J. Agric. Sci. Mansoura Univ., 27 (6): 3683 - 3696, 2002

EFFECT OF NITROGEN FORMS AND LEVELS ON YIELD AND SOME GROWTH CHARACTERS OF BARLEY GENOTYPES UNDER SALINE CONDITIONS

Ahmed, I.A.; Kh.A. Moustafa and K. Amer
Barley Research Department, Field Crops Research Institute, ARC, Giza, Egypt

ABSTRACT

Two field experiments were conducted at El-Hamoul site, Kafr EL-Sheikh Governorate during two successive seasons (1999/2000 and 2000/2001, where soil salinity is the main environmental problem. The experimental materials consisted of fourty-eight barley genotypes, three forms of nitrogen fertilization (Ammonium sulphate, ammonium nitrate and urea) and two levels of nitrogen fertilization (70 and 105 kg N/ha).The objectives of this study were to investigate the interaction effects of salinity and both forms and levels of nitrogen fertilization on yield of some barley promising genotypes. Also, to select the best genotypes under saline condition, which characterized by its low requirements of nitrogen fertilization under saline conditions. The obtained results from the first season proved that applying ammonium nitrate exceeded significantly both ammonium sulphate and urea in case of biological and grain yield. The highest level of nitrogen fertilizer produced the highest values of plant height, biological and grain yields. Out of the fourty-eight genotypes tested under saline conditions, nine genotypes were selected according to their performances under saline condition. The selected nine genotypes produced higher biological and grain yields than the rest of genotypes. Those selec ten entries were reevaluated under same condition in the second growing season 2000/2001 with three national checks; Giza 123, Giza 126 and Giza 2000. Obtained results from the second season confied the results of the first one and proved that ammonium nitrate as nitrogen form is recommended for saline soils. Genotypes evaluation under saline conditions and fertilized with the lowest level of nitrogen fertilization revealed that four genotypes exceeded significantly the national check Giza 123 in grain yield under the low level of nitrogen fertilization. Also, the study of genotypic stability proved that two genotypes seemed to be the most stable genotypes. Those genotypes are of great importance for breeding to low requirements of nitrogen fertilization under saline conditions and should be used in the national breeding program.

Keywords: Barley, soil salinity, nitrogen forms and levels, yield parameters, biological and grain yield stability.

INTRODUCTION

Soil salinity is a wide spread problem in arid and semi-arid regions causing significant decreases in agriculture productivity of the cereals. With the increase in population, effective utilization of saline soils and saline water for agriculture has become necessary. Among cereal crops, barley is the main cereal crop suitable for salt affected areas and is rated tolerant (Rana, 1977, Ahmed *et al.*, 1993 and Ahmed *et al.*, 1998). Nevertheless, considerable depression in grain yield as a result of growing barley in saline soils has also been observed (Rai, 1977, Ahmed *et al.*, 1993 and Ahmed *et al.*, 1998). Thus, to raise yield production under such conditions, it is essential to establish comparative salt tolerance of improved genotypes of barley. Moreover, fertilizer application under saline conditions is of great interest.

Genotypes-salinity-fertilization interactions are of great importance and have been the subject of many studies (Kafkafi, 1984, Feigin, 1985 and Ahmed *et al.*, 1993). Ahmed *et al.* (1993) found that ammonium nitrate as nitrogen fertilizer produced higher grain yield than ammonium sulphate and urea. They found also that increasing the level of nitrogen did not increase the salinity index in most studied traits except 1000 kernel weight and harvest index.

The objectives of this study were to investigate the interaction effects of salinity as well as both forms and levels of nitrogen fertilization on yield of some promising genotypes of barley. Also, to select the best stable genotypes under saline condition which characterized yield stability and its low requirements of nitrogen fertilization.

MATERIALS AND METHODS

Two field experiments were conducted at El-Hamoul site (saline soils), Kafr EL-Sheikh Governorate during two successive seasons i.e., 1999/2000 and 2000/2001. The mechanical and chemical analysis of the experimental site are presented in Table (1).

Table (1): Soil and water chemical analysis of the experimental site at El-Hamoul, Kafr El-Sheikh Governorate.

Depth cm	EC	Cations meq/L				Anions meq/L			
		Na^+	K^+	Ca^{++}	Mg^{++}	CO_3^-	HCO_3^-	Cl^-	SO_4^-
Soil									
Surface	13.92	79.9	3.1	23.9	62.9	0.0	2.25	116.30	51.3
0-30	24.2	210	3.5	40.7	59.8	0.0	3.50	198.5	112.0
30-60	35.7	338	4.9	46.9	65.6	0.0	3.00	332.6	120.0
60-90	25.2	210	3.0	24.8	57.7	0.0	2.00	224.9	68.6
Water	1.88	8.8	0.6	3.0	1.8	0.0	4.5	7.7	2.0

The experimental materials in first season (1999/2000) consisted of fourty-eight genotypes (Table, 2). The plant materials were evaluated under saline soil conditions for their response to different nitrogen forms and levels. Three forms of nitrogen fertilization (ammonium sulphate, ammonium nitrate and urea) and two levels of nitrogen fertilization (70 and 105 kg N/ha) were used. Each genotype was planted in 2 m² (four rows 2.5 m long with 20 cm between rows). Twelve barley genotypes were selected and re-evaluated under the same fertilization treatments in the second season (2000/2001), where each cultivar was sown in plots 5 m² and replicated three times. Data were recorded on plant height (cm), 1000-kernel weight (gm), biological yield (ton/ha) and grain yield (ton/ha) in the first season), while in the second one, plant height (cm), 1000-kernel weight (gm), biological yield (ton/ha) and grain yield (ton/ha) were recorded. Standard analysis of variance using least significant differences (LSD) was performed to estimate the significant differences and the interaction among different treatments (Gomez and Gomez, 1984). Data on biological and grain yield of the twelve genotypes, collected from twelve environments (the combinations of two seasons, three nitrogen forms and two nitrogen doses), were subjected to the stability analysis as proposed by Ebrahat and Russel (1966).

Table (2): Names and pedigree of fourty-eight barley genotypes evaluated (season 1999/2000).

No.	Variety and Pedigree	
1	Giza 123	
2	Giza 124	
3	Giza 125	
4	Giza 126	
5	Giza 2000	
6	Deir Alla 106/Strain 205//Rihan-03	ICB85-0669-OAP-16AP-OAP
7	MAF 102/Volla//WW319 x Giza 119	
8	Api/CM68//Mona/3/DI//Asse/CM65-1W-1B x Giza 121/CI 06248/4/Apm/IB65//11012-213/Api/CM 67//DS/Apr	
9	Rihane/Lignee 527	ICB82-0897-4AP-OAP
10	Api/CM67/3/Emir/Nakta//Mgh6355/4/H251/3/Api/CM67//Ore/5/Arig 8	ICB91-0145-20AP-0AP
11	Campillo llerena/Daphne//Sen	CMB 87A-658-B-3M-1Y-2B-OM
12	Aths/Lignee 686//Lignee 640/Lignee 66	
13	Nacha 2//Lignee 640/Harma-01	ICB89-0825-1AP-1AP-OAP
14	Arizona 5908/Aths//Lignee 640/3/Lignee 640/Lignee 527	ICB89-0830-15AP-OAP-3APH-OAP
15	Api/CM67/3/Emir/Nakta//Mgh6355/4/H251/3/Api CM67/// Ore/5/Api/CM67//Aths*3 ICB91-0133-4APP-0AP	
16	Mari/Aths*2//Arizona 5908/Aths/6/Cita'S'/4/Apm/RI//Manker/3/Maswi/Bon/5/Copal'S' ICB91-0177-18AP-0AP	
17	Bal.16/Api//Deir Alla 106/3/Aths/Lignee 686	
18	Arizona 5908/Aths//Lignee 640	ICB81-0210-1AP-4AP-OAP
19	Rihane//Bc/Goho	ICB83-1488-2AP-0AP-1AP-1APH
20	Arizona 5908/Aths//Lignee 640/4/WI 2891/3/Api/CM67//L2966-64	CB89-0778-16AP-OAP-1APH-OAP
21	Alpha-Bar/Durra//Coracel/3/Aleli	CMB 89A-1029-N-1M-2Y-1B-1Y-1M-OY
22	Thn. Unk. Late Zahor	
23	California Marriout	
24	Barberousse/PI 382696//Gloria-Bar/Come-B ...	CMB92.523-0-2Y-2M-0Y
25	CN 100/DC 23//Fun*3/3/Tra/4/10925-1/5/Bco Mr/As/6/seed source 72-Sal/7/Cita'S' /4/Apm/R1//Manker/ Maswi/Bon/5/Copal'S'	
26	Ager//Api/CM67/3/Cel/WI2269//Ore/4/Lignee 640/Lignee 527	ICB80-0965-9AP-OAP-4APH-OAP
27	Libran/UN AB 271//Gloria-Bar/Come-B/3/...	CMB 92A. 1215-B-1M-2Y-3B-0Y
28	Lignee 527/NK1272	
29	Capa-Bar/3/Api/CM67-B//Mzq/4/CI 14032/3/...	CMB 92A-1425-B-3M-2Y-1D-0Y
30	Donaris/Gloria-Bar//Celo/3/Granado	CMB91A.167-2M-1Y-1M-1Y-2B-0Y
31	Thn.Unk.	
32	GPE 67//Aths/Lignee 6863	
33	Monroe/Esperanza//Quina	CMB92A.1449-R-4M-1Y-2B-0Y
34	Cen-B/3/Lbiran/Una 8271// Gloria-Bar/ ...	CMM 890-896-B-1B-1Y-1M-OY
35	Hma-02//11012-2/CM67/6/UC 566/5/M64-76/Bon//Jo/York/3/M5/Galt//As 46/4/Hj 34-80/Astrix	
36	Giza 117//WI 2197/CI 13450//Arar	
37	As54/Avt//Aths/3/Tripoli/Numer	
38	Arimar/Aths/4/Baca"S"/3/A	C253//CI 08887/CI 05761
39	L91-5 (No. 30, Exp. 1, Sakha stress Prog.)	
40	Quinn/Aloe/Cardo	CMB92A.1439-V-17M-1Y-2B-0Y
41	Cr.115/Pro//Bc/3/Api/CM67/4/Giza 120/5/Satter 2/Numar	
42	Arizona 5908/Aths//Lignee 640/4/Lignee 527// Bahtim/DL71/3/Api/CM67//Mzq	
43	Bco.Mr/Avt//Cel/3/Line 257-14-4/Rhn'S'-5	ICB84-0688-1AP-3AP-0TR-4AP-0TR
44	Man/4/Dal 16/Pro//Apm/Dwli-1Y/3/Api/CM67/5/Aths/Lignee 685	
45	As46/Aths*2//H85-6(Rihane'S'/LM4448-1)	
46	Acsad 618	
47	Lignee 527/Chn-01/4/U. Seak 1766/Api//Cel/3/Weeah	
48	Gloria-Bar/Come-B//Esperanza	CMB 90-312-82B-1B-127GH-0Y

RESULTS AND DISCUSSION

First season experiment:

The main effects of nitrogen forms, nitrogen levels, genotypes and their interactions on number of days to heading, plant height (cm), biological and grain yield (ton/ha) are presented in Table (3).

Table 3: Mean performances of number of days to heading, plant height (cm), biological and grain yield (ton/ha) as affected by nitrogen forms and levels under saline soil condition (1999/2000 season).

Genotype No.	Ammonium Nitrate			Ammonium sulphate			Urea			Nitrogen level		
	30	45	Average	30	45	Average	30	45	Average	30	45	Genotype mean
						Number of days to heading						
1	77.40	78.30	77.90	84.00	81.60	82.80	80.40	80.40	80.40	80.40	80.60	80.10
2	79.80	80.70	80.30	80.10	80.10	80.10	81.00	81.00	81.00	80.50	80.30	80.60
3	78.00	78.90	78.50	78.90	79.80	79.40	80.40	78.60	79.50	79.10	79.10	79.10
4	78.60	79.50	79.10	81.90	80.10	81.00	82.80	81.30	82.10	80.70	81.10	80.30
5	78.90	83.10	81.00	81.30	79.80	80.60	80.10	78.00	79.10	80.20	80.10	80.30
6	79.50	81.30	80.40	81.60	81.00	81.30	81.00	80.70	80.90	80.80	80.70	81.00
7	77.10	77.40	77.30	80.10	79.50	79.80	79.50	78.60	79.10	78.70	78.90	78.50
8	77.70	81.30	79.50	81.00	79.20	80.10	78.90	79.50	79.20	79.60	79.20	80.00
9	77.10	79.80	78.50	82.20	79.80	81.00	81.90	81.00	81.50	80.30	80.40	80.20
10	75.60	77.40	76.50	78.00	77.70	77.90	77.70	74.70	76.20	76.90	77.10	76.60
11	78.90	76.50	77.70	79.20	79.20	79.20	79.20	79.80	79.50	78.80	79.10	78.50
12	78.30	80.40	79.40	78.00	80.40	79.20	78.60	80.10	79.40	79.30	78.30	80.30
13	72.30	73.80	73.10	73.80	73.50	73.70	76.20	74.10	75.20	74.00	74.10	73.80
14	76.80	78.00	77.40	77.70	78.60	78.20	78.90	77.40	78.20	77.90	77.80	78.00
15	77.70	76.80	77.30	78.00	78.60	78.30	77.40	75.60	76.50	77.40	77.70	77.00
16	80.10	81.00	80.60	81.30	78.90	80.10	79.20	79.20	79.20	80.00	80.20	79.70
17	77.70	78.90	78.30	81.00	79.50	80.30	81.30	81.00	81.20	79.90	80.00	79.80
18	76.80	80.10	78.50	78.00	78.90	78.50	78.00	75.90	77.00	78.00	77.60	78.30
19	78.00	77.40	77.70	78.90	78.30	78.60	80.70	78.90	79.80	78.70	79.20	78.20
20	80.10	81.60	80.90	80.70	80.70	80.70	82.20	80.10	81.20	80.90	81.00	80.80
21	73.80	77.40	75.60	78.00	77.40	77.70	77.40	76.50	77.00	76.80	76.40	77.10
22	84.30	84.90	84.60	84.90	82.50	83.70	83.10	81.00	82.10	83.50	84.10	82.80
23	79.80	81.60	80.70	80.70	78.60	79.70	79.20	79.80	79.50	80.00	79.90	80.00
24	73.50	75.90	74.70	74.70	78.30	76.50	76.50	75.90	76.20	75.80	74.90	76.70
25	82.80	81.00	81.90	84.90	82.20	83.60	83.10	82.20	82.70	82.70	83.60	81.80
26	77.40	77.70	77.60	81.60	79.20	80.40	77.70	79.20	78.50	78.80	78.90	78.70
27	79.80	81.00	80.40	82.50	80.40	81.50	82.50	81.00	81.80	81.20	81.60	80.80
28	74.10	74.10	74.10	75.90	76.50	76.20	78.60	76.20	77.40	75.90	76.20	75.60
29	78.90	78.30	78.60	81.60	81.60	81.60	80.40	81.30	80.90	80.40	80.30	80.40
30	78.60	81.00	79.80	81.60	80.40	81.00	81.30	81.00	81.20	80.70	80.50	80.80
31	83.10	83.40	83.30	83.70	82.50	83.10	82.20	82.50	82.40	82.90	83.00	82.80
32	76.50	78.90	77.70	80.70	78.30	79.50	79.80	80.10	80.00	79.10	79.00	79.10
33	83.10	85.20	84.20	84.00	83.10	83.60	84.60	81.60	83.10	83.60	83.90	83.30
34	78.00	79.20	78.60	79.20	80.70	80.00	78.90	79.20	79.10	79.20	78.70	79.70
35	76.80	76.50	76.70	79.50	79.20	79.40	78.30	78.60	78.50	78.20	78.20	78.10
36	78.60	77.10	77.90	81.90	78.90	80.40	78.90	80.70	79.80	79.40	79.80	78.90
37	75.90	74.10	75.00	75.90	73.80	74.90	73.50	74.10	73.80	74.60	75.10	74.00
38	81.00	81.00	81.00	80.10	81.60	80.90	80.40	80.40	80.40	80.80	80.50	81.00
39	80.40	79.20	79.80	81.60	80.40	81.00	81.60	81.00	81.30	80.70	81.20	80.20
40	75.60	75.00	75.30	82.20	77.10	79.70	77.10	79.20	78.20	77.70	78.30	77.10
41	81.30	82.80	82.10	82.80	81.90	82.40	81.90	80.70	81.30	81.90	82.00	81.80
42	75.30	75.30	75.30	76.50	78.00	77.30	79.50	77.70	78.60	77.10	77.10	77.00
43	81.60	80.10	80.90	79.50	79.80	79.70	79.20	79.20	79.20	79.90	80.10	79.70
44	78.30	79.20	78.80	80.40	78.60	79.50	78.60	79.80	79.20	79.20	79.10	79.20
45	79.20	78.60	78.90	79.80	78.60	79.20	80.70	79.20	80.00	79.40	79.90	78.80
46	68.10	69.00	68.60	71.40	71.10	71.30	71.40	71.40	71.40	70.40	70.30	70.50
47	76.20	77.10	76.70	76.50	79.80	78.20	78.00	79.50	78.80	77.90	76.90	78.80
48	72.60	73.50	73.10	75.30	73.80	74.60	74.40	72.90	73.70	73.80	74.10	73.40
	77.9	78.8	78.3	79.9	79.2	79.5	79.5	78.9	79.2	79.1	78.9	
						Plant height (cm)						
1	85.67	85.00	85.33	59.00	83.00	71.00	69.00	76.33	72.67	71.22	81.44	76.33
2	79.67	76.00	77.83	81.00	90.33	85.67	70.33	82.00	76.17	77.00	82.78	79.89
3	80.67	73.00	76.83	83.67	89.00	86.33	78.33	83.00	80.67	80.89	81.67	81.28
4	93.00	83.33	88.17	84.00	88.33	86.17	82.33	74.00	78.17	86.44	81.89	84.17
5	88.67	75.33	82.00	70.67	83.67	77.17	85.33	86.00	85.67	81.56	81.67	81.61
6	84.33	74.00	79.17	71.00	90.33	80.67	80.33	81.67	81.00	78.56	82.00	80.28
7	84.33	77.33	80.83	72.33	75.67	74.00	72.67	71.33	72.00	76.44	74.78	75.61
8	80.00	5.33	77.67	76.00	88.67	82.33	85.00	77.33	81.17	80.33	80.44	80.39
9	89.33	89.00	89.17	87.33	92.00	89.67	89.33	89.33	89.33	88.67	90.11	89.39
10	85.67	73.67	79.67	69.67	84.33	77.00	69.67	86.00	77.83	75.00	81.33	78.17
11	84.00	76.67	80.33	76.00	87.33	81.67	73.67	73.33	73.50	77.89	79.11	78.50
12	78.00	71.00	74.50	78.67	85.33	82.00	82.00	76.33	79.17	79.56	77.56	78.56
13	83.00	71.00	77.00	69.67	72.33	71.00	71.67	64.67	68.17	74.78	69.33	72.06
14	76.00	70.67	73.33	63.00	74.67	68.83	65.33	67.67	66.50	68.11	71.00	69.56
15	92.67	94.33	93.50	86.00	90.00	88.00	95.33	91.00	93.17	91.33	91.78	91.56
16	84.33	78.00	81.17	83.67	92.33	88.00	76.00	88.00	82.00	81.33	86.11	83.72
17	80.67	75.33	78.00	76.00	81.00	78.50	78.67	76.33	77.50	78.44	77.56	78.00
18	73.33	61.67	67.50	69.67	65.33	67.50	68.33	75.33	71.83	70.44	67.44	68.94
19	74.33	75.00	74.67	67.67	92.67	80.17	78.67	80.67	79.67	73.56	82.78	78.17
20	81.67	85.00	83.33	77.67	91.33	84.50	77.33	89.67	83.50	78.89	88.67	83.78
21	86.67	76.67	81.67	75.67	81.33	78.50	78.67	75.67	77.17	80.33	77.89	79.11

Table 3:Cont.

Genotype No.	Ammonium Nitrate			Ammonium sulphate			Urea			Nitrogen level		Genotype mean
	30	45	Average	30	45	Average	30	45	Average	30	45	
22	93.33	88.00	90.67	99.67	108.33	104.00	93.00	99.67	96.33	95.33	98.67	97.00
23	84.00	68.00	76.00	76.00	91.00	83.50	69.67	78.33	74.00	76.56	79.11	77.83
24	74.00	5.00	69.50	65.00	62.33	63.67	68.33	69.00	68.67	69.11	65.44	67.28
25	76.33	81.00	78.67	75.67	85.67	80.67	72.67	68.67	70.67	74.89	78.44	76.67
26	77.33	81.00	79.17	72.33	86.00	79.17	82.00	80.67	81.33	77.22	82.56	79.89
27	74.67	70.00	72.33	69.00	85.33	77.17	73.00	76.00	74.50	72.22	77.11	74.67
28	58.67	74.33	66.50	59.33	72.67	66.00	50.67	68.67	59.67	56.22	71.89	64.06
29	78.00	85.53	81.77	77.00	86.33	81.67	73.33	82.00	77.67	76.11	84.62	80.37
30	91.33	86.00	88.67	85.00	91.33	88.17	83.67	87.67	85.67	86.67	88.33	87.50
31	89.00	79.00	84.00	93.33	92.33	92.83	89.33	86.00	87.67	90.56	85.78	88.17
32	94.00	82.67	88.33	83.00	97.67	90.33	84.67	85.33	85.00	87.22	88.56	87.89
33	89.33	81.67	85.50	79.00	96.00	87.50	75.00	97.00	86.00	81.11	91.56	86.33
34	76.33	74.00	75.17	75.00	81.33	78.17	85.00	77.00	81.00	78.78	77.44	78.11
35	80.00	85.00	82.50	72.67	82.00	77.33	78.33	79.33	78.83	77.00	82.11	79.56
36	82.67	76.00	79.33	75.67	85.33	80.50	85.00	75.67	80.33	81.11	79.00	80.06
37	86.00	80.67	83.33	72.33	93.33	82.83	86.67	83.67	85.17	81.67	85.89	83.78
38	74.67	65.67	70.17	71.00	88.33	79.67	82.00	78.00	80.00	75.89	77.33	76.61
39	83.67	82.33	83.00	73.33	84.67	79.00	88.00	71.00	79.50	81.67	79.33	80.50
40	80.67	66.67	73.67	74.00	81.00	77.50	73.00	67.00	70.00	75.89	71.56	73.72
41	84.33	82.67	83.50	81.33	88.33	84.83	75.67	85.00	80.33	80.44	85.33	82.89
42	81.33	74.00	77.67	73.33	82.33	77.83	70.67	75.33	73.00	75.11	77.22	76.17
43	81.67	9.00	80.33	79.00	86.33	82.67	83.00	80.33	81.67	81.22	81.89	81.56
44	83.67	74.00	78.83	72.67	88.00	80.33	85.33	80.33	82.83	80.56	80.78	80.67
45	79.67	80.67	80.17	83.33	89.33	86.33	85.67	81.33	83.50	82.89	83.78	83.33
46	52.00	55.00	53.50	55.33	64.33	59.83	62.00	49.00	55.50	56.44	56.11	56.28
47	88.33	5.00	81.67	74.00	78.00	76.00	78.33	72.67	75.50	80.22	75.22	77.72
48	79.33	71.00	75.17	64.33	88.00	76.17	67.67	79.67	73.67	70.44	79.56	75.00
	81.67	76.69	79.18	75.21	85.31	80.26	77.70	78.75	78.23	78.19	80.25	
						Biological yield (ton/ha)						
1	9.91	10.02	9.96	4.55	9.29	6.92	8.74	9.47	9.11	7.73	9.59	8.66
2	8.49	8.74	8.62	9.29	12.20	10.75	6.56	10.66	8.61	8.11	10.53	9.32
3	9.93	8.29	9.11	7.10	11.66	9.38	7.65	9.93	8.79	8.23	9.96	9.09
4	12.14	9.84	10.99	9.29	9.38	9.33	7.65	8.11	7.88	9.69	9.11	9.40
5	11.20	5.28	8.24	6.01	9.47	7.74	8.47	9.74	9.11	8.56	8.17	8.36
6	10.05	7.65	8.85	4.83	12.29	8.56	6.10	10.20	8.15	6.99	10.05	8.52
7	11.84	8.01	9.93	7.74	8.92	8.33	7.50	8.65	8.08	9.03	8.53	8.78
8	10.37	9.47	9.92	7.47	12.48	9.97	10.93	10.02	10.47	9.59	10.66	10.12
9	16.03	9.56	12.80	9.29	10.47	9.88	11.84	12.20	12.02	12.39	10.75	11.57
10	9.69	7.56	8.63	7.83	10.02	8.92	6.83	10.11	8.47	8.12	9.23	8.67
11	11.57	8.20	9.88	7.65	9.29	8.47	8.11	7.29	7.70	9.11	8.26	8.68
12	10.36	7.19	8.78	11.02	11.66	11.34	10.93	11.29	11.11	10.77	10.05	10.41
13	12.31	6.92	9.62	7.29	7.29	7.29	8.56	7.05	7.80	9.39	7.09	8.24
14	11.47	9.29	10.38	7.29	10.20	8.74	7.05	9.02	8.03	8.60	9.50	9.05
15	9.29	10.93	10.11	9.47	8.38	8.92	10.47	10.38	10.43	9.74	9.90	9.82
16	10.02	7.47	8.74	7.10	12.84	9.97	7.47	10.11	8.79	8.20	10.14	9.17
17	7.97	7.83	7.90	6.37	9.11	7.74	10.66	6.56	8.61	8.33	7.83	8.08
18	9.38	5.74	7.56	9.11	7.19	8.15	7.74	9.93	8.83	8.74	7.62	8.18
19	10.38	7.92	9.15	6.56	11.20	8.88	8.29	11.66	9.97	8.41	10.26	9.33
20	9.54	11.20	10.37	8.56	11.57	10.06	9.02	10.66	9.84	9.04	11.14	10.09
21	12.00	7.56	9.78	5.10	8.74	6.92	7.56	8.38	7.97	8.22	8.23	8.22
22	10.02	7.01	8.52	8.56	11.57	10.06	8.38	11.11	9.74	8.99	9.90	9.44
23	11.02	6.19	8.61	6.37	11.38	8.88	6.10	9.42	7.76	7.83	9.00	8.42
24	9.20	7.29	8.24	6.01	5.37	5.69	6.85	8.56	7.70	7.35	7.07	7.21
25	8.23	11.20	9.72	7.47	11.11	9.29	7.38	9.46	8.42	7.69	10.59	9.14
26	7.50	10.56	9.03	5.65	10.20	7.92	10.79	8.74	9.77	7.98	9.84	8.91
27	9.47	7.47	8.47	5.65	9.74	7.70	6.01	8.56	7.29	7.04	8.59	7.82
28	9.24	9.84	9.54	6.74	11.29	9.02	4.83	12.48	8.65	6.94	11.20	9.07
29	11.38	11.69	11.54	9.56	10.56	10.06	9.65	10.56	10.11	10.20	10.94	10.57
30	13.57	11.38	12.48	10.75	11.84	11.29	11.29	13.02	12.16	11.87	12.08	11.98
31	11.66	7.19	9.43	10.56	9.74	10.15	12.29	12.93	12.61	11.51	9.96	10.73
32	12.93	7.65	10.29	8.92	12.48	10.70	7.74	9.31	8.53	9.87	9.81	9.84
33	12.11	10.38	11.25	8.92	13.75	11.34	8.38	12.93	10.66	9.81	12.36	11.08
34	10.73	9.20	9.96	8.01	8.11	8.06	9.84	8.38	9.11	9.53	8.56	9.04
35	9.50	12.75	11.12	6.74	10.84	8.79	8.92	10.38	9.65	8.39	11.32	9.86
36	9.93	6.92	8.42	7.47	9.29	8.38	8.27	7.56	7.91	8.55	7.92	8.24
37	9.84	10.38	10.11	7.10	10.20	8.65	10.47	10.02	10.25	9.14	10.20	9.67
38	7.69	6.37	7.03	6.92	10.66	8.79	8.65	8.38	8.52	7.75	8.47	8.11
39	11.11	10.38	10.75	6.37	9.93	8.15	13.02	8.47	10.75	10.17	9.59	9.88
40	10.38	7.83	9.11	5.74	9.29	7.51	8.65	9.11	8.88	8.26	8.74	8.50
41	9.43	7.47	8.45	9.29	8.47	8.88	6.37	9.38	7.88	8.37	8.44	8.40
42	9.75	8.74	9.24	8.29	12.57	10.43	7.10	10.02	8.56	8.38	10.44	9.41
43	9.29	8.65	8.97	8.92	11.75	10.34	10.47	9.47	9.97	9.56	9.96	9.76
44	9.47	7.47	8.47	6.37	11.75	9.06	7.65	11.29	9.47	7.83	10.17	9.00
45	7.13	8.38	7.76	7.19	9.38	8.29	7.29	11.02	9.15	7.20	9.59	8.40

Table 3: Cont.

Genotype No.	Ammonium Nitrate			Ammonium sulphate			Urea			Nitrogen level		
	30	45	Average	30	45	Average	30	45	Average	30	45	mean
46	5.37	8.20	6.78	6.01	8.56	7.29	6.56	6.37	6.47	5.98	7.71	6.85
47	7.78	5.46	6.62	5.83	6.65	6.24	9.74	8.38	9.06	7.78	6.83	7.31
48	6.83	8.74	7.79	4.55	10.02	7.29	8.47	8.42	8.45	6.62	9.06	7.84
	10.09	8.53	9.31	7.48	10.21	8.84	8.53	9.69	9.11	8.70	9.48	
						Grain yield (ton/ha)						
1	3.02	3.08	3.05	0.89	2.21	1.55	2.06	2.76	2.41	1.99	2.68	2.33
2	2.56	2.50	2.53	2.40	2.93	2.66	1.80	2.88	2.34	2.25	2.77	2.51
3	3.24	2.35	2.79	1.72	2.85	2.29	1.90	2.07	1.99	2.29	2.42	2.35
4	3.10	2.58	2.84	1.68	1.69	1.69	1.50	1.78	1.64	2.09	2.02	2.05
5	3.44	1.49	2.46	1.23	2.08	1.66	2.12	2.47	2.29	2.26	2.01	2.14
6	3.26	1.88	2.57	1.17	2.84	2.01	1.55	2.98	2.26	1.99	2.57	2.28
7	3.68	2.78	3.23	1.99	2.76	2.37	2.29	2.10	2.19	2.65	2.54	2.60
8	3.78	2.99	3.38	2.06	3.37	2.72	2.88	2.86	2.87	2.91	3.07	2.99
9	4.94	3.05	3.99	2.44	2.72	2.58	2.54	3.28	2.91	3.31	3.02	3.16
10	3.31	1.90	2.61	1.99	2.03	2.01	2.06	2.32	2.19	2.46	2.08	2.27
11	3.86	2.45	3.15	2.15	2.56	2.36	2.51	2.04	2.28	2.84	2.35	2.60
12	3.01	2.08	2.54	2.79	2.84	2.81	3.23	3.43	3.33	3.01	2.78	2.89
13	4.21	1.73	2.97	1.67	1.83	1.75	2.41	2.35	2.38	2.76	1.97	2.37
14	3.62	2.88	3.25	2.12	2.77	2.45	2.05	2.49	2.27	2.60	2.72	2.66
15	3.00	2.15	2.57	2.35	2.34	2.34	2.94	2.77	2.85	2.76	2.42	2.59
16	3.12	2.21	2.66	1.76	2.93	2.35	2.02	2.54	2.28	2.30	2.56	2.43
17	2.66	2.29	2.47	1.35	2.17	1.76	1.80	1.23	1.52	1.93	1.90	1.92
18	3.32	1.71	2.52	2.48	1.56	2.02	2.46	2.22	2.34	2.75	1.83	2.29
19	3.31	2.20	2.76	1.41	2.50	1.95	1.71	3.04	2.37	2.14	2.58	2.36
20	2.99	3.08	3.04	1.97	2.01	1.99	2.09	2.74	2.42	2.35	2.61	2.48
21	3.73	2.56	3.15	1.25	2.40	1.83	2.09	2.21	2.15	2.36	2.39	2.37
22	2.42	1.87	2.14	1.69	2.49	2.09	1.99	2.69	2.34	2.04	2.35	2.19
23	2.67	1.52	2.09	1.55	2.35	1.95	1.57	2.49	2.03	1.93	2.12	2.02
24	3.14	2.12	2.63	1.55	1.44	1.49	1.80	1.80	1.80	2.16	1.79	1.98
25	2.64	3.20	2.92	2.04	2.32	2.18	1.81	2.61	2.21	2.16	2.71	2.44
26	2.57	3.28	2.93	1.47	2.38	1.93	3.14	2.75	2.94	2.39	2.80	2.60
27	3.16	2.19	2.67	1.29	2.84	2.06	1.52	2.23	1.87	1.99	2.42	2.20
28	2.90	3.24	3.07	1.98	2.88	2.43	1.25	2.78	2.01	2.04	2.97	2.50
29	3.54	3.52	3.53	2.39	2.36	2.38	2.71	2.58	2.65	2.88	2.82	2.85
30	3.92	3.36	3.64	2.78	2.92	2.85	3.24	2.35	2.80	3.31	2.88	3.10
31	3.50	2.26	2.88	2.60	2.88	2.74	3.11	3.47	3.29	3.07	2.87	2.97
32	3.16	1.94	2.55	1.75	2.50	2.13	1.63	2.66	2.14	2.18	2.36	2.27
33	3.34	2.74	3.04	2.06	3.15	2.60	2.00	2.92	2.46	2.47	2.93	2.70
34	3.60	2.84	3.22	2.39	2.19	2.29	2.85	2.90	2.87	2.95	2.64	2.79
35	3.29	4.27	3.78	1.91	3.07	2.49	2.49	2.80	2.65	2.57	3.38	2.97
36	3.08	1.91	2.50	1.17	2.07	1.62	2.13	2.15	2.14	2.13	2.04	2.08
37	2.75	2.76	2.76	1.69	2.67	2.18	2.82	2.90	2.86	2.42	2.78	2.60
38	2.52	1.93	2.22	1.79	2.45	2.12	2.11	2.31	2.21	2.14	2.23	2.19
39	2.78	2.58	2.68	1.27	2.26	1.76	3.08	2.19	2.64	2.37	2.34	2.36
40	3.53	2.27	2.90	1.39	2.53	1.96	2.32	2.36	2.34	2.41	2.39	2.40
41	2.81	2.36	2.59	2.37	2.13	2.25	2.12	2.68	2.40	2.43	2.39	2.41
42	3.16	2.96	3.06	2.06	3.03	2.54	2.12	3.10	2.61	2.44	3.03	2.74
43	2.93	2.68	2.81	2.47	3.31	2.89	3.27	2.40	2.84	2.89	2.80	2.84
44	2.78	1.89	2.33	1.41	2.84	2.13	2.33	2.60	2.47	2.17	2.44	2.31
45	2.49	2.64	2.56	1.99	2.37	2.18	2.42	3.11	2.76	2.30	2.70	2.50
46	1.45	1.99	1.72	1.12	1.52	1.32	1.62	1.55	1.59	1.40	1.69	1.54
47	2.69	1.78	2.23	1.39	1.71	1.55	2.27	2.39	2.33	2.12	1.96	2.04
48	1.65	2.48	2.07	1.02	2.03	1.52	1.94	2.13	2.03	1.54	2.21	1.87
	3.12	2.47	2.79	1.82	2.46	2.14	2.24	2.53	2.39	2.39	2.49	

LSD at 5% for:	No. of days to ehading	Plant height	Biological yield	Grain yield
Nitrogen Form (N)	0.30	1.52	NS	0.13
Nitrogen level (L)	NS	1.24	0.36	NS
N x L	0.43	2.15	0.63	0.19
Genotypes (G)	1.21	6.09	1.79	0.54
G x N	2.09	NS	NS	NS
G x L	NS	NS	NS	NS
G x N x L	NS	NS	NS	NS

Nitrogen fertilizer forms had significant effects on number of days to heading, plant height and grain yield. Ammonium nitrate gave the earliest plants (78.35 day), the highest biological yield (9.31 ton/ha) and grain yield (2.793 ton/ha), while Ammonium sulphate produced the longest plants (80.26 cm). Urea fertilizer gave the lowest values for all the studied characters, therefore, it could be concluded that urea fertilizer is not recommended for saline soils. Obtained results are in good agreement with those obtained by Ahmed *et al.* (1993). Obtained results showed also, that increasing the nitrogen level from 70 to 105 kg/ha increased significantly plant height, biological and grain yields from 78.19 cm, 8.70 ton/ha and 2.39 ton/ha to 80.25 cm, 9.48 ton/ha and 2.49 ton/ha, in respective order. Highly significant interactions effects between nitrogen forms and levels were obtained for all studied characters. Bernstein *et al.* (1974), Kafkafi (1984), Abo-El-Enin *et al.* (1993) and Ahmed *et al.* (1993) proved the importance of nitrogen fertilization under saline conditions.

Data presented in Table (3) revealed that the differences between genotypes were highly significance in case of the four studied characters. A total of 19 genotypes significantly reached the heading time before the check cultivar Giza 123 (Genotype No. 1). The earliest heading dates were obtained from genotypes number 46 followed by 48, 13, and 37, while the latest heading time was recorded by genotypes No. 33, 22, 31 and 25 with number of days to heading of 83.6, 83.5, 82.9 and 82.7 days. Thirty-six genotypes exceeded the check cultivar Giza 123 in plant height, among them eight genotypes (number 22, 15, 9, 31, 32, 30, 33, and 4) produced significantly taller plants than that of Giza 123. On the other hand, genotypes number 9 and 30 highly significantly outyielded the national check Giza 123 in biological yield with an average increase of 2.91 and 3.32 ton/ha, respectively. The respective increases in grain yield for both genotypes (No. 9 and No. 30) were 0.83 and 0.76 in respective order.

The interaction between genotypes and nitrogen forms reached the level of significance only in case of number of days to heading, revealing that varieties were affected differentially when fertilized with different nitrogen forms. Generally, genotypes numbers 9 and 30 gave the highest biological and grain yield when fertilized with ammonium nitrate. Although, the interaction between genotypes and nitrogen levels were non significant in case of the four studied characters, it could be noticed that, under the lower level of nitrogen fertilization, 40, 39, and 42 genotypes outyielded the national check Giza 123 in plant height, biological yield and grain yield, respectively. In the same time, 6, 21 and 27 genotypes gave higher values of the three characters than that of Giza 2000.

The second order interaction effects (genotypes, nitrogen forms and levels) did not reach the level of significance for all characters (Table (3). However, some genotypes gave better yield under the lowest level of fertilization (for each fertilizer form) than the check cultivar.

One of our objectives from this research is to select the best genotypes with lower requirements of the recommended nitrogen fertilization under saline condition. Therefore, a total of 25, 12 and 16 genotypes produced higher biological yield than that of Giza 123 when genotypes were fertilized with the lowest level of ammonium nitrtate, ammonium sulphate and urea, respectively. The respective numbers of genotypes concerning grain yield were 27, 47 and 28 genotypes. Out of those genotypes nine genotypes (No. 8, 9, 11, 12, 30, 35, 43, 44 and 47) were selected according to their productivity (biological and grain yields) as well as their performances under saline condition to build up the experimental materials for the second season (2000/2001) beside Giza 123, Giza 126 and Giza 2000 as national checks. The names and pedigree of selected entries were tabulated in Table (4).

Table (4): Names and pedigree of twelve barley genotypes selected from the first season and treated with different nitrogen forms and levels under saline conditions at Kafr El-Sheikh Governorate (2000/2001 season).

No.	Variety and Pedigree	
8	Api/CM68//Mona/3/Dl//Asse/CM65-1W-1B x Giza 121/Cl 06248/4/Apm/IB65//11012-213/Api/CM 67//DS/Apr	
9	Rihane/Lignee 527	ICB82-0897-4AP-OAP
11	Campillo llerena/Daphne//Sen	CMB 87A-658-B-3M-1Y-2B-OM
12	Aths/Lignee 686//Lignee 640/Lignee 66	
30	Donaris/Gloria-Bar//Celo/3/Granado	CMB91A.167-2M-1Y-1M-1Y-2B-0Y
35	Hma-02//11012-2/CM67/6/UC 566/5/M64-76/Bon//Jo/York/3/M5/Galt//As 46/4/Hj 34-80/Astrix	
43	Bco.Mr/Avt//Cel/3/Line 257-14-4/Rhn'S'-5	ICB84-0688-1AP-3AP-0TR-4AP-0TR
44	Man/4/Dal 16/Pro//Apm/Dwli-1Y/3/Api/CM67/5/Aths/Lignee 685	
47	Lignee 527/Chn-01/4/U. Seak 1766/Api//Cel/3/Weeah	
10	Giza 123	
11	Giza 126	
12	Giza 2000	

Second season:

Data presented in Table (5) show the response of twelve barley genotypes previously selected from the first season to nitrogen forms (ammonium nitrate, ammonium sulphate and urea) as well as two levels of nitrogen (70 and 105 kg N/ha).

Table (5) represents the mean performances of plant height of the studied genotypes as affected by both forms and levels of nitrogen fertilization. The differences between genotypes (G), levels of nitrogen fertilization (L) as well as the interactions between genotypes x nitrogen forms, genotypes x nitrogen levels, nitrogen forms x nitrogen levels and the second order interaction between the three factors reached the level of significance.

Plant height did not significantly affected by nitrogen forms, although, using ammonium nitrate increased plant height. On the other hand, increasing the level of nitrogen fertilization from 70 to 105 kg/ha significantly increased plant height from 49.11 to 51.11 cm, which confirmed the results of the first season. Concerning the differences between genotypes, Genotype No. 6 produced the highest plant height, and significantly exceeded genotypes No. 5, 4, 1, 10, 2, 9, 12 and 3 in plant height. Genotypes No. 11, 7 and 8 followed the genotype No. 6 in plant height, but without significant differences. As for the interaction between genotypes and nitrogen forms, genotypes No. 6 produced the tallest plant (67.92 cm) and significantly exceeded the other genotypes when ammonium nitrate was used. The response of tested genotypes to different levels of nitrogen fertilization showed that genotype No. 6 ranked first with an average of 60.67 cm under the lowest level of nitrogen fertilization. So, it seems that this genotype characterized by its low requirement of nitrogen fertilization. Finally, treated the twelve genotypes with the six combinations of nitrogen forms and levels (three nitrogen forms and two levels of nitrogen) revealed that genotypes No. 6, 8, 11 and 10 occupied the first positions with non-significant differences between them. Genotypes 6, 11 and 10 gave taller plants with the lowest level of nitrogen fertilizer but with different forms of nitrogen fertilization (A. nitrate and A. sulphate). It could be concluded from the previous discussion that genotypes No. 6, 8, Giza 126, and Giza 123 performed well under saline conditions than other genotypes and both A. nitrate and A. sulphate could be used under saline conditions. Genotypes No. 6, Giza 126 and Giza 123 have little requirements from nitrogen fertilization than other genotypes.

Data of 1000-kernel weight (Table, 5) revealed that the differences between nitrogen forms, genotypes, and their interactions reached the level of significance. Urea produced the highest 1000 kernel weight with an average of 32.04 gm compared to 30.24 and 30.01 when A. sulphate and A. nitrate were used, respectively. As for the response of the tested cultivars to the nitrogen forms, data revealed that genotypes No. 8, Giza 2000, No. 2, Giza 123 and Giza 126 produced the highest 1000 kernel weight. Giza 126 and genotypes No. 2 gave their highest 1000 kernel weight using ammonium nitrate, while genotypes Giza 2000 produced the highest 1000 kernel weight when fertilized by ammonium sulphate. On the other hand, genotypes No. 8 and 10 were superior by using urea. As for the response of tested genotypes to the levels of nitrogen fertilization, Giza 123 and Giza 123 and genotypes No. 1, 3, Giza 126 and Giza 2000 produced the highest kernel weight when 70 and 105 kg N/ha were applied, respectively. The interaction between forms and levels of nitrogen fertilization showed that the highest kernel weight (33.46 gm) was produced when barley genotypes fertilized by the highest level of urea. The response of the studied genotypes to the interaction between both forms and levels of nitrogen fertilization, showed that Giza 123 the salt tolerant genotypes produced the highest kernel weight under the lowest level of fertilization of both ammonium sulphate and urea. Followed Giza 123, genotypes No. 8 treated with the highest level of urea and genotypes No. 3 fertilized with the highest level of ammonium nitrate or the lowest level of ammonium sulphate produced also higher 1000 kernel weight. It could be concluded from the aforementioned results that genotypes Giza 123 and genotype No. 3 could tolerant soil salinity and produced higher kernel weight with lowest nitrogen level.

The analysis of variance of biological yield revealed that the differences between nitrogen forms, nitrogen levels, genotypes, as well as all their interactions reached the level of significance. The comparison of nitrogen forms showed that ammonium nitrate produced the highest biological yield and superior significantly both ammonium sulphate and urea being 20.4 and 43.76%, respectively. As indicated in Table (5), biological yield significantly increased from 2.798 to 3.069 ton/ha when barley genotypes fertilized by the highest level of nitrogen fertilization (105 kg N/ha). The overall average of genotypes revealed that genotype No. 6 significantly exceeded all genotypes in biological yield with an average of 4.616 ton/ha. Comparing the twelve genotypes under the three forms of nitrogen fertilizers, data indicated that genotype No. 6 fertilized with ammonium nitrate exceeded significantly all the other combination in biological yield with an average of 6.313 ton/ha. The same genotype gave better biological yield with ammonium sulphate being 4.033 ton/ha. Also, genotype No. 5 with ammonium nitrate and Giza 126 with ammonium sulphate were higher in biological yield under saline condition. As for the interaction between genotypes and nitrogen levels, genotype No. 6 with the lowest level of nitrogen and genotype No. 1 with the higher level of nitrogen significantly exceeded all other genotypes in biological yield and gave 5.467 and 5.150 ton/ha, respectively. The interaction effects of genotypes, nitrogen forms and nitrogen levels were highly significant. Biological yield ranged from 0.70 (genotype No. 1 with the lowest level of ammonium sulphate) to 7.567 (genotype No. 6 treated with the lowest level of ammonium nitrate). Genotypes No. 5 and treated with the lowest level of ammonium nitrate produced the highest biological yield and significantly exceeded all the other genotypes except genotype No. 1 under the highest level of both urea and ammonium nitrate. Also, genotypes No. 11 and 8 treated with the lowest and highest levels of ammonium sulphate, respectively, gave higher biological yield being 5.60 and 5.147 ton/ha, in respective order.

Data presented in Table (5) show that the differences between genotypes, nitrogen forms, and all levels of interaction reached the significance level. Nitrogen forms significantly affected grain yield and the highest grain yield (0.615 ton/ha) was obtained with using ammonium nitrate. The differences between nitrogen levels did not reach the level of significance although the higher level (105 kg N/ha) gave better grain yield than that of 70 kg N/ha. The table shows also that increasing nitrogen level from 70 to 105 kg/ha nonsignificantly increased grain yield from 0.488 to 0.515 ton/ha, respectively. The overall average of genotypes revealed that genotype No. 6 significantly exceeded all the other genotypes with an average grain yield of 0.777 ton/ha). Both genotypes No. 6 and 5 when treated with ammonium nitrate significantly exceeded the other combination (genotypes x nitrogen forms). The interactions between genotypes and nitrogen levels were highly significant. Genotype No. 6, when treated with the lowest level of nitrogen fertilization, gave yield of 0.9389 ton/ha. The responses of the tested genotypes under the combinations of nitrogen forms and levels were highly significant. Grain yield ranged from 0.1 ton/ha (genotype No. 1 fertilized by the lowest level of ammonium sulphate) to 1.53 ton/ha (genotype 5 treated with the lowest level of ammonium nitrate. Genotypes No. 5 and 6 significantly exceeded all the tested genotypes and gave higher yield under the lowest level of ammonium nitrate.

Table (5): Mean performances of plant height, 1000-kernel weight, total biological and grain yields as affected by nitrogen forms and levels of nitrogen fertilization under saline condition at El-Hamoul, Kafr El-Sheikh Governorate, 2000/2001 season.

	A. sulphate 70	A. sulphate 105	Mean	Urea 70	Urea 105	Mean	A. nitrate 70	A. nitrate 105	Mean	Mean of dose 70	Mean of dose 105	Mean
						Plant height (cm)						
1	31.0	54.0	42.5	52.0	58.0	55.0	53.0	52.7	52.8	45.3	54.9	50.1
2	52.0	49.0	50.5	38.3	50.0	44.2	49.3	49.0	49.2	46.6	49.3	47.9
3	51.3	41.0	46.2	35.5	45.7	40.6	41.0	37.0	39.0	42.6	41.2	41.9
4	54.7	59.0	56.8	34.0	50.0	42.0	63.0	44.5	53.8	50.6	51.2	50.9
5	42.3	50.5	46.4	51.0	53.0	52.0	57.0	56.3	56.7	50.1	53.3	51.7
6	57.7	48.5	53.1	58.0	45.3	51.7	66.3	69.5	67.9	60.7	54.4	57.6
7	50.0	51.0	50.5	57.0	63.0	60.0	51.0	53.0	52.0	52.7	55.7	54.2
8	54.0	68.7	61.3	52.0	54.0	53.0	50.5	37.5	44.0	52.2	53.4	52.8
9	41.0	35.5	38.3	39.0	57.0	48.0	36.3	60.0	48.2	38.8	50.8	44.8
10	44.0	39.0	41.5	42.0	55.0	48.5	63.0	48.7	55.8	49.7	47.6	48.6
11	65.0	52.7	58.8	47.0	62.0	54.5	53.0	58.0	55.5	55.0	57.6	56.3
12	48.0	59.0	53.5	38.0	41.0	39.5	49.5	32.0	40.8	45.2	44.0	44.6
Mean	49.3	50.7	**50.0**	45.3	52.8	**49.1**	52.8	49.9	**51.3**	49.1	51.1	
						1000-kernel weight (gm)						
1	31.70	38.20	34.95	32.23	37.93	35.08	34.50	34.20	34.35	32.81	36.78	34.79
2	34.57	32.37	33.47	20.70	26.47	23.58	35.33	39.20	37.27	30.20	32.68	31.44
3	39.77	27.90	33.83	27.40	38.00	32.70	31.20	40.20	35.70	32.79	35.37	34.08
4	33.40	23.43	28.42	22.20	25.53	23.87	27.90	21.10	24.50	27.83	23.36	25.59
5	26.63	26.00	26.32	27.40	30.10	28.75	32.77	27.50	30.13	28.93	27.87	28.40
6	26.93	25.03	25.98	36.77	34.27	35.52	33.07	24.80	28.93	32.26	28.03	30.14
7	26.30	28.10	27.20	29.87	30.70	30.28	22.07	32.50	27.28	26.08	30.43	28.26
8	25.80	29.83	27.82	38.30	40.33	39.32	23.90	18.80	21.35	29.33	29.66	29.49
9	24.90	25.20	25.05	28.40	33.20	30.80	22.70	27.00	24.85	25.33	28.47	26.90
10	33.87	22.40	28.13	41.10	32.50	36.80	40.60	28.63	34.62	38.52	27.84	33.18
11	35.50	32.17	33.83	31.77	35.70	33.73	36.40	36.80	36.60	34.56	34.89	34.72
12	37.80	37.93	37.87	31.37	36.80	34.08	22.00	27.10	24.55	30.39	33.94	32.17
	31.43	29.05	**30.24**	30.63	33.46	**32.04**	30.20	29.82	**30.01**	30.75	30.78	
						Biological yield (ton/ha)						
1	0.700	3.250	1.975	2.900	6.300	4.600	1.700	5.900	3.800	1.767	5.150	3.458
2	1.760	2.300	2.030	2.150	2.900	2.525	3.800	1.500	2.650	2.570	2.233	2.402
3	4.367	2.900	3.633	1.600	3.440	2.520	2.750	3.850	3.300	2.906	3.397	3.151
4	3.880	4.133	4.007	1.420	2.780	2.100	4.000	2.250	3.125	3.100	3.054	3.077
5	3.500	2.350	2.925	1.600	2.300	1.950	6.300	4.567	5.433	3.800	3.072	3.436
6	4.633	3.433	4.033	4.200	2.800	3.500	7.567	5.060	6.313	5.467	3.764	4.616
7	1.650	2.000	1.825	2.250	2.150	2.200	2.280	3.867	3.073	2.060	2.672	2.366
8	2.200	5.147	3.673	2.300	2.313	2.307	1.550	1.200	1.375	2.017	2.887	2.452
9	1.400	1.750	1.575	1.350	2.400	1.875	3.100	3.200	3.150	1.950	2.450	2.200
10	2.547	1.200	1.873	2.000	1.600	1.800	3.800	2.633	3.217	2.782	1.811	2.297
11	5.600	3.453	4.527	1.140	3.000	2.070	3.800	4.000	3.900	3.513	3.484	3.499
12	2.400	2.950	2.675	1.533	1.700	1.617	1.000	3.900	2.450	1.644	2.850	2.247
	2.886	2.906	**2.896**	2.037	2.807	**2.422**	3.471	3.494	**3.482**	**2.798**	**3.069**	
						Grain yield (ton/ha)						
1	0.100	0.595	0.348	0.415	1.067	0.741	0.287	0.993	0.640	0.267	0.885	0.576
2	0.323	0.383	0.353	0.340	0.380	0.360	0.743	0.330	0.537	0.469	0.364	0.417
3	0.793	0.420	0.607	0.310	0.573	0.442	0.440	0.593	0.517	0.514	0.529	0.522
4	0.720	0.860	0.790	0.180	0.487	0.333	0.800	0.360	0.580	0.567	0.569	0.568
5	0.523	0.350	0.437	0.260	0.410	0.335	1.153	0.803	0.978	0.646	0.521	0.583
6	0.837	0.503	0.670	0.580	0.527	0.553	1.400	0.820	1.110	0.939	0.617	0.778
7	0.310	0.430	0.370	0.427	0.330	0.378	0.450	0.610	0.530	0.396	0.457	0.426
8	0.315	0.783	0.549	0.430	0.440	0.435	0.277	0.280	0.278	0.341	0.501	0.421
9	0.260	0.270	0.265	0.230	0.400	0.315	0.520	0.547	0.533	0.337	0.406	0.371
10	0.477	0.190	0.333	0.320	0.280	0.300	0.800	0.470	0.635	0.532	0.313	0.423
11	0.960	0.587	0.773	0.210	0.530	0.370	0.687	0.720	0.703	0.619	0.612	0.616
12	0.300	0.440	0.370	0.247	0.240	0.243	0.140	0.540	0.340	0.229	0.407	0.318
	0.493	0.484	**0.489**	0.329	0.472	**0.401**	0.641	0.589	**0.615**	**0.488**	**0.515**	

LSD at 5% for:	Plant height	1000-Kernel weight	Biological yield	Grain yield
Nitrogen Form (N)	NS	0.914	0.330	0.059
Nitrogen level (L)	1.978	NS	0.270	NS
N x L	3.427	1.293	0.467	0.083
Genotypes (G)	4.846	1.829	0.661	0.118
G x N	8.394	3.167	1.144	0.204
G x L	6.853	2.586	0.934	0.167
G x N x L	11.87	4.479	1.618	0.289

It could be concluded from the above mentioned results that ammonium nitrate is recommended for saline soils. Ahmed *et al.* (1993) came to the same recommendation. The Egyptian genotypes Giza, 123, Giza 126 and Giza 2000 proved to be tolerant genotypes. Also, genotypes No. 5, 6 are recommended to be used in future breeding programs for salt tolerance. Ahmed *et al.* (1998) reported that grain yield is seriously affected by soil salinity. They also mentioned that Giza 123 proved to be salt tolerant genotypes and great importance to raise grain yield under saline condition through selecting tolerant genotype and improve the recommendation package for saline soils.

Yield stability

Ahmed (1998) reported that in order for a cultivar to be coomercially successful, it must perform well across a range of environments. Knowledge of genotype-environments interaction lead to successful evaluation of stable genotype, which could be uysed in successful breeding programs. These types of iteraction are of of major concern for developing such cultivars. The combined analysis of variance over environments (years, nitrogen forms and two levels) showed that the differences between genotypes were highly significant for both biological and grain yields. The average of biological and grain yields of the 12 genotypes ranged from 4.879 to 7.563 and from 1.228 to 1.811 ton/ha, respectively.

Data presented in Table (6) revealed that the genotypes x environments interaction for biological and grain yields were highly significance, which indicated that there were changes in the relative ranking or magnitudes of differences among genotypes over environments. The average of biological and grain yields along with their regression coefficients and deviation from regression coefficients are presented in Table (6). Eberhart and Russell (1966) proposed that an ideal genotype is that one which has the highest yield over a broad range of environments, a regression coefficient (b) of one and deviation from regression (S^2d) of zero. Obtained results showed that linear response to change in environments (b) ranged from 0.731 to 1.381 for biological yield and from 0.711 to 1.331 for grain yield. However, all (b) values were not significantly different from unity, except for genotypes No. 2, No. 3 and No. 8 in case of biological yield and No. 2, 8 and Giza 126 in case of grain yield. In addition, the estimates of deviation from regression S^2d were also not significantly from zero in both traits. On the bases of all three stability parameters (mean, b and S^2d), it is clear that six genotypes in biological yield and seven genotypes in grain yield gave higher yield above the grand mean. Among these entries, genotypes numbers 5 and 6 had the highest yield and can be considered the most stable genotypes for both biological and grain yields. On the other hand, genotype No. 1, Giza 126 and No. 9 in biological yield and genotypes No. 1, 3, 9 and 4 in grain yield were more stable. Those genotypes are should be of great value for developing new varieties of barley and they can be used in the future breeding programs for evoloving high yielding and stable genotypes.

Table (6): Stability measurements of biological and grain yields of some barley genotypes calculated from observation of two years, three nitrogen forms and two levels of fertilization.

	Biological yield			Grain yield		
Genotype	Mean	b	S^2b	Mean	b	S^2b
1	6.790	1.002	1.339	1.783	1.138	-0.058
2	6.984	1.381**	0.049	1.789	1.331**	-0.038
3	7.563	1.298**	-1.038	1.809	1.183	-0.050
4	5.880	0.847	-0.566	1.582	0.978	-0.068
5	6.646	0.965	1.097	1.778	1.123	0.089
6	7.188	0.770	-0.074	1.811	0.929	-0.002
7	5.683	1.017	-0.389	1.367	0.886	-0.078
8	4.879	0.731*	0.493	1.229	0.764*	-0.086
9	6.305	1.197	-0.025	1.633	1.110	0.073
10	5.480	0.974	-0.369	1.379	0.944	-0.001
11	6.449	0.875	0.237	1.335	0.711*	-0.038
12	5.305	0.959	-0.267	1.228	0.903	-0.039
Mean	6.360			1.560		

REFERENCES

Abo-Elenin R.A.; W.E. Ahmed and I.A. Ahmed (1993). Effect of some nitrogen forms and levels on barley tolerance to salinity. H. Leith and A. Al Masoom (eds.): Towards the rational use of high salinity tolerant plants, Proceedings of the first ASWAS conference, December 8-15, 1990 at the United Arab Emirates University, Al Ain, United Arab Emirates, 2: 115-120.

Ahmed, I.A. (1998). Evaluation fo some barley genotypes under different environmental conditions. Egypt. J. Appl. Sci., 13 (6): 72-79.

Ahmed, I.A.; R.A. Abo-Elenin and W.E. Ahmed (1993). Interactive effects of salinity and both forms and levels of nitrogen fertility on growth and yield of barley. H. Leith and A. Al Masoom (eds.): Towards the rational use of high salinity tolerant plants, Proceedings of the first ASWAS conference, December 8-15, 1990 at the United Arab Emirates University, Al Ain, United Arab Emirates, 2: 121-128.

Ahmed, I.A.; A.M. El-Sherbieni and A.M.O. El-Bawab (1998). Studies on salt tolerance of barley cultivars: Source of tolerance. J. Agric. Sci. Mansoura Univ., 23 (7): 2981-2992.

Bernstein, S.; S. Singh; K.N. Dayanand and J.S. Bakshi (1974). Interactive effects of salinity and fertility on yield of grains and vegetables. Agron. J., 66: 412-421.

Eberhart, S.A. and W.A. Russel (1966). Stability parameters for comparing varieties. Crop Sci., 6: 36-40.

Feigin, A. (1985). Fertilization management of crops irrigated with saline water. Plant and Soil, 89: 285-299.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons Inc., USA.

Kafkafi, U. (1984). Plant nutrition under saline conditions. In: I Shainberg and J. Shalhevet (eds.), Soil salinity under irrigation processes and management, pp. 319-338, Spinger-Verlag, Berlin.

Rana, R.S. (1977). Plant adaptation to soil salinity and alkalinity. Indo-Hungarian Seminar on Management of Salt Affected Soils, Karnal, India 1-14.

Rai, M. (1977). Varietal tolerance in rabi cereals to the application of saline water. Ind. J. Agron., 24 (4): 206-211.

تأثير صور الآزوت ومعدلاته على محصول وصفات النمو فى الشعير المنزرع فى الأراضى المالحة

إسماعيل عبد المنعم أحمد ، خالد أحمد مصطفى، خيرى عبد العزيز عامر
قسم بحوث الشعير - معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية - الجيزة - مصر.

أجريت تجربتان حقليتان خلال موسمى ١٩٩٩/٢٠٠٠ و ٢٠٠٠/٢٠٠١ فى منطقة الحامول بمحافظة كفر الشيخ بجمهورية مصر العربية حيث تمثل ملوحة التربة أحد المشاكل الرئيسية لزيادة الإنتاج الزراعى فى هذه المناطق . فى الموسم الأول أستخدم ٤٨ صنف وسلالة من الشعير لدراسة استجابة هذه الأصناف والسلالات لثلاث صور من الأزوت (كبريتات الأمونيوم ، نترات الأمونيوم ، اليوريا) . استخدم معدلين من كل من هذه الأسمدة (المعدل الأول الموصى به وهو ١٠٥ كيلو جرام أزوت/هكتار) والمعدل الثانى (معدل منخفض ٧٠ كيلو جرام أزوت/هكتار). وكان الهدف من هذه الدراسة هو دراسة انتخاب أفضل السلالات التى تعطى أنتاجية عالية تحت ظروف الأراضي الملحية وكذلك اختيار أفضل صور الأزوت التى تلائم الأراضى الملحية بالاضافة إلى التعرف على أفضل أصناف وسلالات الشعير التى تعطى إنتاجية عالية تحت مستويات التسميد المنخفضة.

أظهرت الدراسة فى العام الأول أن استخدام نترات الأمونيوم تفوق معنويا على صور الأزوت الأخوى وأعطى أعلى إنتاجية للمحصول البيولوجى ومحصول الحبوب . كما أظهرت النتائج أيضا أن زيادة معدل التسميد يؤدى إلى زيادة المحصول البيولوجى والحبوب . أظهر تقييم الأصناف تفوق تسعة سلالات فى الإنتاجية عن صنف المقارنة.

فى الموسم الثانى (٢٠٠٠/٢٠٠١) استخدمت السلالات التسعة المنتجبة مع أصناف المقارنة جيزة ١٢٣، جيزة ١٢٦ ، جيزة ٢٠٠٠ فى تجربة حقلية نفذت بنفس الموقع وتحت نفس معاملات التسميد السابق ذكرها.

أيدت النتائج المتحصل عليها ما سبق الحصول عليه فى الموسم الأول وهو أن استخدام نترات الأمونيوم يجب أن يوصى به فى الأراضى الملحية وأن هناك استجابة لزيادة عنصر الأزوت تتمثل فى زيادة طول النبات ، المحصول البيولوجى ومحصول الحبوب. بتقييم الأصناف الأثنى عشر المختبرة وجد أن هناك أربعة سلالات مبشرة تتفوق على صنف المقارنة جيزة ١٢٣ تحت المستوى الأقل من التسميد الازوتى . وتمثل هذه السلالات أهمية لاستخدامها فى برامج التربية لأنتج أصناف مقاومة للملوحة وذات احتياجات سمادية منخفضة.

وبدراسة مقاييس الثبات للأصناف الاثنى عشر تحت ١٢ بيئة مختلفة (سنتى الدراسة ، ٣ صور الأزوت ، معدلين للازوت) لصفتى المحصول البيولوجى ومحصول الحبوب وجد أن هناك سلالتين تتميزان بالثبات لهاتين الصفتين ، مما يظهر مدى أهميتها فى البرنامج الوطنى لتربية الشعير .