Minufiya J. Agric. Res. Vol. 32 No.5: 1239 - 1264 (2007)

RESPONSE OF SOME BARLEY GENOTYPES TO SALINIZED WATER

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(Received: Aug. 19, 2007)

ABSTRACT: *Two pot experiments were carried out during two successive seasons 2005 /2006 and 2006/2007 at the experimental farm, faculty of Agriculture, Minufiya University to evaluate the salt tolerance of ten barley genotypes such as Minufiya 4, Minufiya 6, Minufiya 7, Minufiya 11, Minufiya 12, Minufiya 13, Minufiya 14, Minufiya 16, Minufiya 19 and Minufiya 39 which were grown under four levels of salinity i.e., 0.0, 5000, 10000 and 15000 mg/l of a mixture of NaCl and $CaCl_2$. The obtained results indicated that the significant increase in all growth aspects, total water content (TWC %), relative water content (RWC%), the concentrations of chlorophyll, total soluble sugars (TSS), total carbohydrates, proline, total free amino acids (TAA), N, P, K concentrations and yield attributes at the lowest level of salinity, meanwhile, the lowest values of Na%, osmotic pressure (OP) and heading date were detected as a result of the application of the lowest level of salinity in both seasons On the other hand, the two barley genotypes M. 16 and M. 39 decrease in the above mentioned characters except Na % which was found to be increased with increasing salinity levels. Significant differences were detected among genotypes in all characters under study expect TWC and TSS which were found to be insignificant. The genotype M. 6 had the highest values of TWC, Gs. M. 6, M.7 and M. 11 showed the highest values of RWC, meanwhile the highest values of OP where obtained by M. 39 and M. 19. The interaction of salinity with genotypes was significant for flag leaf area, fresh and dry weight / plant, total chlorophyll (chl. a + b), carotenoids, TSS T.C, proline, TAA, N, P, K % and weight of grains / plant. Spike length, spike No./ plant, spikeletes No./spike, grains No. / spike, grain yield / plant and 100-grains weight were varied significantly due to salinity and the different genetic background of the barley genotypes while the interaction was not significant. G. M. 13 accumulated the lowest value of Na% indicating that this barley genotype showed more tolerance to salinity, meanwhile G. M. 39 was found to be less. G. M. 4 recorded the lowest number of days to heading at the level 5000 mg / L. The three barley genotypes M.4, M. 7 and M. 11 could be considered as more salt tolerant.*

Key words: *Barley genotypes, Salt stress, water relations, carbohydrates, proline, heading date and yield.*

INTRODUCTION

Barley (*Hordeum vulgaries* L.) is one of the major cereal crops for human and animal feeding as well as in molt production. Therefore, more efforts and studies should be done to improve its production.

Soil salinity is a major environmental stress limiting plant growth and crop productivity. It alters a wide array of metabolic processes in growing plants (Hamdia and El-Komy 1998, Del Zoppo *et al.*, 1999 and Goicocchea *et al.*, 2000), Many investigators reported that salinity has inhibitory effects on growth, yield and the productivity of many cereal crops, such as wheat (Abdel-Aleem *et al.*, 1994, Selim *et al.*, 1996 and Olao *et al.*, 1999), barley (Salib *et al.*, 2002 and Selim and El-Gamal 2004)

The aim of the present work was to study the salt tolerance of some barley genotypes grown in artificial salinized soil and investigate the effects of salt on growth characters, some physiological and chemical compositions as well as yield and its attributes of some barley genotypes to identify their salinity tolerance.

MATERIALS AND METHODS

Two pot experiments were performed at the Experimental Farm, Faculty of Agriculture Shibin El- Kom during the winter seasons of 2005/2006 and 2006/2007 to study the salt tolerance of ten barley genotypes such as Minufiya 4, Minufiya 6, Minufiya 7, Minufiya 11, Minufiya 12, Minufiya 13, Minufiya 14, Minufiya. 16, Minufiya. 19 and Minufiya. 39. The pedigree of the ten barley genotypes are presented in table (1) these ten barley genotypes have been taken from Khatab A. B. (unpublished data) crop, science dept. Silty clay soil was used in these experiments. Some physical and chemical properties of this soil determined according to Jackson (1967) and are given in Table (2).

Table (1): The pedigree of the tested barley genotypes:

Genotype	Pedigree	Pure line	
G. 1	26692 xIDa	Minufiya 4	(M. 4)
G. 2	K 700 202 x K 128	Minufiya 6	(M. 6)
G. 3	K 18377 X wing	Minufiya 7	(M. 7)
G. 4	K 19991 x K 26692 // IR iar	Minufiya 11	(M. 11)
G. 5	K 1126 x K 128	Minufiya 12	(M. 12)
G. 6	K 19991 / K6692 // K 1991 / IRiar	Minufiya 13	(M. 13)
G. 7	K 700202 // K 19991 IR iar	Minufiya 14	(M. 14)
G. 8	K19991/ IR iar // K- 18377/wing 12	Minufiya 16	(M. 16)
G. 9	K19991/ IR iar // K- 18377/wing 15	Minufiya 19	(M. 19)
G. 10	K19991/ IR iar // IR iar //125	Minufiya 39	(M. 39)

Table (2): Physical and chemica properties of the soil.

Property	Volume
a) Physical properties:	
Sand (%)	5.63
Silt (%)	43.6
Clay (%)	49.07
Ca CO3 (%)	1.7
b) Chemical properties:	
pH	7.58
E.C mmhs /cm	0.52
C.E. C mg / 100 g	30.2
Organic matter	1.56
Soluble ions	mg/100 gm soil
Cations	30.2
Ca^{++}	1.30
Mg^{++}	1.01
Na^{+}	1.21
K^{+}	
Anions	-
Co^{-}_{3}	1.1
HCO^{-}_{3}	1.5
Cl^{-}	

Ten grains of each genotype were sown on December 25th 2005 and 10th of December 2006 respectively, in plastic pots , 25 cm inner diameter and 30 cm depth, the pots were fulled with 6 kg dry silty clay soil. Forteen days after sowing, the seedlings were thinned to three uniform plants per each pot. Pots were irrigated with salinized water as a mixture of NaCl and Ca Cl_2 at the ratio of 1 : 1 at 5000, 10000, 15000 mg / l and tap water as a control. Soil moisture was kept at 65 % of total water holding capacity of the soil during the experimental period. All pots were fertilized with NPK at a rate of 1.2, 0.77 and 1.46 g/pot, respectively. Superphosphate was applied before planting while nitrogen in the form of ammonium nitrate (33 % N) and potassium in the form of potassium sulphate (48% K_2O) were applied after sowing as recommended. Each experiment included 40 treatments (10 genotypes and 4 levels of salinity) The design of the experiment was split plot with six replicates (three for growth, leaf water relations and chemical constituents and the other three replicates for yield and its components). The genotypes were arranged randomly as main plot, whereas salinity treatments were distributed randomly as sub plots. Six plant samples were taken randomly 85 days after sowing to determine the following parameters:-

1- Vegetative growth parameters:-

Plant height (cm), number of leaves and tillers / plant, flag leaf area (cm^2), fresh and dry weight of plant (g) (oven dried at 70°C for 72 hrs).

2- Leaf water relations:-

Total water content (TWC%) and osmotic pressure (in atm.) were measured according to Gosev (1960). Relative water content (RWC %) was determined using the method described by Barris and Weatherly (1962).

3- Chemical constituents :-

3.1. Photosynthetic pigments (Chlorophyll a + b and carotenoids) was extracted from fresh leaves using actone 85 % and estimated to Wettestein (1957), calculated as mg/ g dry weight.

3.2. Total soluble sugars and total carbohydrates, were estimated in dried shoots using the method described by Dubois *et al.* (1956).

3.3. Free proline in fresh leaves extracted and estimated as described by Bates *et al.*, (1973)

3.4. Total free amino acids (TAA) in dried shoots were determined according to Rosen (1957).

3.5. Minerals: 0.2 g of dried shoot was digested in $H_2 So_4$, H_2O_2 (5 : 1) for chemical analysis of minerals, N, P, K and Na, Total nitrogen was determined using micro-kjeladahel as described by A.O.A.C. (1985). Phosphorus as the method of Snell and Snell (1954), potassium and sodium was estimated using the flame photometer according to Allen (1974), then their concentrations (%) were calculated.

4- Heading date: Number of days from sowing to the first appearance of owns.

5-yield and its components :- At harvest (about 132 days from sowing) the following aspects were recorded, spike length (cm), number of spikes / plant, number of spikeletes / spike, weight of graines / spike, weight of graines / plant and 100- grain weight (seed index).

The obtained date were statistically analysis using the COSTAT program and the L.S.D. test at the probability levels of 5 % was calculated according to Gomez and Gomez (1984).

RESULTS AND DISUSSION

1- Growth Characters:-

The growth parameters of the ten barley genotypes are given in Tables (3, 4 and 5).

Concerning the effect of salinized water on the growth parameters of barley genotypes, the mean values showed that plant height, number of leaves and tillers / plant, flag leaf area and dry weight / plant significantly increased under the lowest level of salinity (5000 mg/ l) and then decreased as salinity increased up to 15000 mg/l.

Table (3): Effect of salinity levels on growth characters of barley plants during 2005/2006 and 2006/2007 seasons.

Characters / Salinity treatments (mg/l)	2005/2006						2006/2007					
	Plant height (cm)	No. of leaves/ plant	No. tillers / plant	Leaf area (cm^2)	Fresh wt. / plant (g)	Dry wt./ plant (g)	Plant height (cm)	No. of leaves/ plant	No. tillers / plant	Leaf area (cm^2)	Fresh wt. / plant (g)	Dry wt./ plant (g)
00 0	64.23	15.2	5.73	15.95	14.30	4.72	66.90	18.83	4.83	19.98	14.03	6.43
5000	73.86	19.26	6.90	19.09	17.82	6.16	69.93	23.03	5.63	22.68	17.03	5.01
10000	53.30	15.66	5.26	11.89	13.09	4.78	58.60	19.73	4.53	15.28	12.92	4.98
15000	45.50	12.16	3.70	8.04	8.29	3.04	51.40	14.23	3.16	10.36	8.75	3.40
L.S.D 5 %	2.68	1.62	0.71	0.60	1.34	0.28	4.74	1.33	0.79	0.90	0.89	0.45

Table (4): Genotypes vegetative growth characters as affected by salinity during 2005/2006 and 2006/2007 seasons.

Characters / Genotypes	2005/2006						2006/2007					
	Plant height (cm)	No. of leaves / plant	No. of tellers / plant	Leaf area (cm^2)	Fresh weight / plant(g)	Dry weight / plant(g)	Plant height (cm)	No. of leaves / plant	No. of tellers / plant	Leaf area (cm^2)	Fresh weight / plant(g)	Dry weight / plant(g)
M.4	71.24	14.58	5.58	17.22	15.24	4.34	66.83	17	5.25	18.82	15.15	4.7
M.6	60.25	15.75	5.25	16.92	14.28	4.85	64.25	14.25	4.16	10.67	15.01	4.89
M.7	72.0	14.58	6.58	14.50	14.66	5.69	73.75	18.66	5.66	23.48	14.07	5.16
M.11	70.5	19.25	5.83	19.43	15.55	6.47	73.75	19.16	4.83	18.94	15.8	5.46
M.12	67.25	17.25	5.5	17.70	15.66	4.85	69.00	22.75	5.41	17.07	15.74	6.83
M.13	57.41	14.50	4.91	9.46	12.09	4.94	57.00	24.00	3.91	16.67	13.01	4.97
M.14	50.16	18.75	5.66	9.73	13.49	4.44	52.50	22.83	4.58	15.84	13.46	5.88
M.16	42.25	14.33	4.66	9.97	10.51	3.22	52.50	16.00	3.16	15.15	10.56	3.89
M.19	50.25	14.41	5.75	7.29	11.48	4.17	56.25	16.00	4.83	11.61	11.58	4.07
M.39	52.5	12.33	4.25	21.26	10.51	3.76	51.25	13.91	3.58	14.57	8.60	3.67
L.S.D.5%	3.76	2.30	1.27	0.80	1.29	0.52	5.28	2.85	0.87	1.33	1.31	0.43

Table (5): The interaction effect between salinity levels and some barley genotypes on vegetative growth characters during 2005/2006 and 2006/2007 seasons.

Treatments		2005 / 2006					
Genotype	Salinity (mg/l)	Plant height (cm)	No. of leaves / plant	No. of tillers /plant	Leaf area (cm^2)	Fresh wt./ plant (g)	Dry wt./ plant (g)
M.4	0000	83	15	6.33	17.44	17.69	4.4
	5000	91.33	17.33	8.5	20.40	21.1	5.99
	10000	65.66	15.67	4.0	18.00	12.53	4.03
	15000	52.0	10.33	2.67	13.65	9.66	2.62
M.6	0000	65	14	4	19.01	14.19	4.89
	5000	73	19.33	6	16.15	21.12	6.81
	10000	58	17	5	19.90	12.03	4.66
	15000	45	12.67	3	6.75	9.8	3.04
M.7	0000	71.67	13.0	6	11.14	14.1	5.71
	5000	81.0	18.33	9	18.00	18.97	7.73
	10000	65	15	7	13.50	16.82	5.80
	15000	60	12	5	14.25	8.86	3.52
M.11	0000	77.67	19	5.67	18.56	11.11	5.13
	5000	92.67	24	8	28.35	22.53	9.67
	10000	66.33	19.33	6	18.00	18.7	6.85
	15000	51.33	14.67	4	14.17	9.72	4.24
M.12	0000	75	16	6	24.86	15.37	4.12
	5000	83	20	8	30.64	19.59	6.01
	10000	63	17.67	6.67	13.50	16.09	4.27
	15000	48	15.67	3.33	7.09	11.39	3.51
M.13	0000	61	13.0	6	7.84	13.81	4.63
	5000	67.67	19.33	7	12.07	17.65	6.37
	10000	56	15.0	5	5.40	11.07	4.64
	15000	45	10.67	3	3.67	5.82	2.96
M.14	0000	51	18.0	6.33	15.19	12.54	4.06
	5000	67	24.0	7.5	11.55	18.03	5.96
	10000	42	19.33	6.0	7.87	14.49	5.0
	15000	40.67	13.67	5	5.40	8.87	2.73
M.16	0000	53	18	5.0	10.72	14.35	4.16
	5000	47	15	4.33	12.75	12.48	3.7
	10000	37	13	4.0	9.45	9.62	3.13
	15000	32	11.33	3.0	7.20	4.58	1.92
M.19	0000	53	14	6.0	11.55	13.37	4.92
	5000	75	19.33	6.67	19.12	15.12	5.55
	10000	39	13.33	5.0	6.75	10.0	3.43
	15000	34	11.0	4.0	5.10	7.29	2.72
M.39	0000	61	12	6	28.12	16.6	5.1
	5000	52	16	5	23.15	10.57	3.89
	10000	50	11.67	4	21.00	9.2	3.37
	15000	47	9.67	3	14.02	6.97	2.71
L.S.D 5 %	Sal.× G.	7.50	N.S	N.S	0.1	2.58	1.04

Table (5): Continued.

Treatments		2006 / 2007					
Genotype	Salinity (mg/l)	Plant height (cm)	No. of leaves /plant	No. of tillers /plant	Leaf area (cm^2)	Fresh wt./ plant (g)	Dry wt./ plant (g)
M.4	0000	69	16	6	19.50	15.96	5.17
	5000	75.33	20	7	24.15	20.64	6.59
	10000	66	18	5	20.27	13.75	5.02
	15000	57	14	3	12.37	10.13	3.49
M.6	0000	70	16	4	14.40	14.64	4.93
	5000	74	25	5	13.65	21.35	6.33
	10000	60	23	4.33	9.90	14.73	4.73
	15000	53	13	3.33	8.25	9.32	3.65
M.7	0000	80	18	5	24.19	13.85	4.45
	5000	84	22.33	7	32.40	16.96	7.11
	10000	67	19.33	6	26.40	14.79	5.29
	15000	63	15	4.67	17.60	10.70	3.47
M.11	0000	81	18.67	5	17.06	14.27	4.78
	5000	85	23	6	29.32	21.0	7.06
	10000	75	19.67	5.33	17.50	16.51	5.78
	15000	55	15	3.0	13.50	11.45	4.25
M.12	0000	73	22	5	29.70	15.97	6.75
	5000	78	27	7	35.62	20.24	9.20
	10000	66	25	5.67	19.12	15.97	7.74
	15000	59	17	4	11.55	10.81	3.65
M.13	0000	57	23	4	19.95	13.72	4.84
	5000	66	30	5	25.31	18.25	7.1
	10000	55	25	3.67	15.30	12.32	4.93
	15000	50	18	3	8.62	7.29	3.03
M.14	0000	55	19.33	5	21.60	12.29	5.6
	5000	58	31	6	18.52	17.64	7.33
	10000	50	25	4.33	13.50	14.29	6.22
	15000	47	15.33	3.0	10.72	8.82	4.33
M.16	0000	59	20	4	16.09	14.49	5.17
	5000	55	17	3.33	19.80	12.19	4.25
	10000	51	14.67	3.0	12.75	9.64	3.46
	15000	45	12.33	2.33	10.12	5.92	2.68
M.19	0000	65	17	5.33	14.02	12.88	4.64
	5000	70	20	6.0	18.00	16.48	5.42
	10000	48	14.6	5.0	9.00	11.63	3.96
	15000	42	12.31	3.0	6.75	7.48	2.57
M.39	0000	60	18	5	19.50	13.61	5.07
	5000	54	15	4	17.10	11.06	4.08
	10000	48	12.33	3	12.00	7.61	3.09
	15000	43	10.33	2.33	9.00	5.05	2.44
L.S.D 5 %	Sal.x G.	N.S	N.S	N.S	N.S	2.63	0.86

As regards to barley genotypes M. 16 and M. 39 which exhibited the gradual decrease in all growth parameters by increasing the level of salinization of irrigation water up to 15000 mg/l. Similar results obtained by Selim *et al.*, (1996) on some wheat genotypes, Willadino *et al.* (1999) on maize, Selim and El-Gamal (2004) on barley "cultivates". Abdel-Aleem *et al.* (1994) found that increasing salinity levels significantly decreased plant height, number of tillers / plant, fresh and dry weights of wheat cultivars. Also Selim and El-Gamal (2004) reported that plant height, number of leaves and tillers / plant, flag leaf area of barley plant were increased significantly with increasing the NaCl concentration in irrigation water up to 8000 mg / l , meanwhile the level of 16000 mg / l caused a significant decrease in all growth parameters of barley genotypes. The reduction in growth characters may be attributed to the osmotic stress due to lowering of the external water potential as well as the direct toxicity by contain ions on metabolic process. (Greenway and Munns, 1980).

Data presented in the same Tables indicated that the ten barley genotypes under study varied significantly in most growth characters studied. The highest values of most growth characters were obtained from the three barley genotypes i.e M. 4, M. 7 and M. 11, meanwhile the lowest values of the above mentioned characters, were recorded by M. 16 and M. 39 as compared with other genotypes. The results are in agreement with those obtained by Reggiani *et al.* (1994), Selim *et al.* (1996) on wheat genotypes and Selim and El-Gamal (2004) on barley genotypes.

Moreover, data given in Table (5) indicated that the interactions of salinity with genotypes were found to be significant for growth characters. In this regard the highest values of plant height recorded with G. M. 11 under 5000 mg/l, meanwhile G. M. 12 gave the highest values of leaf area. The interactions of genotypes with salinity were found to be insignificant for number of leaves and tillers per plant in both seasons of study. In this respect Abdel Aleem *et al.*, (1994) showed a significant interaction between wheat genotypes and salinity indicating that genotypes responded differently to salinity levels. Also, Selim and El-Gamal (2004) revealed that a significant interaction between barley genotypes and salinity for plant height, number of leaves and tillers / plant, leaf area and root and shoot dry weight as a result of genotypes responded differently to salinity levels.

2- Leaf water relations:-

Data presented in Table (6) showed that, total water content (TWC) and relative water content (RWC) were remarkably and sharply declined at the highest level of salinity (15000 mg/ l), whereas osmotic pressure (OP) was found to be increased. These results were true in the both seasons. Similar results obtained by Selim (1996) and Selim and El-Gamal (2004). The decline in RWC may be partially due to higher exposure to enviromental factors such as temperature and solar radiation as suggested by Clarke and Richards (1988). Also, part of the decrease may be due less to complete closure of stomata in older leaves (Ritchince *et al.*, 1990).

There were significant differences among the ten barley genotypes in TWC, RWC and OP in both seasons. G. M. 6 had the highest values of TWC, Gs. M. 7 and M. 11 gave the highest values of, RWC. Meanwhile the highest values of OP were obtained by Gs. M. 39 and M. 19 in the first and second seasons respectively (Table 7). Similar results were obtained by Selim (1996) and Selim and El-Gamal (2004).

Table (6): Effect of salinity on water relations of barley plants during the 2005 /2006 and 2006/2007.

Character / Salinity levels (mg/l)	2005 / 2006			2006 / 2007		
	T. water content %	Relative water content%	Osmotic pressure (atm.)	T. water content %	Relative water content%	Osmotic pressure (atm.)
0.0	76.48	74.66	6.34	73.89	71.87	6.31
5000	76.26	77.83	7.01	74.4	72.61	7.28
10000	73.03	75.28	8.13	70.81	72.25	8.73
15000	69.73	68.07	9.46	68.39	65.62	9.98
L.S.D 5%	2.25	1.7	0.30	2.08	5.55	0.53

Table (7): Genotypes water relations as affected by salinity during 2005 / 2006 and 2006/2007 seasons.

Character / Genotype	2005 / 2006			2006 / 2007		
	T. water content %	Relative water content%	Osmotic pressure (atm.)	T. water content %	Relative water content%	Osmotic pressure (atm.)
M.4	76.23	74.91	8.00	72.56	65.65	7.32
M.6	81.75	73.8	7.83	80.07	72.33	7.44
M.7	73.04	80.11	7.24	71.39	68.38	7.97
M.11	73.34	77.29	7.24	69.78	74.93	7.51
M.12	80.81	76.47	8.09	76.7	73.24	7.66
M.13	73.89	73.12	7.36	73.55	71.68	8.16
M.14	72.84	71.93	7.24	72.41	68.67	8.52
M.16	69.36	70.93	7.76	67.95	70.54	8.72
M.19	73.13	72.60	8.14	68.49	73.98	8.79
M.39	64.37	68.41	8.43	65.83	66.49	8.69
L.S.D 5%	5.49	.3.14	0.34	5.03	5.88	0.41

As regard to the effect of the interaction between genotypes and salinity, its clear from Table (8) that the values of interaction for TWC and RWC were

not significant in both seasons, meanwhile OP tended to show a significant increase in all genotypes under salt stress conditions. The highest values were recorded by M.39 and M.19 barley genotypes at the salinity level of 15000 mg/L meanwhile the lowest values obtained by genotype M. 7 and genotype M. 11 the first season and second season respectively These results are harmony with those obtained by Selim (1996).

Table (8). The interaction effect between salinity levels and some barley genotypes on water relations in leaves during 2005/2006 and 2006/2007 seasons.

Treatments		2005/2006			2006/2007		
Genotype	Salinity mg/l	T. Water content (%)	Relative water content (%)	Osmotic pressure (atm.)	T. Water content (%)	Relative water content (%)	Osmotic pressure (atm.)
M.4	0000	77.02	75.06	6.3	73.02	72.02	6.08
	5000	79.33	79.1	7.4	75.1	75.15	6.86
	10000	75.18	76	8.31	72.1	73.44	7.94
	15000	73.22	69.51	10.05	70.5	66.13	8.53
M.6	0000	86.48	74.15	6.21	82.11	70.8	6.14
	5000	86.31	80.44	6.94	84.02	78.11	6.16
	10000	83.22	78.06	8.13	79.05	75.03	7.87
	15000	74.33	62.4	10.06	75.13	65.41	9.15
M.7	0000	74.05	80.01	5.81	72.6	68.81	6.11
	5000	75.11	83.2	6.46	73.81	73.44	7.59
	10000	72.08	81.15	7.18	71.06	70.18	8.69
	15000	71.5	76.1	9.53	68.11	62.44	9.5
M.11	0000	74.13	78.05	6.11	70.8	74.61	5.81
	5000	74.51	82.4	7.02	71	78.55	6.17
	10000	72.81	80.15	7.69	69.05	76.41	8.0
	15000	71.92	71.11	8.16	68.3	70.15	9.69
M.12	0000	86.11	76.44	6.41	81.66	73.45	6.07
	5000	81.95	81.55	7.5	77.04	77.15	6.77
	10000	79.37	79.31	8.87	75.05	74.33	8.14
	15000	75.83	68.61	9.11	73.06	68.05	9.67
M.13	0000	75	70.1	5.81	76.2	72.02	6.04
	5000	76	79.4	6.20	77.04	75.15	6.93
	10000	72	75.01	8.41	71.15	73.44	8.15
	15000	71.5	68	9.02	70.03	66.13	10.9
M.14	0000	73	71.41	6.33	74.03	68.81	6.52
	5000	74	75.11	6.77	75.42	73.44	8.33
	10000	72	72.2	7.42	71.06	70.18	9.05
	15000	70	69	8.86	69.15	62.44	10.18
M.16	0000	70.1	75.1	6.91	69.11	73.15	6.75
	5000	72.5	73.4	7.24	70.5	72.11	7.61
	10000	69.4	70.7	7.78	67.2	71.05	9.81
	15000	65.0	64.55	9.14	65.01	65.9	10.77
M.19	0000	76.1	72.8	6.81	71.4	75.01	7.05
	5000	75.1	76.41	7.53	70.81	79.02	8.06
	10000	74.0	72.91	8.69	68.31	73.11	9.5
	15000	66.0	68.3	9.56	63.44	68.81	10.56
M.39	0000	66.0	73.05	6.81	68.01	70.1	6.6
	5000	68	70.11	7.42	69.32	68.31	7.55
	10000	62	67.33	8.81	64.3	65.42	9.8
	15000	60.5	63.15	10.69	61.7	62.13	10.81
L.S.D5 %	Sal × G	N.S	N.S	0.69	N.S	N.S	0.83

3- Chemical constituents (Photosynthetic pigments, total soluble sugars, total carbohydrates, proline and total free amino acids):

Data in Tables (9, 10 and 11) indicated that chlorophyll (a + b), carotenoids, total soluble sugars (TSS), total carbohydrates (TC) and total free amino acids (TAA) were increased significantly due to irrigation with saline water up to 10000 mg/l followed by a significant decrease at the level of 15000 mg/l in all genotypes except Gs. M. 16 and M. 39 which showed a gradual decrease in these characters with increasing salinity levels in both seasons. Proline concentration increased under salinity levels of 5000 and 10000 mg/l then decreased at the highest salinity level of 15000 mg/l of all genotypes in both seasons. These results are in accordance with those obtained by Nofal *et al.* (2001) on *Chamacrops humilis L.* and *Phoenix canariensis* Hort., Al-Qubaie (2002) on neem and Selim and El-Gamal (2004) on barley. The increase in carbohydrates under salt stress might be attributed to that, available carbohydrate, can not be translocated and utilized because of deficiency in ATP. This deficiency is a result of lower inorganic phosphate intake under salinity (Mass and Nieman, 1978). Also Cusido *et al.* (1987) found that the levels of free amino acids especially aspartic, glutamic and proline increased under salt stress conditions.

Regarding the concentrations of photosynthetic pigments, TSS, TC, proline and TAA of barley genotypes, data presented in the same tables revealed a significant differences among genotypes in their content of these characters. Moreover T.SS was not significant in the second season only. In addition, the highest concentration of TC recorded by G. M.12 as compared with other genotypes in both seasons. Similar results obtained by Ashraf (1989) on vigna cultivars, Selim *et al.* (1996) on wheat genotypes and Selim and El- Gamal (2004) on barley.

Concerning the concentration of chl. (a+b), carotenoids, TSS, TC, proline and TAA at all salinity levels in both seasons, the highest values of these traits were recorded with the lowest level of salinity followed by the moderate level. Meanwhile the lowest values were recorded under the highest level of salinity in most genotypes compared with control. In addition TSS concentration was not significant in the second season only. Similar results obtained by Selim and El-Gamal (2004). In this concern, Greenway and Munns (1980) pointed out that many plant species especially the tolerant produce different amino acids and carbohydrates to mitigate or prevent the loss of activity of several enzymes. Begum and Karmoker (1999) suggested that, proline produced in the leaf is transported to the root of the stressed plant, thereby helping the plant to regulate the osmotic potential of root cells under salinity.

Table (9): Effect of salinity on photosynthetic pigments, total soluble sugars, total carbohydrate, proline and total free amino acids during 2005/2006 and 2006/2007 seasons.

	2005 / 2006						2006 / 2007					
Character / Salinity levels (mg/l)	Chlorophyll a+b (mg/g D.W)	Carotenoids (mg/g D.W)	Total soluble sugars (mg/gD.W)	Total carbohydrate (mg/g D.W)	Proline (u/g D.W)	Total free amino acids (mg/g. D.W)	Chlorophyll a+b (mg/g D.W)	Carotenoids (mg/g D.W)	Total soluble sugars (mg/gD.W)	Total carbohydrate (mg/g D.W)	Proline (u/g D.W)	Total free amino acids (mg/g. D.W)
0.0	4.46	1.47	15.63	216.09	1530.03	12.46	4.27	1.24	15.28	227.69	1605.47	14.46
5000	4.78	1.68	18.44	258.24	1857.83	13.99	4.67	1.48	21.46	268.09	1839.67	16.05
10000	4.44	1.49	16.69	231.28	1651.36	12.41	4.43	1.28	15.9	242.2	1674.26	14.24
15000	3.64	1.21	12.83	174.70	1392.56	10.15	3.46	1.006	12.91	177.18	1482.76	11.24
L.S.D 5%	0.14	0.13	0.75	17.25	79.27	0.61	0.17	0.13	5.66	14.76	37.5	0.79

Table (10): Genotypes photosynthetic pigments total soluble sugars, total carbohydrates, proline and total free amino acids as affected by salinity during 2005/2006 and 2006/2007 seasons.

	2005/2006						2006/2007					
Character / Genotype	Chlorophyll a+b (mg/g D.W)	Carotenoids (mg/g D.W)	Total soluble sugars (mg/gD.W)	Total carbohydrate (mg/g D.W)	Proline (U/g D.W)	Total free amino acids (mg/g. D.W)	Chlorophyll a+b (mg/g D.W)	Carotenoids (mg/g D.W)	Total soluble sugars (mg/gD.W)	Total carbohydrate (mg/g D.W)	Proline (U/g D.W)	Total free amino acids (mg/g. D.W)
M.4	4.86	1.5	18.31	230.66	1601.48	14.52	4.29	1.37	16.88	213.5	1623.05	12.5
M.6	4.67	1.78	16.05	259.19	1683.77	10.98	5.01	1.66	15.45	264.1	1741.66	10.67
M.7	4.79	1.29	15.42	144.32	1729.53	15.82	3.95	0.84	15.25	226.88	1767.8	14.66
M.11	5.04	1.81	18.22	250.56	1755.34	16.95	4.65	1.2	18.81	261.54	1712.1	15.79
M.12	4.82	1.84	16.5	270.1	1452.5d	11.93	4.48	1.53	16.61	279.17	1698.96	12.04
M.13	4.54	1.68	18.07	224.79	1437.17	10.64	4.85	1.71	16.00	237.52	1437.8	17.75
M.14	4.01	1.43	16.89	207.98	1662.74	16.42	4.44	1.37	15.77	231.34	1671.67	15.69
M.16	3.38	0.86	10.80	164.46	1461.70	7.28	3.26	0.80	19.95	192.17	1508.85	11.63
M.19	4.22	1.55	16.82	242.15	1750.17	11.42	4.34	1.32	17.96	224.91	1720.1	17.96
M.39	2.90	0.75	10.77	156.61	1544.44	6.55	2.84	0.62	11.19	156.8	1622.77	11.14
L.S.D 5%	0.34	0.09	1.129	16.98	88.41	0.99	0.34	0.11	N.S	11.91	42.54	0.85

Table (11): The interaction effect between salinity levels and some barley genotypes on photosynthetic pigments, total soluble sugars, total carbohydrates, proline and total free amino acids concentrations during 2005/2006 and 2006/2007 seasons.

Treatments		2005 / 2006					
Genotypes	Salinity (mg/g)	Chlorophyll a+b (mg/g D.Wt)	Caroenoids (mg/g D.Wt)	Total soluble sugars (mg/gD.Wt)	Total carbohydrate (mg/g D.Wt)	Proline Ug/g D.Wt	Total free amino acids (mg/g. D.Wt)
M.4	0000	4.72	1.45	17.33	206.15	1446.20	13.4
	5000	5.49	1.68	21.51	272.33	1880.30	17.7
	10000	4.96	1.57	19.3	251.13	1751.1	15.01
	15000	4.28	1.31	15.1	193.04	1330.30	12.0
M.6	0000	4.08	1.82	16.34	255.2	1370.1	12.3
	5000	5.26	2.01	20.15	311.06	1560.1	13.61
	10000	4.92	1.91	17.10	281.14	1480.0	11.8
	15000	4.31	1.62	12.41	233.05	1400	10.02
M.7	0000	4.75	1.25	13.81	196.72	1665.5	15.4
	5000	5.42	1.55	19.24	215.1	1990.3	18.4
	10000	4.94	1.36	17.33	197.03	1800.5	17.0
	15000	4.07	1.03	11.31	168.44	1460.3	12.5
M.11	0000	5.0	1.72	18.01	224.30	1590.1	16.3
	5000	5.51	2.01	21.55	302.1	2001.2	19.21
	10000	5.12	1.85	19.01	274.11	1770.0	18.0
	15000	4.48	1.66	14.43	201.8	1660.1	14.3
M.12	0000	4.56	1.81	15.71	248.01	1550	11.4
	5000	5.35	1.95	19.33	300.55	1900.1	12.5
	10000	4.82	1.86	16.77	266.1	1800.0	10.5
	15000	3.98	1.51	12.40	222.13	1485	9.55
M.13	0000	4.41	1.69	17.5	215.44	1365	10.14
	5000	4.98	1.91	20.2	271.13	1695	12.33
	10000	4.69	1.75	19.5	235.4	1452	11.1
	15000	3.88	1.38	15.1	177.03	1236	9.0
M.14	0000	3.92	1.48	16.61	205.30	1566	16.4
	5000	4.58	1.55	19.81	250.41	1982	18.3
	10000	4.27	1.51	18.7	231.12	1772.3	17.01
	15000	3.22	1.20	12.44	145.13	1330.1	14.0
M.16	0000	3.92	1.04	12.4	195.4	1540.1	9.4
	5000	3.72	0.99	11.20	182.3	1750.1	8.12
	10000	3.41	0.78	10.01	160.01	1306.2	6.30
	15000	2.78	0.65	9.61	120.14	1250.4	5.31
M.19	0000	4.33	1.44	15.81	232.15	1605.3	11.1
	5000	4.60	1.70	20.03	307.22	2005.1	12.8
	10000	4.51	1.65	18.78	261.03	1880.3	11.8
	15000	3.32	1.23	12.66	168.22	1510.0	10.01
M.39	0000	3.36	1.02	12.8	182.30	1600	8.8
	5000	2.98	0.82	11.4	170.1	1800.1	7.02
	10000	2.51	0.67	10.4	151.13	1501.2	5.6
	15000	2.05	0.51	8.5	118.25	1330	4.8
L.S.D.5%	Sal × G	N.S	0.18	2.25	33.90	177.51	1.98

Table (11): Continued.

Treatments		2006 / 2007					
Genotypes	Salinity (mg/g)	Chlorophyll a+b (mg/g D.Wt)	Caroenoids (mg/g D.Wt)	Total soluble sugars (mg/gD.Wt)	Total carbohydrate (mg/g D.Wt)	Proline Ug/g D.Wt	Total free amino acids (mg/g. D.Wt)
M.4	0000	4.09	1.31	16.21	197.78	1501	12.8
	5000	5.68	1.60	19.55	255.13	1900.2	14.2
	10000	4.49	1.53	18.04	220.03	1690	13.01
	15000	3.73	1.06	13.75	181.06	1401	10.01
M.6	0000	4.39	1.5	18.06	271.0	1605.1	13.2
	5000	5.19	1.75	21.01	321.4	1800.2	15.8
	10000	4.70	1.56	19.55	300.3	1700.1	10.11
	15000	3.64	1.33	14.61	224.15	1690.2	9.05
M.7	0000	3.86	0.81	14.66	220.15	1701	14.06
	5000	4.59	1.01	18.56	260.28	2003	17.05
	10000	4.28	0.93	15.8	235.02	1866.1	15.55
	15000	3.08	0.62	12.01	192.1	1501.1	12.01
M.11	0000	4.62	1.11	19.33	235.11	1580.1	17.06
	5000	5.53	1.41	22.01	315.04	1990.2	18.1
	10000	4.88	1.32	20.15	295.41	1680.1	17.56
	15000	3.61	0.96	13.75	200.6	1600.8	10.44
M.12	0000	5.02	1.71	15.61	252.11	1706.3	12.05
	5000	5.79	2.02	18.44	291.04	1901.1	13.2
	10000	5.12	1.85	16.11	280.01	1800	9.85
	15000	4.74	1.42	11.65	233.14	1562.6	7.6
M.13	0000	4.87	1.65	17.45	224.18	1470	17.45
	5000	5.22	1.93	20.02	300.12	1580.1	20.02
	10000	4.89	1.8	11.9	255.13	1500.8	18.9
	15000	4.25	1.48	14.65	170.66	1200.3	14.65
M.14	0000	4.2	1.35	15.45	215.33	1690.3	15.15
	5000	5.23	1.87	17.51	280.04	1801.1	17.51
	10000	4.96	1.41	16.11	261.22	1705.3	16.11
	15000	3.87	1.19	14.01	168.44	1490	14.01
M.16	0000	3.81	1.05	13.33	220.01	1490	13.33
	5000	3.53	0.87	12.05	207.33	1660	12.05
	10000	3.20	0.81	11.1	190.91	1500.1	11.1
	15000	2.84	0.49	10.05	150.44	1385	10.05
M.19	0000	4.15	1.20	16.81	230.15	1650.1	16.81
	5000	4.78	1.66	20.55	270.22	1880.3	20.55
	10000	4.43	1.42	19.41	249.13	1750	19.41
	15000	3.68	1.02	15.1	150.15	1600	15.1
M.39	0000	3.67	0.75	12.75	210.94	1660.8	12.75
	5000	3.00	0.68	11.61	180.03	1880.20	11.61
	10000	2.61	0.59	10.85	135.14	1550.1	10.85
	15000	2.10	0.49	9.56	101.11	1400	9.56
L.S.D 5%	Sal×G	0.68	0.22	N . S	23.79	84.93	1.70

Mineral concentration:-

Results in Table (12) showed that, the concentrations of N, P and K in shoots of barley genotypes were found to be decreased significantly under salt

stress conditions, whereas the concentration of Na increased. The highest values of N, P, and K and the lowest values of Na were recorded at the level of 5000 mg/l compared to with control. M 39 and M. 16 genotypes showed the gradual decrease in N, P and K and the gradual increase in Na concentration. Similar results were observed by Selim (1996), Zekri and Parson (1992) on citrus, El-Sheweikh (1980) on wheat and Al-Qubaie (2002) on neem. The increase in shoot nitrogen content under moderate salinity conditions might be attributed to enhancement of salinity to protein synthesis in cereals (Langdale *et al.*, 1973). The decrease in P concentration under salt stress might be attributed to that increasing salinity may lead to decrease in CO_2 in the soil that may reduce the uptake of P by plants (Hassan *et al.*, 1970). The decrease in K concentration under salinity stress conditions may be attributed to the antagonism between the excess of Na and K (Shimose, 1969) and / or disturbance in the osmotic pressure of soil solution which was responsible for lowering the movement of water and solvents from roots via vegetative portions (Al-Qubaie, 2002) Moreover, increasing Na accumulation in sensitive cultivars than that in tolerant cvs. may be attributed to that in salt tolerant Cvs., less transported Na from roots to shoots was observed than do salt sensitive Cvs. (Sahachtman *et al.*, 1989).

Table (12): Effect of salinity on minerals concentration during 2005/2006 and 2006/2007 seasons.

Characters / Salinity (mg/l)	2005/2006				2006/2007			
	N %	P%	K %	Na%	N a %	P %	K %	N a%
000	2.11	0.25	2.61	0.63	2.21	0.26	2.68	0.62
5000	2.68	0.31	2.91	0.61	2.73	0.32	2.93	0.58
10000	2.42	0.26	2.6	0.74	2.45	0.28	2.57	0.72
15000	1.86	0.20	2.18	0.85	1.81	0.22	2.12	0.86
L.S.D 5 %	0.08	0.03	0.1	0.06	0.15	0.03	0.17	0.01

Data in Table (13) showed that, N, P, K and Na concentrations varied significantly among barley genotypes in both seasons. The highest values were found in M. 12, M.14, M.7 and M.39 for N, P, K and Na respectively in the first season. M.13 accumulated the lowest Na, indicating that M.13 was more tolerant to salinity and M.39 was less tolerant. Similar results previously obtained by Selim and El- Gamal (2004).

Concerning the interaction between salinity and genotypes it was observed that, there were marked differences in mineral concentration except Na in the first season (Table 14). Similar results obtained by Selim (1996).

4-Heading date:

Data presented in Tables (15, 16 and 17) indicated that the barley genotypes were found to be differed significantly for heading date meanwhile the interaction between genotypes and salt treatment were not significant for

this trait. Similar results were obtained in both seasons. In this respect, the lowest number of days to the first appearance of owns was obtained at the level of 5000 mg/l. Moreover, G. M.4 gave the least number of days to heading in both seasons. The difference among the tested genotypes in number of days to heading time could be attributed to their differences in genetic background. G. M.4 recorded a lowest number of days to heading at the level of 5000 mg/l in both seasons in similar results obtained by several authors, Bauer *et al.* (1988), Abo-Warda (1993) and Ibrahim *et al.* (1995) on wheat genotypes.

5-Yield and its components :

Data reported in Table (15) clearly showed that, spike length, spike number / plant, and 100-grain weight were varied significantly due to salinized water. The highest values of these characters were recorded at the lowest level of salinity (5000 mg /l) compared with those of the control or other salinity levels. The lowest values were recorded at 15000 mg /l. Similar results were obtained by Selim *et al.* (1996) on wheat genotypes. In this respect Munns and Rawson (1999) found that salinity decreased formation of spikelet primordia and final spikelet number of spike were reduced. Also, Aldesuquy (1998) reported that, irrigation of wheat plants by NaCl at 66 or 99 m M decreased all yield components .

Data presented in Table (16) indicated that yield attributes differed significantly among genotypes in both seasons. The genotype M. 6 gave the highest values of spike length and spikes number / plant. The highest weight of grains per plant was attached by genotype M. 11 as compared with other genotypes in both seasons. These results are in harmony with those obtained by Selim *et al.* (1996) and Selim and El- Gamal (2004).

The interactions between genotypes and salinity were found to be insignificant for yield and its components except weight of grains per plant in the first season only (Table 17). Similar results were obtained by Selim *et al.* (1996).

Table (13): Genotypes mineral content as affected by salinity during 2005/2006 and 2006/2007 seasons.

Characters / Genotype	2005/2006				2006/2007			
	N %	P%	K %	Na%	N a %	P %	K %	N a%
M.4	2.63	0.29	3.1	0.69	2.58	0.30	2.89	0.64
M.6	2.41	0.29	2.09	0.77	2.42	0.28	2.14	0.7
M.7	2.1	0.33	2.89	0.64	2.28	0.34	2.99	0.64
M.11	2.4	0.27	2.73	0.59	2.4	0.27	2.75	0.64
M.12	2.69	0.23	2.30	0.78	2.58	0.24	2.73	0.69
M.13	2.35	0.32	2.89	0.59	2.25	0.34	2.73	0.54
M.14	2.67	0.36	3.06	0.61	2.69	0.37	3.21	0.58
M.16	1.80	0.15	1.93	0.87	1.84	0.16	1.93	0.93
M.19	1.96	0.21	2.93	0.65	2.17	0.23	2.76	0.63
M.39	1.68	0.12	1.88	0.91	1.82	0.15	1.79	0.92
L.S.D 5 %	0.14	0.02	0.18	0.1	0.25	0.03	0.22	0.08

Table (14): The interaction effect between salinity levels and some barley genotypes on minerals concentrations in shoots during 2005/2006 and 2006/2007 seasons.

Treatments		2005/2006				2006/2007			
Genotypes	Salinity	N (%)	P (%)	K (%)	Na(%)	N (%)	P (%)	K (%)	Na(%)
M.4	0000	2.35	0.27	3.0	0.65	2.46	0.29	2.89	0.61
	5000	3.12	0.36	3.44	0.6	2.91	0.35	3.22	0.59
	10000	2.85	0.30	3.21	0.71	2.71	0.32	2.95	0.63
	15000	2.21	0.25	2.75	0.80	2.05	0.26	2.50	0.75
M.6	0000	2.21	0.28	2.02	0.73	2.15	0.26	2.15	0.60
	5000	2.89	0.35	2.65	0.61	3.01	0.33	2.67	0.58
	10000	2.55	0.31	1.90	0.85	2.62	0.30	2.0	0.75
	15000	2.0	0.23	1.8	0.91	1.90	0.24	1.72	0.9
M.7	0000	2.05	0.31	2.8	0.54	2.11	0.32	2.95	0.56
	5000	2.51	0.39	3.15	0.48	3.0	0.4	3.4	0.53
	10000	2.20	0.34	3.01	0.70	2.51	0.36	3.06	0.65
	15000	1.65	0.30	2.61	0.85	1.51	0.29	2.56	0.81
M.11	0000	2.19	0.25	2.71	0.5	2.25	0.24	2.8	0.55
	5000	2.91	0.35	3.2	0.48	3.11	0.36	3.11	0.51
	10000	2.63	0.3	3	0.67	2..55	0.31	2.95	0.68
	15000	1.88	0.19	2.01	0.72	1.72	0.20	2.14	0.85
M.12	0000	2.44	0.22	2.51	0.75	2.31	0.23	2.66	0.65
	5000	3.25	0.28	2.85	0.7	3.09	0.30	3.01	0.60
	10000	3.01	0.27	2.07	0.8	2.81	0.26	2.5	0.71
	15000	2.06	0.18	1.8	0.87	2.11	0.19	1.95	0.80
M.13	0000	2.01	0.31	2.8	0.56	1.95	0.33	2.75	0.58
	5000	3.09	0.4	3.21	0.53	2.82	0.41	3.23	0.46
	10000	2.52	0.33	3.05	0.55	2.21	0.35	2.91	0.52
	15000	1.8	0.24	2.51	0.72	1.71	0.28	2.05	0.62
M.14	0000	2.06	0.35	3.0	0.62	2.61	0.36	3.22	0.65
	5000	3.26	0.49	3.61	0.44	3.30	0.45	3.72	0.48
	10000	3.05	0.36	3.2	0.56	2.8	0.38	3.31	0.53
	15000	2.31	0.25	2.75	0.85	2.05	0.29	2.61	0.71
M.16	0000	2.03	0.18	2.41	0.72	2.11	0.19	2.33	0.7
	5000	1.88	0.16	2.01	0.85	1.91	0.17	2.05	0.8
	10000	1.75	0.14	1.8	0.91	1.85	0.16	1.75	1.0
	15000	1.56	0.12	1.51	1.0	1.52	0.15	1.60	1.23
M.19	0000	1.91	0.20	2.91	0.55	2.03	0.22	2.82	0.59
	5000	2.16	0.25	3.11	0.51	2.36	0.26	3.06	0.52
	10000	2.06	0.22	3.05	0.75	2.45	0.24	2.92	0.68
	15000	1.71	0.19	2.65	0.81	1.85	0.18	2.61	0.75
M.39	0000	1.90	0.16	2.32	0.75	2.19	0.18	2.22	0.72
	5000	1.75	0.13	1.95	0.91	1.82	0.16	1.81	0.89
	10000	1.63	0.11	1.77	0.95	1.72	0.14	1.68	1.05
	15000	1.44	0.08	1.48	1.06	1.56	0.13	1.45	1.19
L.S.D 5 %	Sal × G	0.28	N.S	0.37	N.S	0.50	N.S	0.44	N.S

Table (15): Effect of salinity on heading date, yield and its components during 2005/2006 and 2006/2007 seasons.

Characters / Salinity (mg/l)	2005/2006							2006/2007						
	Heading date	Spike length (cm)	Spikes No. / Plant	Spikeletes No. / Spike (g)	Grain weight / spike (g)	Grain weight / plant (g)	Weight 100-grain (g)	Heading date	Spike length (cm)	Spikes No. / Plant	Spikeletes No. / Spike (g)	Grain weight / spike (g)	Grain weight / plant (g)	Weight 100-grain (g)
000	101.8	5.95	4.63	27.46	1.01	3.17	3.29	102.2	5.45	4.6	26.33	0.83	2.77	1.63
5000	99.6	7.8	6.13	41.13	1.89	5.18	4.11	98.9	6.65	6.13	34.46	1.07	3.76	4.30
10000	101.6	5.96	4.73	28.96	1.24	3.43	3.30	101.73	5.61	4.6	24.93	0.79	2.47	3.51
15000	106.36	4.66	3.86	17	0.61	1.29	2.71	107.1	4.25	3.66	17.46	0.49	1.48	2.46
L.S.D 5 %	3.85	0.36	0.75	5.53	0.34	0.8	0.28	3.32	0.35	0.27	4.48	0.17	0.65	0.39

Table (16): Genotypes heading date and yield and its components as affected by salinity during 2005/2006 and 2006/2007 seasons.

Character / Genotype	2005/2006							2006/2007						
	Heading date	Spike length (cm)	Spikes No./ plant	Spikeletes / No Spike	Grain weight / spike(g)	Grain weight / plant(g)	Weight 100-grain	Heading date	Spike length (cm)	Spikes No./plant	Spikeletes / No Spike	Grain weight / spike(g)	Grain weight / plant(g)	Weight 100-grain
M.4	95.5	6.25	5.66	38.33	1.49	5.69	3.05	97.25	5.33	3.66	30.75	0.45	2.56	2.72
M.6	104.25	7.91	5.75	26.25	1.44	4.26	4.36	103.5	6.29	5.75	21.25	0.59	2.21	3.91
M.7	102.75	5.25	4.83	25.5	1.12	2.54	3.52	100.5	5.6	4.08	30.75	0.43	2.22	3.39
M.11	98.25	7.25	5.58	37.66	1.94	6.26	4.36	99	5.83	5.08	29.08	1.08	4.02	3.9
M.12	97.5	6.5	4.5	31.33	1.45	3.67	3.88	98.75	5.66	5.33	24.83	1.09	2.39	5.32
M.13	100.25	6.41	5.08	21.08	0.91	2.16	3.516	102.75	6	4.83	17.75	0.51	1.31	3.36
M.14	98	5.16	3.91	31.41	1.47	2.85	3.36	99.83	5.18	5.5	26.16	0.84	3.78	3.02
M.16	109.5	5.04	4.58	20.33	0.65	1.17	2.65	109.5	4.91	4.08	23.83	0.85	2.29	3.05
M.19	105.75	5.25	4.58	36.5	1.19	2.86	2.81	101.75	5.15	5.25	31.33	0.91	2.74	3.07
M.39	110.91	5.91	3.19	18	0.4	1.24	2.16	112	4.95	3.91	22.25	0.66	2.69	3.0
L.S.D 5 %	3.26	1.14	0.59	5.78	5.58	1.07	0.48	3.1	0.66	0.74	3.99	0.17	1.01	0.85

Table (17): The interaction effect between salinity levels and some barley genotypes on yield and its components during 2005/2006 and 2006/2007 seasons.

Treatments		2005/2006						
Genotype	Salinity mg/l	Heading date	Spike length (cm)	Spikes No./plant	Spikletes No/spike	Grain weight/ spike(g)	Grain weight /plant(g)	Weight of 100 grains(g)
M.4	0000	94	5.33	5.33	32.67	1.51	5.37	2.9
	5000	93	8	7	55	1.91	9.08	3.97
	10000	95	6.67	5.67	44	1.37	6.14	3.17
	15000	100	5	4.66	21.67	1.02	2.18	2.17
M.6	0000	105	7.33	6	22.67	1.34	5.09	4.27
	5000	102	9	6.33	31.33	2.36	5.76	5.1
	10000	103	8	5.67	25.67	1.34	5.23	4.67
	15000	107	6.33	5.0	23.33	0.72	1.43	3.43
M.7	0000	103	6.33	4.33	28.33	1.01	2.51	3.5
	5000	100	6.67	5.66	35.33	2.34	4.57	4.77
	10000	101	4.67	4.66	23	0.75	2.1	3.23
	15000	107	3.33	4	15.33	0.41	0.98	2.53
M.11	0000	100	8	6.67	43	1.97	7.16	4.5
	5000	93	10.33	7.33	51	3.34	10.76	4.87
	10000	95	6	4.67	37.33	1.78	5.3	4.1
	15000	105	4.67	3.67	19.33	0.66	1.83	3.47
M.12	0000	95	5.67	4.0	28.33	1.54	3.3	3.53
	5000	92	7.67	5.67	47.33	1.71	5.03	5.07
	10000	100	7.33	4.67	36	1.40	4.9	3.77
	15000	103	4.67	3.67	13.67	0.74	1.47	3.17
M.13	0000	104	4.67	4.33	20.33	0.42	1.63	2.63
	5000	95	8.67	6.33	30	1.51	3.7	4.13
	10000	97	6.67	6.0	21.67	1.33	2.28	3.7
	15000	105	5.66	3.67	12.33	0.41	1.04	2.96
M.14	0000	98	4	3.33	31	1.29	3.27	3.5
	5000	96	7	5.0	48.33	1.93	4.5	4.23
	10000	98	5.33	4.33	32	1.8	2.74	2.97
	15000	100	4.33	3.0	14.33	0.9	0.90	2.93
M.16	0000	105	5.83	4.33	20.0	0.32	1.02	2.77
	5000	108	6	6.0	31	1.13	1.94	3.0
	10000	110	5	4.0	18.33	0.54	0.92	2.4
	15000	115	3.33	4.0	15	0.22	0.81	1.83
M.19	0000	106	5.33	4.67	29.67	0.77	1.59	2.83
	5000	104	7.67	5.33	53.67	1.69	4.72	3.23
	10000	105	4.33	4.33	37.33	1.57	3.81	3.0
	15000	108	3.67	4.0	25.33	0.76	1.34	2.2
M.39	0000	108	6	3.33	18.67	0.32	1.25	2.43
	5000	110	7	6.0	26.33	0.60	1.78	2.2
	10000	112	5.67	3.33	14.33	0.35	0.98	2.06
	15000	115	5.0	3.0	12.67	0.29	0.92	1.97
L.S.D 5 %	Sal × G.	N.S	NS	N.S	N.S	NS	2.15	N.S

Table (17): Continued.

Treatments		2006/2007						
Genotype	Salinity mg/l	Heading date	Spike length (cm)	Spikes No./plant	Spikletes No/spike	Grain weight/ spike(g)	Grain weight /plant(g)	Weight of 100 grains(g)
M.4	0000	97	5.17	3.67	28.33	0.46	3.58	2.77
	5000	95	6.17	5	45	0.78	3.94	3.3
	10000	98	5.5	4.0	29.66	0.36	1.76	2.85
	15000	102	4.5	2.67	20	0.24	0.96	2.0
M.6	0000	103	5	5.67	20.33	0.53	2	3.57
	5000	100	8	7.33	28	0.76	2.91	4.77
	10000	101	7.17	5.33	22	0.64	2.48	4.2
	15000	110	5	4.67	14.66	0.45	1.46	3.13
M.7	000	101	5.77	3.67	32	1.04	2.16	3.47
	5000	97	7.0	5.33	34.33	1.12	3.11	4.06
	10000	99	5.67	4.0	31.67	0.84	2.06	3.36
	15000	105	3.67	3.33	25	0.74	1.55	2.67
M.11	0000	103	6	5.33	28.67	1.13	4.02	4.07
	5000	92	7	6	36.67	1.24	5.7	4.46
	10000	96	5.83	5	28.33	1.02	3.79	4
	15000	106	4.5	3	22.67	0.96	2.57	3.07
M.12	0000	97	5.67	5	25.67	1.26	2.45	5
	5000	93	6.67	6.67	32.67	1.45	3.28	6.17
	10000	100	6.0	5.33	26	1.14	2.91	5.47
	15000	105	4.33	4.33	15	0.50	0.94	3.33
M.13	0000	105	5.83	4.33	18.33	0.42	1.05	2.4
	5000	98	6.83	6.0	21.33	0.66	2	4.27
	10000	101	6.17	5	18.67	0.62	1.16	3.7
	15000	107	5.17	4	11.67	0.34	1.06	3.07
M.14	0000	101	5.17	5	25.33	0.80	4.18	3.43
	5000	95	6.33	7	37.33	1.28	5.15	3.9
	10000	97	5.5	6	26	0.87	3.75	2.87
	15000	106	3.73	4	16	0.42	2.07	1.9
M.16	0000	103	5	4	25	0.85	2.34	3.47
	5000	109	6.5	5.67	37	1.20	3.83	4.23
	10000	111	4.67	3.67	22.67	1.04	1.9	2.8
	15000	115	3.5	3	10.67	0.33	1.04	1.73
M.19	0000	103	5.47	6	29.67	0.84	2.95	3
	5000	101	6.17	7.33	38.33	1.5	3.31	3.53
	10000	99	4.83	4.33	30	0.91	3.0	3.33
	15000	104	4.17	3.33	27.33	0.73	1.68	2.1
M.39	0000	110	5.5	3.67	30	0.96	3.01	3.86
	5000	112	5.83	5	33	1.04	4.39	4.03
	10000	116	4.5	3.67	14.33	0.47	1.91	2.53
	15000	111	4.0	3.33	11.67	0.19	1.46	1.60
L.S.D 5 %	Sal × G	N.S	NS	N.S	N.S	NS	NS	N.S

Finally, from the aforementioned results, it could be concluded that the three barley genotypes such as Minufiya 4, 7 and 11 were found to be more salt tolerant than the other barley genotypes under study. Decreasing Na% content in these genotypes and increasing of the dry weight and grain yield of barley plants. These a good indicator for identifying the salt tolerant of barley genotypes.

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استجابة بعض سلالات الشعير للملوحة

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الملخص العربى

أجريت تجربتان خلال موسمى ٢٠٠٦/٢٠٠٥ ، ٢٠٠٧/٢٠٠٦ فى المزرعة البحثية لكلية الزراعة جامعة المنوفية لتقدير مدى تحمل عشرة سلالات شعير للملوحة (منوفية ٤، منوفية ٦ ، منوفية ٧ ، منوفية ١١، منوفية ١٢، منوفية ١٣، منوفية ١٤، منوفية ١٦، منوفية ١٩، منوفية ٣٩) النامية فى أربع مستويات من الملوحة (صفر ، ٥٠٠٠ ، ١٠,٠٠٠ ، ١٥,٠٠٠ ملليجرام /لتر) كمخلوط من كلوريد الصوديوم وكلوريد الكالسيوم وأوضحت النتائج إلى :

زادت معنويا صفات النمو والمحتوى الكلى للماء ومحتوى الماء النسبى وتركيزات كلورفيل أ+ب، الكاروتينيدات والسكريات الكلية الذائبة والكربوهيدارت الكلية والأحماض الأمينية الحرة ، نيتروجين ، فوسفور ، بوتاسيوم ومكونات المحصول عند تركيز ٥٠٠٠ مليجرام / لتر بينما أعطى أقل قيم للصوديوم والضغط الأسموزى وتاريخ طرد السنابل فى كلا الموسمين .

على الجانب الآخر أظهرت سلالتى منوفية ٦، منوفية ٣٩ نقصاً فى جميع الصفات السابقة عدا تركيز الصوديوم الذى زاد تدريجياً مع زيادة مستويات الملوحة .

أظهرت السلالات إختلافاً معنوياً لجميع الصفات المدروسة عدا المحتوى الكلى للماء والسكريات الكلية الذائبة حيث لم تكن معنوية فى الموسم الأول والثانى على التوالى .

أعلى القيم فى محتوى الماء الكلى سُجل للسلالة منوفية ٦ بينما أعلى القيم لمحتوى الماء النسبى تحقق مع السلالات منوفية ٦ ، منوفية ٧ ، منوفية ١١ بينما سجلت السلالتان ١٩ ، ٣٩ أعلى القيم للضغط الأسموزى .

أظهر التفاعل بين الملوحة والسلالات اختلافاً معنوياً لمساحة ورقة العلم والوزن الغض والجاف للنبات وتركيز كلورفيل أ + ب والكاروتينيدات والسكريات الكلية الذائبة والكربوهيدرات الكلية والوزن الجاف لحبوب النبات .

أظهرت النتائج اختلافات معنوية للملوحة والسلالات فيما يتعلق بطول السنبلة وعدد السنابل / نبات وعدد السُنيبلات / سنبلة ووزن حبوب السنبلة ووزن حبوب النبات ووزن ١٠٠ حبه بينما لم يكن التفاعل بينها معنوياً .

أقل تراكم للصوديوم قد تحقق مع الصنف منوفية ١٣ وهذا يُشير إلى أنه أكثر تحملا للملوحة بينما الصنف منوفية ٣٩ كان اقل تحملا للملوحة . وحقق الصنف منوفية ٤ اقل قيم لطرد السنابل وذلك عند مستوى الملوحة ٥٠٠٠ جزء فى المليون.

تبعاً لذلك يُمكن أن نستنتج أن السلالات منوفية ٤ ، منوفية ٧ ، منوفية ١١ أكثر تحملا للملوحة .