **A**
		100%	1.493 **A**	1.468 **A**	0.1517 **A**	0.1450 **A**	0.9100 **A**	0.9217 **A**	0.3750 **B**	0.3683 **B**
WII		50%	1.125 **D**	1.080 **E**	0.0783 **E**	0.0833 **C**	0.4567 **D**	0.4533 **F**	0.4533 **A**	0.3717 **B**
		75%	1.347 **B**	1.303**CD**	0.1017 **D**	0.1050 **B**	0.5867 **C**	0.5833 **D**	0.3217 **C**	0.3233 **C**
		100%	1.398 **B**	1.360**BC**	0.1183 **C**	0.1183 **B**	0.6567**BC**	0.6583 **C**	0.2917 **D**	0.2883**D**
Water regulation X Irrigation levels										
DI		50%	1.138 **D**	1.132 **C**	0.0833 **D**	0.0883 **B**	0.4667 **D**	0.4633 **F**	0.4417 **A**	0.3817 **B**
		75%	1.393 **B**	1.343 **B**	0.1150 **B**	0.1217 **A**	0.6217 **C**	0.6167 **D**	0.3617 **C**	0.3600**BC**
		100%	1.438**AB**	1.410**AB**	0.1333 **A**	0.1267 **A**	0.8233 **A**	0.8317 **A**	0.3250 **D**	0.3200 **D**
RDI		50%	1.250 **C**	1.188 **C**	0.0917 **C**	0.1000 **B**	0.4150 **D**	0.4950 **E**	0.4533 **A**	0.4233 **A**
		75%	1.413**AB**	1.372**AB**	0.1217 **B**	0.1250 **A**	0.7100**BC**	0.7167 **C**	0.3883 **B**	0.3883 **B**
		100%	1.453 **A**	1.418 **A**	0.1267 **A**	0.1367 **A**	0.7433**AB**	0.7483 **B**	0.3417**CD**	0.3367**CD**
Water source X Water regulation X Irrigation levels										
WI	DI	50%	1.193 **E**	1.220 **E**	0.0933**FG**	0.1000**DEF**	0.4867 **E**	0.4867 **G**	0.4300 **A**	0.4100**ABC**
		75%	1.447**AB**	1.407**AB**	0.1300**CD**	0.1333**ABC**	0.6733 **C**	0.6700 **C**	0.4200 **A**	0.4167**ABC**
		100%	1.510 **A**	1.480 **A**	0.1500**AB**	0.1367 **AB**	0.9900 **A**	1.007 **A**	0.3667 **BC**	0.3600 **D**
	RDI	50%	1.333 **D**	1.260**DE**	0.1000 **F**	0.1100**CDE**	0.3633 F	0.5233 **F**	0.4533 **A**	0.4567 **A**
		75%	1.473 **A**	1.417**AB**	0.1400**BC**	0.1500 **A**	0.8167 **B**	0.8300 **B**	0.4367 **A**	0.4333**AB**
		100%	1.477 **A**	1.457 **A**	0.1533 **A**	0.1533 **A**	0.8300 **B**	0.8367 **B**	0.3833 **B**	0.3767**CD**
WII	DI	50%	1.083 F	1.043 **F**	0.0733 **H**	0.0767 **F**	0.4467 **E**	0.4400 **H**	0.4533 **A**	0.3533 **D**
		75%	1.340 **D**	1.280**CDE**	0.1000 **F**	0.1100**CDE**	0.5700 **D**	0.5633 **E**	0.3033 **D**	0.3033**EF**
		100%	1.367**BCD**	1.340**BCD**	0.1167 **E**	0.1167**BCD**	0.6567 **C**	0.6567 **C**	0.2833 **D**	0.2800 **F**
	RDI	50%	1.167 **E**	1.117 **F**	0.0833**GH**	0.0900**EF**	0.4667 **E**	0.4667**GH**	0.4533 **A**	0.3900**BCD**
		75%	1.353**CD**	1.327**BCD**	0.1033 **F**	0.1000**DEF**	0.6033 D	0.6033 **D**	0.3400 **C**	0.3433**DE**
		100%	1.430**ABC**	1.380**ABC**	0.1200**DE**	0.1200**BCD**	0.6567 **C**	0.6600 **C**	0.3000 **D**	0.2967**EF**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.
Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Phosphorus: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant differences between (DI) and (RDI) in both seasons. Irrigation levels, level (100%) gave the highest significant value in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI). WI X DI X RDI had highest significant values in the first season. In the second season, WI X RDI showed highest significant value. The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in the second season, the treatments of WI X 75% and in both seasons, the treatments of WI X 100% recorded highest significant Phosphorus values. The interaction between water regulation and irrigation levels: in the second season, (DI & RDI) X 75% and (DI & RDI) X 100% in both seasons treatments gave highest significant Phosphorus values. The interaction among: the three studied factors: in the second season, RDI X 75% and RDI X 100% in both seasons treatments gave highest significant Phosphorus values than all other treatments except WI X DI X 75% in the second season and WI X DI X 100% in both seasons.

Potassium: concerning water source, in the first season well II had higher significant value than well I but well I gave higher significant value than well II in the second season. Water regulation, there are insignificant difference between DI and RDI in both season. Irrigation levels, level 100% gave the highest significant values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI), WI X DI had higher significant valuethan last two treatments in the first season. In the second season WI X DI &RDI showed highest significant value.

The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X 100 recorded highest significant Potassium values.

The interaction between water regulation and irrigation levels: in both seasons, DI X 100% treatments gave highest significant Potassium values except RDI X 100% treatment in the first season.

The interaction among: the three studied factors: the treatments of WI X DI X 100% in both seasons had highest significant Potassium values.

Calcium: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, (RDI) gave higher significant value than DI in both seasons. Irrigation levels, level 50% gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation: WI X RDI gave highest significant value in both seasons.

The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WI X (50%&75%) and WII X 50% in the first season recorded highest significant Potassium values.

The interaction between water regulation and irrigation levels: in season, DI X 50% and in both seasons, RDI X 50% treatments gave highest significant Calcium values. The interaction among: the three studied factors: in the first season, the treatments of WI X (DI&RDI) X (50%&75%) and WII X (DI&RDI) X 50% also in the second season WII X RDI X 50% and WII X (DI&RDI) X 50% had higher significant Calcium values than most of other treatments in the first season. WI X RDI X
50% showed higher significant calcium value than most of other treatments.

Data in table (9) showed the effect of well water source, water regulation, irrigation levels and their interaction on leaf mineral content Jujube trees (2010&2011) seasons**.**

Magnesium: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant differences between (DI) and (RDI) in both seasons. Irrigation levels, level (100%) gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI), in the first season, WI X DI and in both seasons, WI X RDI had higher magnesium values than all other treatments except WI X DI in the second season.The interaction between water source and irrigation levels, in both season, the treatments of WI X 100% recorded highest significant magnesium values than all treatments.

The interaction between water regulation and irrigation levels, in the first season, DI X 100% and in both seasons, RDI X 100% treatments gave highest significant magnesium values than all other treatments.

The interaction among: the three studied factors: in the first season, WI X DI X 100% and in both seasons, the treatments of WI X RDI X 100% had higher significant magnesium values than all other treatments.

Sodium: concerning water source, well II gave higher significant value than well I in both seasons. Water regulation, DI gave higher significant value than RDI in both seasons. Irrigation levels, level (100%) gave the highest value in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI). In both seasons, (WII X DI) and in the second season, (WII X RDI) gave higher significant values.

The interaction between: water source and irrigation levels (ETc = 50, 75 and 100%): in both seasons, the treatments of WII X 100% recorded highest significant sodium values.

The interaction between water regulation and irrigation levels: in the both seasons, DI X 100% and RDI X 100% in the second season treatments gave highest significant sodium values.

The interaction among: the three studied factors: in both seasons, WII X DI X 100% and WII X RDI X 100% in the second season treatments gave highest significant sodium values than all other treatments.

Ferry: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, RDI gave higher significant value than DI in both seasons. Irrigation levels, level 100% gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation (DI & RDI), there are insignificant differences between WI X (DI & RDI) in both seasons.

The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded highest significant ferry values.

The interaction between water regulation and irrigation levels: in both seasons, (DI&RDI) X 100% treatments gave highest significant ferry values. The interaction among: the three studied factors: the treatments of WI X DI X 100% in both seasons had higher significant ferry values than other treatments.

Table (9) Effect of well water source, water regulation, irrigation levels and their interaction on leaf mineral contents of Jujube trees (2010&2011).

Treatments			Mg%		Na (ppm)		Fe (ppm)		Zn (ppm)	
			1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
W	WI		0.2500 **A**	0.246 **A**	355.2**B**	348.6**B**	431.8**A**	416.1**A**	25.67**A**	23.89**A**
	WII		0.2105 **B**	0.2050 **B**	398.8**A**	399.1**A**	367.7**B**	358.7**B**	19.06**B**	18.00**B**
WR	DI		0.2261 **A**	0.2178 **A**	384.1**A**	381.8**A**	395.6**B**	383.5**A**	24.28**A**	22.83**A**
	RDI		0.2344 **A**	0.2333 **A**	369.8**B**	365.9**B**	404.0**A**	391.3**A**	20.44**B**	19.06**B**
ETc	50%		0.1975 **C**	0.1950 **C**	330.4**C**	318.5**C**	334.0**C**	332.6**C**	23.50**A**	22.17**A**
	75%		0.2258 **B**	0.2183 **B**	385.3**B**	379.0**B**	412.1**B**	400.8**B**	22.58**A**	21.00**A**
	100%		0.2675 **A**	0.2633 **A**	415.2**A**	424.0**A**	453.3**A**	438.8**A**	21.00**B**	19.67**B**
Water source X Water regulation										
WI	DI		0.2433 **A**	0.234**AB**	360.1**C**	358.4**B**	435.6**A**	421.6**A**	27.56**A**	25.89**A**
	RDI		0.2567 **A**	0.258**A**	350.2**C**	338.8**C**	428.1**A**	410.7**A**	23.78**B**	21.89**B**
WII	DI		0.2089 **B**	0.201**B**	408.1**A**	405.1**A**	355.6**C**	345.4**C**	21.00**C**	19.78**C**
	RDI		0.2122 **B**	0.209**B**	389.4**B**	393.0**A**	379.9**B**	372.0**B**	17.11**D**	16.22**D**
Water source X Irrigation levels										
WI	50%		0.1983 **D**	0.1983**CD**	324.0**E**	300.2**E**	358.8**D**	342.5**E**	26.83**A**	25.33**A**
	75%		0.2433 **B**	0.2317 **B**	360.3**D**	357.8**CD**	447.0**B**	431.8**B**	26.00**AB**	23.83**AB**
	100%		0.3083 **A**	0.3083 **A**	381.2**C**	387.8**BC**	489.7**A**	474.0**A**	24.17**B**	22.50**B**
WII	50%		0.1967 **D**	0.1917 **D**	336.8**E**	336.8**D**	309.2**E**	302.7**F**	20.17**C**	19.00**C**
	75%		0.2083**CD**	0.2050**CD**	410.3**B**	400.2**B**	377.2**D**	369.8**D**	19.17**CD**	18.17**CD**
	100%		0.2267**BC**	0.2183**BC**	449.2**A**	460.2**A**	416.8**C**	403.7**C**	17.83**D**	16.83**D**
Water regulation X Irrigation levels										
DI	50%		0.1983 **C**	0.1917 **D**	334.2**D**	330.7**C**	320.0**D**	306.5**D**	25.50**A**	24.00**A**
	75%		0.2200**BC**	0.2167 **C**	387.2**BC**	381.8**B**	406.5**B**	396.2**B**	24.83**A**	23.00**AB**
	100%		0.2600 **A**	0.2450 **B**	431.0**A**	432.8**A**	460.2**A**	447.8**A**	22.50**B**	21.50**BC**
RDI	50%		0.1967 **C**	0.1983**CD**	326.7**D**	306.3**C**	348.0**C**	338.7**C**	21.50**BC**	20.33**CD**
	75%		0.2317 **B**	0.2200 **C**	383.5**C**	376.2**B**	417.7**B**	405.5**B**	20.33**CD**	19.00**DE**
	100%		0.2750 **A**	0.2817 **A**	399.3**B**	415.2**A**	446.3**A**	429.8**A**	19.50**D**	17.83**E**
Water source X Water regulation X Irrigation levels										
WI	DI	50%	0.2000 **D**	0.1967**DE**	325.3**F**	318.7**DE**	348.0**DE**	332.0**FG**	29.33**A**	27.67**A**
		75%	0.2367**BC**	0.2300**CD**	362.3**DE**	361.7**BCD**	437.3**B**	428.0**B**	28.33**A**	26.33**A**
		100%	0.2933 **A**	0.2767 **B**	392.7**C**	395.0**B**	521.3**A**	504.7**A**	25.00**B**	23.67**B**
	RDI	50%	0.1967 **D**	0.2000**CDE**	332.7**F**	281.7**E**	369.7**CD**	353.0**EFG**	24.33**BC**	23.00**B**
		75%	0.2500 **B**	0.2333 **C**	358.3**DE**	354.0**BCD**	456.7**B**	435.7**B**	23.67**BCD**	21.33**BC**
		100%	0.3233 **A**	0.3400 **A**	369.7**D**	380.7**BC**	458.0**B**	443.3**B**	23.33**BCD**	21.33**BC**
WII	DI	50%	0.1967 **D**	0.1867 **E**	343.0**EF**	342.7**CD**	292.0**F**	281.0**H**	21.67**CDE**	20.33**C**
		75%	0.2033**CD**	0.2033**CDE**	412.0**BC**	402.0**B**	375.7**CD**	364.3**DEF**	21.33**DEF**	19.67**CD**
		100%	0.2267**BCD**	0.2133**CDE**	469.3**A**	470.7**A**	399.0**C**	391.0**CD**	20.00**EF**	19.33**CD**
	RDI	50%	0.1967 **D**	0.1976**DE**	330.7**F**	331.0**CD**	326.3**E**	324.3**G**	18.67**FG**	17.67**DE**
		75%	0.2133**CD**	0.2067**CDE**	408.7**C**	398.3**B**	378.7**CD**	375.3**DE**	17.00**GH**	16.67**EF**
		100%	0.2267**BCD**	0.2233**CD**	429.0**B**	449.7**A**	434.7**B**	416.3**BC**	15.67**H**	14.33**F**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.

Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Zinc: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, (DI) gave higher significant value than (RDI) in both seasons. Irrigation levels, level (50%&75%) gave the highest values in both seasons.

The interaction between water source (WI & WII) and water regulation: (WI X DI) gave the highest significant value in both seasons. The interaction between: water source and irrigation levels (ETc = 50, 75 and

100%): in both seasons, the treatments of WI X 50% recorded higher significant zinc values than all treatments except WI X 75% in both seasons. The interaction between water regulation and irrigation levels: in season, DI X 50% and in both seasons and DI X 75% in the first season treatments gave highest significant values except DI X 75% in the first season. The interaction among: in both seasons, the treatments of WI X DI X (50%&75%) had higher significant values than all treatments.

These results was agreement with **Dejampour Lolaei *et al.*, (2012)** who found that the potassium (K^+), magnesium (Mg^{2+}), calcium (Ca^{2+}), sodium (Na^+) and chloride (Cl^-) ion concentrations of the leaves and roots were significantly affected due to different salinity levels. The concentration of Mg^{2+}, Cl^- and Na^+ as well as the Na^+/K^+ ratio in the leaves of *Prunus* rootstocks were increased by the salinity stress, whereas it had no significant effect on the Ca^{2+} and K^+ concentrations as well as the Na^+/Ca^{2+} ratio. **Also, Lucena *et al.*, (2012)** who noticed a significant reduction of N, P, K^+, Ca^{+2} and Mg^{+2} in the leaves of mango cultivars 'Haden', 'Palmer' and 'Uba' with increasing salinity levels.

Data in table (10) showed the effect of well water source, water regulation, irrigation levels and their interaction on fruit quality of Jujube trees (2010&2011) seasons**.**

Table (10) Effect of well water source, water regulation, irrigation levels and their interaction on fruit quality of Jujube trees (2010&2011).

Treatments			Acidity%		TSS %		Total sugars %	
			1st season	2nd season	1st season	2nd season	1st season	2nd season
W		WI	0.2039**A**	0.1944**A**	20.48**A**	20.68**A**	14.98**A**	15.48**A**
		WII	0.2350**A**	0.2256**A**	18.96**B**	18.46**B**	13.34**B**	13.57**B**
WR		DI	0.2239**A**	0.2161**A**	19.42**A**	19.24**A**	13.86**A**	14.09**B**
		RDI	0.2150**B**	0.2039**A**	20.02**A**	19.89**A**	14.46**A**	14.95**A**
ETc		50%	0.2492**A**	0.2450**A**	17.42**B**	16.58**C**	11.98**B**	12.51**B**
		75%	0.2133**B**	0.1983**B**	20.45**A**	20.35**B**	14.99**A**	15.33**A**
		100%	0.1958**C**	0.1867**B**	21.28**A**	21.77**A**	15.52**A**	15.73**A**
Water source X Water regulation								
WI		DI	0.2078**C**	0.2000**AB**	20.16**A**	20.29**A**	14.63**A**	15.23**A**
		RDI	0.2000**C**	0.1889**B**	20.80**A**	21.08**A**	15.32**A**	15.72**A**
WII		DI	0.2400**A**	0.2322**A**	18.68**A**	18.20**B**	13.09**B**	12.96**C**
		RDI	0.2300**B**	0.2189**AB**	19.24**A**	18.71**B**	13.60**B**	14.18**B**
Water source X Irrigation levels								
WI		50%	0.2417**AB**	0.2333**B**	17.93**D**	17.65**D**	13.05**D**	14.22**C**
		75%	0.1950**DE**	0.1817**D**	21.15**B**	21.63**AB**	15.55**AB**	15.80**AB**
		100%	0.1750**E**	0.1683**D**	22.35**A**	22.77**A**	16.33**A**	16.42**A**
WII		50%	0.2567**A**	0.2567**A**	16.92**E**	15.52**E**	10.90**E**	10.80**D**
		75%	0.2317**BC**	0.2150**BC**	19.75**C**	19.07**C**	14.43**C**	14.87**BC**
		100%	0.2167**CD**	0.2050**C**	20.22**C**	20.78**B**	14.70**BC**	15.03**BC**
Water regulation X Irrigation levels								
DI		50%	0.2533**A**	0.2550**A**	17.05**B**	16.10**C**	11.40**C**	11.48**C**
		75%	0.2183**B**	0.2000**C**	20.25**A**	20.03**B**	14.85**A**	15.18**A**
		100%	0.2000**BC**	0.1933**C**	20.95**A**	21.60**A**	15.33**A**	15.62**A**
RDI		50%	0.2450**A**	0.2350**B**	17.80**B**	17.07**C**	12.55**B**	13.53**B**
		75%	0.2083**BC**	0.1967**C**	20.65**A**	20.67**AB**	15.13**A**	15.48**A**
		100%	0.1917**C**	0.1800**C**	21.62**A**	21.95**A**	15.70**A**	15**83**A
Water source X Water regulation X Irrigation levels								
WI	DI	50%	0.2433**ABC**	0.2433**ABC**	17.60**DE**	16.97**FG**	12.63**FG**	13.93**CD**
		75%	0.2033**DEF**	0.1833**EF**	21.10**ABC**	21.37**ABC**	**15.33**BCD	15.57**ABC**
		100%	0.1767**EF**	0.1733**EF**	21.77**AB**	22.53**AB**	15.93**AB**	16.20**AB**
	RDI	50%	0.2400**ABC**	0.2233**BCD**	18.27**CDE**	18.33**EF**	13.47**EF**	14.50**BC**
		75%	0.1867**EF**	0.1800**EF**	21.20**ABC**	21.90**AB**	15.77**ABC**	16.03**AB**
		100%	0.1733**F**	0.1633**F**	22.93**A**	23.00**A**	16.73**A**	16.63**A**
WII	DI	50%	0.2633**A**	0.2667**A**	16.50**E**	15.23**G**	10.17**H**	9.033**E**
		75%	0.2333**ABCD**	0.2167**CD**	19.40**BCDE**	18.70**DEF**	**14.37**DE	14.80**ABC**
		100%	0.2233**BCD**	0.2133**CD**	20.13**ABCD**	20.67**BCD**	14.73**BCDE**	15.03**ABC**
	RDI	50%	0.2500**AB**	0.2467**AB**	17.33**DE**	15.80**G**	11.63**G**	12.37**D**
		75%	0.2300**ABCD**	0.2133**D**	20.10**ABCD**	19.43**CDE**	14.50**CDE**	14.93**ABC**
		100%	0.2100**CDE**	0.1967**DE**	20.30**ABCD**	20.90**ABC**	14.67**BCDE**	15.03**ABC**

Mean having the same letter (s) in each row, column or interaction are insignificantly different at 5% level.
Water source = (WI, WII), water regulation (WR) = (deficit irrigation= DI, regulated deficit irrigation= RDI), irrigation levels = (ETc = crop evapotranspiration).

Acidity: concerning water source, there are insignificant differences between well I and well II in both seasons. Water regulation, (DI) had higher significant acidity value than RDI while there are insignificant differences

between (DI) and (RDI) in the second season. Irrigation levels, level (50%) gave the highest values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI), in both seasons, WII X DI had higher significant acidity values than all other treatments except WI X DI and WII X RDI in the second season. The interaction between water source and irrigation levels, in both season, the treatments of WII X 50% recorded higher significant acidity values than all treatments except WI X 50% in the first season.
The interaction between water regulation and irrigation levels, in both seasons, DI X 50% treatments and RDI X 50% in the first season, gave highest significant acidity values than all other treatments. The interaction among: in both seasons, the treatments of WII X RDI X 50%, had higher significant acidity values than the most of other treatments.

TSS: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant differences between (DI) and (RDI) in both seasons. Irrigation levels, level (75%) in the first season and level (100%) in both seasons. gave the highest significant values. The interaction between water source (WI & WII) and water regulation (DI & RDI). In both seasons, there are insignificant differences between (DI) and (RDI) in both seasons (WII X DI&RDI) in the first season, (WII X RDI) gave higher significant values than the second season. The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded higher significant TSS values than the other treatments except WI X 75% in the second season. The interaction between water regulation and irrigation levels: in the both seasons, (DI& RDI) X 75% in the first season and (DI&RDI) X 100% in both seasons treatments gave highest significant TSS values. The interaction among: in both seasons, WI X RDI X 100% treatments gave higher significant TSS values than the most of other treatments.

Total sugars: concerning water source, well I gave higher significant value than well II in both seasons. Water regulation, there are insignificant differences between (DI) and (RDI) in the first season but RDI gave higher significant value than DI in second season. Irrigation levels, level (75%&100%) gave the highest values in both seasons. The interaction between water source (WI & WII) and water regulation (DI & RDI), there are insignificant differences between WI X (DI & RDI) in both seasons.

The interaction between: water source and irrigation levels (ETc =50, 75 and 100%): in both seasons, the treatments of WI X 100% recorded higher significant total sugars values than all treatments except WI X 75% in both seasons. The interaction between water regulation and irrigation levels: in both seasons, (DI&RDI) X (75%&100%) treatments gave highest significant total sugars values.

The interaction among: the treatments of WI X RDI X 100% in both seasons had higher significant total sugars values than the most of other treatments.

These results were agreement with **Chaves *et al.*, (2007)** who found that fruit quality characters were mediated by a reduction in vigour, leading to an increase on light interception in the cluster zone. Because plant water status during most of the dates along the season was not significantly different between PRD and DI, and when different, PRD even exhibited a higher leaf water potential than DI vines.

It could be concluded that: irrigation with well I (with EC values 3.68 dS/m) through PRD at 100% of ETc increased fruit quality of Jujube trees. Under limited water resources (where trees supplied with 75 or 50% of ETc), PRD is a viable irrigation option to give the highest Jujube yield and fruit quality comparing with DI.

References

[1]. Aganchich B.; Tahi1 H.; Wahbi1 S.; Elmodaffar C. and R. Serraj (2007). Growth, water relations and antioxidant defence mechanisms of olive (*Olea europaea* L.) subjected to partial root drying (PRD) and regulated deficit irrigation (RDI). Plant Biosystems, 141 (2): 252-264.

[2]. Ahmadi S.H.; M.N. Andersen; F. Plauborg; R.T. Poulsen; C.R. Jensen; A.R. Sepaskhah; and S. Hansen (2010). Effects of irrigation strategies and soils on field grown potatoes: Gas exchange and xylem [ABA]. Agricultural Water Management, 97: 1486-1494.

[3]. Al-Abdoulhadi I. A.; H. A. Dinar; G. Ebert and C. Buttner (2012). Influence of salinity stress on photosynthesis and chlorophyll content in date palm (Phoenix dactylifera L.) cultivars. African Journal of Agricultural Research; 7: 22, 3314-3319.

[4]. Al-Hayani A. M. and I. A. Manar (2009). Effect of soil salinity on some physical and chemical parameters of lemon (Citrus limon Burm) fruits. Diyala Agricultural Sciences Journal, 1: (2): 25-29.

[5]. Brown J.D. and O.Lilleland 1946. Rapid determination of potassium and sodium in plant material and soil extract by flame photometry. Proc. Amer. Soc. Hort. Sci. 48:341-346.

[6]. Chapman , H. D. and P. F. Pratt 1961. Method of Analysis for Soils , Plants and Waters , Univ. California, Div. Agric. Sci. Priced Pub. 4034.

[7]. Chaves M.M.; T.P. Santos; C.R. Souza; M.F. Ortun; M.L. Rodrigues; C.M. Lopes; J.P. Maroco and J.S. Pereira (2007). Deficit irrigation in grapevine improves water-use efficiency while controlling vigour and production quality. Annals of Applied Biology, 150: 237–252.

[8]. Clarke G.M. and R.E. Kempson (1997). Introduction to the design and analysis of experiments. Arnold, a Member of the Holder Headline Group, 1st Edt. London, UK.

[9]. Dejampour J.; N. Aliasgarzad; M. Zeinalabedini; M. R. Niya; E. M. Hervan (2012). Evaluation of salt tolerance in almond [*Prunus dulcis* (L.) Batsch] rootstocks. African Journal of Biotechnology; 11: 56, 11907-11912. 31 ref.

[10]. Duncan D.B. (1955). Multiple range and multiple F Test. Biometrics, 11: 1-42.

[11]. FAO – Food and Agriculture Organisation (1992). The use of saline waters for crop production. Rhodes JD, Kandiah A, Mashak AM. FAO Irrigation and Drainage Paper 48. FAO, Rome.

[12]. Jakson, M. L. (1967). Soil Chemical Analysis pp. 183, , New Delhi, India.

[13]. Lolaei A.; M. A. Rezaei; M. K. Raad; and B. Kaviani (2012). Effects of salinity and calcium on the growth, ion concentration and yield of olive (Olea europaea L.) trees. Annals of Biological Research, 3: 10, 4675-4679.

[14]. Loveys B. R.; P. R. Dry; M. Stoll; M. G. McCarthy (2000). Using plant physiology to improve the water use efficiency of horticultural crops. Acta Horticulturae 537:187 – 199.

[15]. Lucena C. C.; Siqueira D. L.; Martinez H. E. P. and P. R. Cecon (2012).Salt stress effect on nutrient absorption in mango tree. Revista Brasileira de Fruticultura, 34 (1): 297-308.

[16]. Marsal J.; M. Mata; J. del Campo; A. Arbones; X. Vallverdú; J. Girona; and N. Olivo (2008). Evaluation of partial root-zone drying for potential filed use as a deficit irrigation technique in commercial vineyards according to two different pipeline layouts. Irrigation Science 26:347–356.

[17]. Ministry of Agriculture, A.R.E. (2012). Agriculture Directorates of Governorates- Economic Affairs Sector.

[18]. Ruiz, M.; G. Olivieri; and F.Vita Serman (2011). Effects of saline stress in two cultivars of Olea europea L: 'Arbequina' and 'Barnea'. Acta Horticulturae, 924: 117-124.

[19]. Sepaskhah A.R. and Ahmadi, S.H. (2010). A review on partial root-zone drying irrigation. International Journal of Plant Production, 4 (4): 241-258.

[20]. Trugo, E. and A.H.Meyer, (1929). Improvement of the Denige,s colorimetric method for phosphorus and arsenic. Ind. Eng. Chem. Asnal. Ed. 1:136-139.