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ESTIMATION OF SALT TOLERANCE AND PRODCUTIVITY OF SOME BARLEY VARIETIES UNDER TWO IRRIGATION WATER SALINITY LEVELS AT RAS SUDR

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ABSTRACT

Four field experiments were carried out in Ras Sudr Research Station, DRC during 1999/2000 and 2000/2001 winter growing seasons to evaluate eight barley varieties under two salinity levels of irrigation water (8000 and 11000 ppm) in calcareous soil. Data of growth recorded at 80 days after sowing cleared that, raising level of irrigation water salinity greatly decreased each of plant height, number of tillers/plant, number of leaves /plant and leaf area/plant but, increased leaves dry weight/plant. Also, at harvest, yield and yield components were decreased due to raising level of irrigation water salinity.

Generally, results pointed to the relative growth vigor for ICARDA-1 and Beecher barley CVS compared with the other barley varieties were tested under the two levels of irrigation water salinity and followed by Giza 123 and Rihane 0.3. Results showed the superiority of ICARDA-1 and Beecher in yeild components except grain numbers/spik, where Giza 123 was at par with ICARDA-1 and Beecher under both levels of irrigation water salinity.

ICARDA(1) and Beecher were higher and more than the other barley varieties in leaves chemical contents i.e. proline, Mg and SO_4 except chlorid. And these varieties were more tolerance for salinity where K/Na ratio was more than one compared with the other barley varieties were tested under the same conditions.

INTRODUCTION

Under arid conditions, irrigation crops with poor quality water must induce a certain amount of salinization of the plants. The strategy in Egypt seeks this expansion in Sinai where an area of about 0.6 million faddans is proposed to be cultivated with relatively low quality irrigation water through El-Salam canal (Gomaa, 1992). Many of the reclaimed areas have poor productivity due to its irrigation with underground saline water. The total production of barley for these areas can be improved by introducing high yielding varieties that show high adaptability to such stress conditions.

Salinity is one of the biotic stress factors that reduce the value and productivity of considerable area in many arid and semi-arid regions of the world, as well as is considered as the major limition on growth and yield of many crop plants, in these regions (Cheesman, 1988). Crop plants differ in salt tolerance exist not only among different genus and species but even within a species which may be considered salt sensitive (Epstein *et al.* 1980). However, salinity has an inhibitory effect on growth, chemical contents in leaves and yield as well as yield attributes of many crops in differentially responses (Perez – Alfocea *et al.*, 1993). Also, adverse effects on yield and its components of barley were observed in different barley cultivars grown under saline conditions. The reduction in growth and yield characters in

barley with increasing salinity levels has been reported by many investigators (Schaller *et al.*, 1981), Ahmed, 1986 and Ahmed *et al.*, 1998).

The main objective of the present investigation aimed to estimate growth, leaves chemical, content measured at 80 days after sowing, yield and yield attributes of eight barley varieties under two irrigation water salinity levels at Ras Sudr, South of Sinai.

MATERIALS AND METHODS

Four field experiments were carried out in Ras Sudr Research station, D.R.C. at South Sinai Governorate, Egypt, during the two winter growing seasons of 1999/2000 and 2000/2001. The study aimed to define the most productive bread barley cultivars among the tested eight varieties ICARDA-1. Giza 121, Giza 123, Giza 126, Giza 125, Rihane-03, California Mariout and Beecher (USA), when grown in calcareous soil under two irrigation water salinity levels average i.e. 8000 and 11000 ppm of under ground water used. The tested barley varieties were estimated under each level of water salinity in separate experiment every season. Complete block design with three replicates was used. In both seasons, the soil was follow during the summer season. The sowing date was 30 November in both seasons. Where, seeds at rate 80 kg / fed were drilled in rows distanced at 15 cm a part with 5 m length. Each plot included 20 rows i.e. the plot area was 15 m^2. Triple super phosphate (37.5% P_2O_5) and potassium sulphate (50% K_2SO_4) at rate of 100 kg/fed. for each were added before sowing. Also, nitrogen as ammonium sulfate (21.6% N) was added at rate of 80 kg N/fed. in three equal doses at sowing, tillering, and booting stages. Harvest was made on April 5 in both seasons. Other cultural practices were applied as usual in barley field under calcareous soil conditions.

To study the effect of irrigation water salinity level on growth traits for the tested varieties, vegetative sample of 10 competitive tagged plants were taken at 80 days after sowing from the 2^{nd} pair rows for each plot. The individual plants were used to measure the growth characters i.e. plant height, number of tillers / plant, number of leaves / plant, leaves dry weight gm/plant and leaf area (cm^2) /plant. Some chemical contents of leaves were determined in dry samples after 80 days i.e. K/Na ratio, Mg^{++}, Cl^- and SO_4 at ppm according to Bates *et al* 1973 in fresh leaves. These leaves chemical contents were related to salt tolerance of cerial crops and with other chemical as glycine betine, allcholic suger .... Etc. and it uses of some characters to the selection cratirea for the salt tolerance.

Also, at harvest, 10 competitive tagged plant were taken from the fourth inner row of each plot to count number of spikes/plant, and number of grains/ spike. Meantime, an area of 3 m^2 was harvested from the middle 10 rows of each plot to determine number of spikes/m^2, 1000-grain weight, grain and straw yields/fad.

Soil chemical analysis of the experimental field in both seasons 1999/2000 and 2000/2001are shown in Table (1).

Table (1) : Soil chemical analysis of the experimental fields in 1999/2000 and 2000/2001 seasons.

Seasons	EC mmhos cm	PH	$CaCO_3$ %	Available N, P, K, Ca and Mg (ppm)					Organic matter %	SAR %
				N	p	K	Ca	Mg		
1999/2000	7.8	7.13	22.0	3.01	1.81	6.09	18.5	1.0	0.5	13.9
2000/2001	8.4	7.41	22.7	3.04	1.84	7.00	19.0	1.1	0.6	14.0

EC[4] = Electric conductivity measured as ds/m decisiemens/mi.em mhos/25C°.

Average chemical analysis of under ground water irrigation water at Ras Suder over two growing seasons for two levels are shown in Table (2).

Table (2): Average chemical analysis of underground irrigation water at Ras Sudr averaged over the two growing seasons for two levels of salinity.

Salinity levels	pH	T.D.S (ppm)	Cations (mg/L)				Anions (mg/L)		
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
Low	7.7	8100	8.9	9.4	21.0	0.91	41.0	2.9	3.0
High	7.8	11050	13.8	14.5	39.0	1.04	57.0	4.0	4.6

Table (3): A list of barley varieties which used in the experiments.

No.	Name and Pedigree	Origin
1	ICARDA-1 Harmal-03 / Beecher	ICARDA
2	Giza 121	EGYPT
3	Giza 123	EGYPT
4	Giza 126	EGYPT
5	Giza 125	EGYPT
6	Rihane-03 AS 46 // AVT / A / hs	ICARDA
7	California Mariout	EGYPT
8	Beecher Introduced to Egypt and named Giza 118	USA

The obtained data were subjected to standard analysis of variance for randomized complete block design. Snedecor and Cochran 1967. Duncan multiple range test was used to compare means as described by Steel and Torrie, (1960).

RESULTS AND DISCUSSION

Data in Table (4) show the effect of irrigation water salinity levels on some growth traits for the tested barley cultivars recorded at 80 days after sowing.

The data show growth parameters went on decreasing due to increasing salinity levels of irrigation water from 8000 to 11000 ppm except that of the dry weight of leaves. The magnitudes of reduction differed from trait to another. The highest reduction was observed with number of tillers/plant, which accounted 29.4 and 21.1% to in the first and second season, respectively. The last reduction was occurred with plant height.

Table (4) : Effect of irrigation water salinity level (8000 and 11000 ppm) on growth characters for some barley cultivars in 1999/2000 and 2000/2001 growing seasons.

Main effects	Plant height/cm		No. of tillers/plant		No. of leaves/plant		Leaves dry weight plant (gm)		Leaf area/plant (cm^2)	
	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001
	Low level of irrigation water salinity 8000 ppm									
(1) ICARDA-1	66.4 a	74.1 a	3.5 a	3.7 a	10.9 a	11.4 a	6.07 a	6.26 a	14.7 a	14.9 a
(2) Giza 121	46.0 d	54.1 d	2.1 d	2.3 d	9.6 d	9.9 d	5.41 c	5.66 bc	12.8 c	12.5 d
(3) Giza 123	61.3 b	70.0 b	3.1 b	3.3 b	10.3 bc	11.0 b	5.49 bc	6.00 b	14.0 b	14.1 ab
(4) Giza 126	50.1 d	53.1 d	2.2 cd	2.4 cd	8.5 e	9.4 e	5.30 c	5.50 c	12.4 f	12.4 d
(5) Giza 125	56.1 c	63.6 c	2.5 c	2.7 c	10.0 cd	10.0 cd	5.70 b	5.80 b	13.1 d	13.2 cd
(6) Rihane-03	55.1 c	65.0 c	2.6 c	2.7 c	10.0 cd	10.3 c	5.75 b	5.90 b	13.5 c	13.6 bc
(7) California	55.1 c	64.0 c	2.6 c	2.6 cd	9.6 d	9.8 d	5.41 c	5.75 bc	12.8 e	12.6 d
(8) Beecher	66.0 ab	74.0 ab	3.4 ab	3.6 ab	10.8 ab	11.2 ab	6.10 a	6.40 a	14.5 a	14.6 ab
F-test	**	**	*	*	*	*	*	*	*	*
LSD 0.05	4.98	4.00	0.35	0.31	0.54	0.36	0.29	0.20	0.56	0.68
	High level of irrigation water salinity 11000 ppm									
(1) ICARDA-1	60.4 ab	64.1 a	2.4 a	2.6 a	8.4 a	9.0 a	6.79 a	6.99 a	13.0 a	12.5 a
(2) Giza 121	44.0 d	49.3 b	2.0 b	2.1 bc	7.4 bc	7.6 c	5.60 c	5.75 cd	10.0 d	9.0 d
(3) Giza 123	55.5 b	68.1 a	2.1 ab	2.3 b	8.1 ab	8.5 b	6.15 bc	5.45 d	12.1 b	11.8 b
(4) Giza 126	47.1 cd	49.9 b	2.0 b	2.0 c	7.0 c	7.1 d	5.75 bc	6.00 c	10.2 d	9.4 d
(5) Giza 125	51.4 bc	53.1 b	2.3 ab	2.4 ab	8.0 ab	7.9 c	6.00 bc	6.10 c	11.0 c	10.5 c
(6) Rihane-03	50.9 bc	54.2 b	2.2 ab	2.5 ab	7.8 b	7.9 c	6.25 b	6.50 b	11.2 c	10.4 c
(7) California	44.4 d	48.9 b	2.0 b	2.2 bc	7.4 bc	7.6 c	5.60 c	5.75 cd	10.2 d	9.0 d
(8) Beecher	61.3 a	63.5 a	2.5 a	2.7 a	8.5 a	9.0 a	7.00 a	7.10 a	13.4 a	12.6 a
F-test	**	*	*	*	*	*	*	*	*	*
LSD 0.05	4.80	5.80	0.32	0.28	0.50	0.48	0.50	0.35	0.75	0.65

There was significant reduction in leaf area/plant, but increasing the level of irrigation water salinity increased leaves dry weight of plant. This means the subjecting the barley plant to more stress by increasing irrigation water salinity level, the plant produced more thicked leaves. The reductions in these growth characters were resulted from the decreased in net photosynthesis, stomatal conductance and transpiration rate when barley plants were subjected to water stress condition. This was explained by Naire and Khuble (1990) and Cheesman (1988).

Under the low level of irrigation water salinity, results of two seasons indicated that ICARDA-1 and Beecher c.v. had the tallest plants followed by Giza 123 one then Giza 126, 125 and California cv. This was also the same under high level of irrigation water salinity but with one exception in each season. Where, there were no significant differences in plant height among Giza 125 and Rihane-03 cvs in the first season, as well as, between the ICARDA-1 and Beecher cvs in the two seasons.

Similar to plant height when plants were irrigated by water of a low salinity level, data of the two seasons also cleared that ICARDA-1 and Beecher cvs could produced the highest number of tillers/plant followed by Giza 123 cv too.

Whereas, the two cultivars of Giza 121 and 126 produced the lowest number of tillers / plant. While, under high level of irrigation water salinity, there were light significant differences in number of tillers/plant among the group of Giza cvs and Rihane-03 in the first season as well as among Giza 125 and Rihane-03, there were no significant differences between them. ICARDA-1 and Beecher had much tillers/plant than the rest tested cvs in both season.

Recorded data in both seasons and under both water irrigation salinity levels indicted that ICARDA-1 and Beecher cvs had the highest number of leaves/plant followed by Giza-123. While, in regard to leaves dry weight/plant, also, ICARDA-1 and Beecher had heavier leaves dry weight/plant compared with the rest cvs, and followed by Giza 123 and Rihane-03 and this was true in both seasons and under both two levels of irrigation water salinity.

Also, the obtained data clearly show that ICARDA-1 and Beecher cvs had the larger leaf area/plant followed by Giza 123. This was true during both seasons and under irrigation water salinity levels, compared with the other barley varieties under the same conditions.

Regardless leaves dry weight/plant, results showed a diversity among the tested barley cultivars in the relative decrease of the other growth traits recorded here due to raising levels of irrigation water salinity. This finding indicating to the importance of certain cultivar to be stock to improve specific growth trait for sat tolerance. For instance, the two barley cultivars i.e. ICARDA-1 and Beecher recorded the lowest relative reduction followed by Giza 123 in all traits studied in both seasons when increased the level of irrigation water salinity from 8000 to 11000 ppm. Under the same condition of this work, most of the obtained results were in harmony with those of Naire and Khuble (1990) and Perez-Alfocea *et al* (1993) as well as Afiah and Abdel Hakim (1999).

B. Leaves chemcial contents :

Data which pertaining the effect of irrigation water salinity level on leaves chemical contents measured at 80 days after sowing for the tested barley varieties are presented in Table (5).

So, potassium $(K)^{+}$, Magenisium $(Mg)^{++}$, Chlorid $(Cl)^{-}$ and sulfate $(SO_4)^{--}$ were determined in dry leaves. But, the proline content was determined in fresh leaves.

The results showed clearly that, increasing stress from 8000 ppm to 11000 ppm increased significantly proline, Magnisum, Chlorid and Sulfate in both seasons in the same age. 80 days after sowing. The data indicated that, increasing irrigation water salinity level from 8000 to 11000 ppm gave the differences in K/Na ratio under every level of salinity in water due to the variance between barley varieties.

The studied barley genotypes were significantly differed regarding the leaves chemicals contents i.e. proline, K/Na ratio, Mg, SO_4 and Cl which of fresh and dry leaves weight in the same sample (80 days after sowing). Some varieties such as ICARDA-1 and Beecher followed by Giza 123 cvs were more tolerant to salinity stress in both seasons and under both two salinity levels of irrigation water. Since, they accumilated significantly more proline, Mg^{++} and SO^{--} and less accumulated significantly Cl^{-} chloride, also K/Na ratio more than one unit compared with the other barley varieties followed by Giza 123 and Rihan-03.

In both seasons and under the two salinity levels i.e. 8000 and 11000 ppm, barley genotypes differed significantly in their leaves contents of proline, chlorid and sulfate as well as Magnisium and K/Na ratio which could be used as selection criteria for salinity tolerance.

The salt tolerant genotypes i.e. ICARDA-1 Beecher and Giza 123 accumulated more proline, Mg, sulfate and highest K/Na ratio more than one unit but lower chloride and Na contents in leaves by increasing irrigation water salinity from 8000 to 11000 ppm under Ras Sudr conditions.

C. Yield and its components

Data in Table (6) show the effect of irrigation water salinity level on yield and yield components for the tested barley varieties.

C.1. Effect of increasing level of irrigation water salinity

Like as in the most growth traits and leaves chemical contents (Table 3 and 4), results in Table (5) showed great decreases in yield and yield components due to raising level of irrigation water salinity. This was true in the two seasons. Increasing the level of water salinity from 8000 to 11000 ppm decreased the grain yield by 37.1 and 46.1% in the first and second seasons, respectively. Most of these reductions resulted from the reductions in spike numbers $/m^2$ and number of grains per spike rather than the reduction in 1000-grain weight which seems to be more stable to the environmental changes. Straw yield showed also reductions amounted to more than one third in both seasons. This was also a function of the reduction in plant height in a minor magnitude due to tillering capacity of relatively major magnitude.

Table (5) : Effect of irrigation water salinity on leaves chemical contents of barley varieties was measured at 80 days after sowing during both growth seasons.

Main effects	Proline ppm		K/Na ratio		Mg ppm		Sulfat SO_4 ppm		Chlorid Cl ppm	
	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001
	Low level of irrigation water salinity 8000 ppm									
(1) ICARDA-1	591 a	630 a	1.31 a	1.21 a	311b	300 bc	290 a	288 a	280 b	288 ab
(2) Giza 121	415 c	511 d	0.98 b	1.00 b	281 e	299 bc	260 b	267 b	280 b	291 ab
(3) Giza 123	591 a	630 a	1.00 ab	1.00 b	311b	321 b	280 ab	270 ab	290 a	300 a
(4) Giza 126	512 b	600 b	0.76 ab	0.89 b	300 c	296 bc	210 d	220 c	280 b	275 b
(5) Giza 125	560 ab	560 c	1.00 ab	1.00 b	290 d	300 bc	280 ab	275 ab	210 d	240 c
(6) Rihane-03	500 b	600 b	1.00 b	1.00 b	308 dc	310 b	240 c	260 b	290 a	280 ab
(7) California	500 b	560 c	0.88 b	0.98 b	265 f	280 c	250 bc	260 b	280 b	290 ab
(8) Beecher	591 a	624 ab	0.99 b	1.05 ab	340 a	355 a	300 a	290 a	220 c	230 c
F-test	**	**	*	*	**	**	*	*	*	*
LSD 0.05	65.0	28.0	0.32	0.20	8.0	25.0	30.0	23.0	10.0	25.0
	High level of irrigation water salinity 11000 ppm									
(1) ICARDA-1	640 a	660 a	1.31 a	1.21 a	350 b	310 de	299 a	320 a	300 ab	310 ab
(2) Giza 121	500 c	520 d	1.00 b	1.00 bc	299 cd	300 e	280 b	288 b	300 ab	305 b
(3) Giza 123	599 ab	658 ab	0.99 b	1.00 bc	310 cd	320 cd	300 a	300 ab	310 a	320 a
(4) Giza 126	535 c	600 bc	0.79 b	0.85 c	320 c	310 de	230 c	240 c	295 b	295 b
(5) Giza 125	588 b	590 bc	1.00 b	1.05 ab	329 bc	350 b	300 a	295 ab	240 c	268 c
(6) Rihane-03	500 c	620 b	1.00 b	1.00 bc	328 bc	330 c	270 b	280 b	300 ab	310 ab
(7) California	530 c	580 c	0.95 b	1.00 bc	288 d	299 e	270 b	290 b	300 ab	320 a
(8) Beecher	600 ab	630 ab	0.98 b	1.11 ab	380 a	370 a	310 a	299 ab	240 c	250 c
F-test	*	*	*	*	**	**	*	*	**	**
LSD 0.05	45.0	40.0	0.30	0.18	0.30	0.18	18.0	30.0	15.0	15.0

Table (6) : Effect of irrigation water salinity (8000 and 11000 ppm) on yield and yield attributes of some barley varieties at Ras Suder during two growing seasons 1999/2000 and 2000/2001.

Varieties	No. of spikes/m²		No. of grains/spike		100 grain weight		Grain yield(ardab)/fed		Straw yield(ton) /fed.	
	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001	1999/2000	2000/2001
	Low level of irrigation water salinity 8000 ppm									
(1) ICARDA-1	230 a	240 a	36.8 a	40.7 a	34.4 a	35.1 a	10.9 a	11.3 a	2.7 a	2.9 a
(2) Giza 121	188 cd	200 b	30.1 bc	31.1 bc	28.1 cd	27.1 b	5.8 d	6.2 c	1.1 d	1.3 cd
(3) Giza 123	217 b	225 ab	36.1 ab	37.5 ab	32.1 b	31.4 ab	9.6 b	10.2 b	2.2 b	2.3 b
(4) Giza 126	180 d	199 b	30.1 bc	31.4 bc	27.9 d	27.5 b	6.1 d	6.8 d	1.3 cd	1.3 cd
(5) Giza 125	198 c	200 b	33.1 b	35.1 b	30.1 c	29.1 b	8.1 c	8.9 c	1.6 c	1.8 bc
(6) Rihane-03	191 cd	205 b	34.1 ab	36.1 ab	30.0 c	30.1 b	7.9 c	8.6 c	1.6 c	1.7 c
(7) California	170 d	200 b	29.1 c	30.1 c	27.0 d	27.1 b	4.0 e	5.9 d	1.0 d	1.1 d
(8) Beecher	230 a	245 a	35.7 ab	39.4 ab	33.9 ab	34.9 a	9.6 b	9.9 b	2.5 ab	2.6 ab
F-test	**	*	**	**	**	**	**	**	**	**
LSD 0.05	12.0	35.0	3.2	4.9	2.1	4.5	1.2	1.0	0.45	0.55
	High level of irrigation water salinity 11000 ppm									
(1) ICARDA-1	190 ab	199 a	31.7 a	32.1	31.4 a	35.1 a	4.8 a	5.4 a	1.2 a	1.3 a
(2) Giza 121	180 b	181 b	30.1 ab	31.1	30.1 b	30.0 b	3.9 ab	4.4 ab	1.0 ab	1.1 ab
(3) Giza 123	131 e	141 d	28.1 ab	27.1	26.1 c	25.1 c	2.0 c	1.8 c	0.5 c	0.6 c
(4) Giza 126	145 d	141 d	27.1 b	28.1	25.7 c	24.6 c	2.2 c	1.9 c	0.6 bc	0.5 c
(5) Giza 125	180 b	165 c	30.7 ab	30.9	28.1 bc	27.1 bc	2.7 bc	3.0 bc	0.7 bc	0.9 bc
(6) Rihane-03	161 c	175 bc	29.1 ab	30.1	29.1 bc	29.6 bc	3.0 bc	3.3 bc	0.9 b	1.0 b
(7) California	168 c	140 d	27.0 b	28.0	25.1 c	24.1 c	2.0 c	1.7 c	0.4 c	0.5 c
(8) Beecher	191 a	195 ab	30.9 a	31.9	31.3 a	33.0 ab	4.6 a	4.8 ab	0.9 b	1.2 ab
F-test	**	**	*	N.S	**	**	**	**	**	**
LSD 0.05	10.0	16.0	3.5		1.3	5.0	1.7	2.1	0.3	0.29

C.2. Varieties effect

It is evident from recorded data that ICARDA-1 and Beecher cvs produced much number of spikes/m^2 than the rest tested varieties except Giza 123 in the two seasons and under both salinity levels, low and high irrigation water where, differences between them in this trait did not reach to the significance level. Meantime, the two cvs of Giza 121 and 126 recorded lower number of spikes as compared with the rest varieties in most cases.

Meantime, results showed no differences between the ICARDA-1 and Beecher cvs and other barley cultivars in number of grains/spike under the two levels of irrigation water salinity over the two seasons. This was also the same comparison among ICARDA-1 and Beecher compared with Rihane-03 in two seasons and under levels of salinity used However, the three Giza varieties i.e. Giza 121, 126 and Giza 125 were similar in having the lowest number of grains/spike over the two seasons under the low level of irrigation water salinity. Also, under high level of irrigation water salinity ICARDA-1 and Beecher had many grain numbers/spikes than the other barley varieties over both seasons. Here, it can be conclude that the competition between spikes and grains of the spike on assimilate was not severe. Since, the cultivars that produced much spike numbers/m^2 attained also higher grain numbers/spike even with the rais in irrigation water salinity level. This may be due to the lower number of spikes/m^2 under both conditions.

As in number of grains/spike, results indicated that ICARDA(1) and Beecher cvs had heavier grain than the other tested barley cvs followed by Giza 123 and Rihane-03 under high levels of irrigation water salinity during both seasons. Where, there was no difference between both these cvs in this respect. Also, the differences among Giza 123 and the cvs of Giza 121, 126 and 125 under both seasons and under both the levels of irrigation water salinity did not reach the significance different between of them.

Under, the conditions of the present study, the ICARDA-1 and Beecher barley cvs superiority of cvs having higher number of spikes m^2 and higher number of grains/spike in grain weight too, point to the low competition among these components on assimilates during maturity.

Accordingly, under low level or irrigation water salinity, results cleared that ICARDA-1 and Beecher barley cvs could produce the highest grain and straw yields/fed. followed by Giza 123 and Rihane-03, cvs then Giza 125 and California Mariout cultivars, the two Giza 125 and Giza 121 were similar in giving the lowest values of both yields. This was true in the two seasons. While, under high level of irrigation water salinity, the tested two cvs of ICARDA-1 and Beecher produced comparable grain and straw yields/fed. over the two seasons. However, ICARDA-1 cv out yielded the rest cvs in both seasons. Meantime, the Giza 123 cvs surpassed the other Giza cvs in this respect over the two seasons. These results could be ascribed to the superiority of the other barley cultivars tested in yield and its components. Similar results were previously obtained under saline conditions by Epstein *et al* (1980), Schaller *et al* (1981), Rawson *et al* (1988), Richards *et al* (1997) Ahmed *et al* (1998).

Finally, it is worthy to note that the relative decreases in different yield components due to raising the level of irrigation water salinity reflected a

great diversity among the tested cultivars in salt tolerance over the two seasons, it is worth mentioning that all yield components were reduced due to increasing salinity level from 8000 to 11000 ppm. The grain yield was reduced by more than 40% reaching 50% in Giza 126 in the second season. Yield of Giza 125 went down by >49% in both seasons. Also, using 8000 ppm salinity level of irrigation water. Back to Table (4), under this condition ICARDA-1 and Beecher cvs produce higher yield followed by Rihane-03 and Giza group and the lowest yield was of Giza 126 and California Mariout. These indicate that this order of tolerance can be read as ICARDA-1 and Beecher followed by Giza 123 more tolerant than the other barley varieties tested in this study. When the salinity level increased to be very saline water, all the eight barley cultivars produced reduced yields and rate of reduction was 40% and more. Also, yield components went on reducing due to increasing the level of irrigation water salinity. Both Spike numbers/m^2 and grain numbers/ spike caused most of the reduction in grain yield rather than 1000 grain weight (gm).

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تقدير تحمل الملوحة والإنتاجية فى بعض أصناف الشعير تحت مستويين من ملوحة مياه الرى فى رأس سدر

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أقيمت أربعة تجارب حقلية فى محطة بحوث رأس سدر (جنوب سيناء) مركز بحوث الصحراء فى موسمى ١٩٩٩/٢٠٠٠ ، ٢٠٠٠ / ٢٠٠١ فى تربة جيرية تروى بماء آبار ملوحتها ٨٠٠٠ و ١١٠٠٠ جزء فى المليون وقد زرعت ثمانية أصناف من الشعير هى إيكاردا-١ ، جـ١٢١ ، جـ١٢٣ ، جـ١٢٥ ، جـ١٢٦ ، Rihane-03 ، California Mariout والصنف Beecher وذلك لتقييم درجة تحملها لملوحة مياه الرى فى هذه المنطقة وقد استخدم لذلك تصميم القطاعات كاملة العشوائية.

أخذت عينات خضرية بعد ٨٠ يوم من الزراعة مكونة من ١٠ نباتات لتقدير بعض صفات النمو وكذا تقدير حمض البرولين فى الأوراق الخضراء وتم تجفيف جزء من العينة لتقدير بعض محتويات الأوراق من العناصر التالية : نسبة البوتاسيوم : الصوديوم ، تركيز المغنسيوم ، تركيز الكلوريد وتركيز الكبريتات.

وعند الحصاد تم تقدير بعض مكونات المحصول : عدد سنابل / م^2، عدد حبوب السنبلة وزن ١٠٠٠ حبة (جم).

وكذلك أخذت مساحة ٣ متر مربع من كل قطعة تجربة لتقدير محصول الحبوب (أردب) / فدان ومحصول القش بالطن / فدان.

وكانت أهم النتائج المتحصل عليها هى :

عموما ١- أثرت الملوحة على طول النبات وعدد الأفرع وعدد الأوراق/نبات حيث كانت أقل فى الأصناف جـ١٢٥ ، جـ١٢٦ ، جـ١٢١ بينما كانت الأصناف ايكاردا-١ ، Beecher ، جـ١٢٣ أكثر تحملا للملوحة.

٢- فى الأوراق الخضراء زاد تركيز حمض البرولين وفى الأوراق الجافة زاد تركيز المغنسيوم والكلوريد والكبريتات وكذلك نسبة البوتاسيوم إلى الصوديوم وكانت هذه الزيادة واضحة فى أصناف ايكاردا(١) ، Beecher ، جـ١٢٣ أكثر منها فى باقى الأصناف.

٣- حدث نقص فى المحصول نتيجة الرى بمياه تركيزها ١١٠٠٠ جزء فى المليون ، مقارنة بالرى بمياه تركيزها ٨٠٠٠ جزء فى المليون وذلك فى كلا موسمى الزراعة ، وكان التدرج فى قيمة المحصول ومكوناته من الأكثر إلى الأقل فى الأصناف ايكاردا-١ ، Beecher ، جـ١٢٣ مقارنة بباقى الأصناف.

يمكن القول بأن أصناف الشعير ايكاردا-١ ، Beecher ، جيزة ١٢٣ أكثر تحملا لملوحة مياه الرى أكثر من باقى الأصناف المستخدمة فى هذه الدراسة.