

SALT TOLERANCE IN BARLEY: SOURCE OF RESISTANCE AND GRAIN YIELD STABILITY

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ABSTRACT

During 1999/2000 and 2000/2001, a total of 136 and 108 barley genotypes besides five Egyptian cultivars were evaluated for salt-tolerance in a series of field experiments at four locations. The soils of these locations were carefully selected to represent different degrees of salinity level. The obtained results showed marked variation among genotypes concerning the studied characters. The genotypes significantly differed in plant height, biological yield and grain yield. It was possible to identify some barley genotypes that could survive under salt stress conditions. Therefore, those genotypes proved again their ability to tolerate soil salinity. Yield stability parameters proved that ten genotypes appeared to be the most stable genotypes and could tolerate saline stress. Those genotypes are of great important in breeding point of view and should incorporate in the national breeding program for to increase yielding ability under salt stress environments

Keywords: Barley, salt tolerance, source of resistance, and yield stability.

INTRODUCTION

The salinity of soils and irrigation water is a problem that restricts yields on forty million hectares of irrigated lands, which is approximately one-third of the irrigated land on earth (Epstein *et al.*, 1980). In Egypt only, there are about two million acres of the irrigated land adversely affected by the accumulation of salts (Abo El-Enine *et al.*, 1981). Differences in salt-tolerance among barley genotypes have established by several works, despite difficult in defining and measuring tolerance (Epstein *et al.*, 1980; Abo El-Enine *et al.*, 1981; Shaller *et al.*, 1981; Ahmed *et al.*, 1998). The reduction in barley yield with increasing salinity levels has been reported (Abo El-Enine *et al.*, 1981 and Ahmed *et al.*, 1998). Recently, the national breeding program has focused on the development of high yielding cultivars tolerant to the major environmental stress, i.e drought and salinity. The development of tolerant cultivar to soil salinity requires the availability of genetically diverse genotypes. Genotype x environment interactions (GE) are of major concern for developing commercially cultivar. In national program, genotypes are often evaluated in different environments before selecting stable genotypes. Stability of a genotype refers to its consistency in performance across environments and its affected by GE interaction. A significant GE interactions can be partitioned into components using regression analysis (Finlay and Wilkinson, 1963 and Eberhart and Russel, 1966). The objectives of this study were to evaluate and identified some barley genotypes for salt tolerance and yield stability under saline conditions.

MATERIALS AND METHODS

During 1999/2000 and 2000/2001 growing seasons series of yield trials were conducted at two locations (El-Serw and El-Hamoul) and four locations (El-Noubaria, El-Hamoul, Tag El-Az and El-Gemmeiza), respectively. At the first season, barley genotypes were evaluated in four groups of yield trials namely A-Yield trial (72 genotypes grown in 2 m² plots), B-Yield trial (48 genotypes grown in 4.2 m² plots), D-Yield trial (24 genotypes grown in 10.5 m² plots) and E-Yield trial (12 genotypes grown in 20 m² plots). The respective number of genotypes tested in the same yield trials in the second season were 64, 32, 16 and 10 genotypes. The soil of this experiment was carefully selected to represent different levels of soil salinity. Data were recorded on plant height (cm), total biological and grain yields (ton/ha). Statistical analysis was carried out as outlined by Gomez and Gomez (1984). Sixty genotypes were selected to test their yield stability over five environments (two location in the first season and three locations in the second one) using the method proposed by Eberhart and Russell (1966).

RESULTS AND DISCUSSION

First season experiments:

During the first season (1999/2000), a total of 136 barley genotypes besides five Egyptian cultivars namely Giza, 123, Giza 124, Giza 125, Giza 126 and Giza 2000 were evaluated in four field experiments conducted in saline soils. Obtained results are showed in Tables (1, 2, 3 and 4).

The first yield trial (A-Trial) was conducted at El-Serw, and El-Hamoul. Data (Table, 1) revealed significant differences between genotypes with marked decrease in plant height, biological yield, and grain yield due to soil salinity in each location. Plant height ranged from 78.67 to 123.0, 51.67 to 92.67 and from 67.17 to 103.3 cm, at El-Serw, El-Hamoul and the combined analysis. Eight, fifty-three and 24 genotypes were insignificantly taller than Giza 123 at El-Serw El-Hamoul, and over locations, respectively. Genotype No. 29 followed by 51, 61 and 48 produced the tallest. The averages biological yield ranged from 14.39 to 27.39; 7.608 to 22.83 and 12.31 to 24.49 for El-Serw, El-Hamoul and over locations. At El-Serw, the highest values of biological yield were obtained from genotypes numbers 12, 25, 9, 4, 18, 5 and 31. At El-Hamoul, the most sever environment, genotypes numbers 31, 9, 29, 21, 19, 1, 20, 23, 63 and 62 produced higher biological yield than Giza 123. As for the combined analysis over the two locations, eight genotypes insignificantly outyielded Giza 123 with an average biological yield ranged from 20.61 to 24.49 ton/ha. For grain yield, 14, 51 and 31 genotypes gave higher grain yield than that of Giza 123 at El-Serw, El-Hamoul and over the two locations. The average grain yield ranged from 3.521 to 9.546; 1.439 to 5.865 and from 3.234 to 7.698 ton/ha at El-Serw, El-Hamoul and the combined analysis, respectively. Genotypes numbers 9, 21, 1, 31, 13, 7, 19, 11, 17 and 29 produced higher values for plant height, biological and grain yields at El-Hamoul where soil salinity was more higher than that of El-Serw. Those genotypes were promoted to be tested in B-Yield in the second season of this study.

Table 1: Plant height, biological and grain yield of 72 barley genotypes evaluated in A-Yield Trial under saline soils in 1999/2000 growing season.

Genotype No.	Plant height			Biological yield			Grain yield		
	El-Serw	El-Hamoul	Mean	El-Serw	El-Hamoul	Mean	El-Serw	El-Hamoul	Mean
1	90.67	80.00	85.33	22.133	20.750	21.442	6.516	5.354	5.935
2	96.33	76.00	86.17	17.983	14.802	16.393	6.502	3.168	4.835
3	102.33	83.00	92.67	23.240	14.663	18.952	7.456	4.067	5.762
4	102.00	73.33	87.67	26.145	17.568	21.857	8.521	4.607	6.564
5	95.33	67.00	81.17	25.177	12.588	18.883	6.806	3.831	5.319
6	107.67	83.33	95.50	23.517	16.738	20.128	6.626	3.611	5.118
7	112.33	84.33	98.33	19.643	15.908	17.776	6.488	5.188	5.838
8	104.33	81.00	92.67	19.228	17.430	18.329	5.810	3.182	4.496
9	104.33	91.67	98.00	26.422	22.548	24.485	9.531	5.865	7.698
Giza 123	112.67	71.67	92.17	23.932	18.877	20.404	6.875	3.016	4.945
11	112.67	80.33	96.50	20.958	17.707	19.332	4.828	4.703	4.766
12	119.00	81.67	100.33	27.390	17.430	22.410	8.335	4.219	6.277
13	98.67	80.33	89.50	20.058	18.398	19.228	5.658	5.215	5.437
14	94.33	68.33	81.33	20.335	14.663	17.499	5.762	3.431	4.596
15	106.67	77.00	91.83	20.888	15.908	18.398	6.536	4.939	5.737
16	103.33	65.67	84.50	14.802	11.897	13.349	3.521	2.947	3.234
17	106.00	88.33	97.17	22.963	18.185	19.574	8.077	4.634	6.356
18	104.33	70.00	87.17	25.177	10.790	17.983	8.189	1.715	4.952
19	99.33	80.50	89.92	17.430	21.165	19.298	5.637	4.814	5.226
Giza 124	95.00	80.00	87.50	19.920	19.228	19.574	6.184	4.219	5.201
21	85.33	82.00	83.67	19.505	21.718	20.612	7.159	5.644	6.401
22	103.67	64.00	83.83	22.133	18.047	19.090	6.252	3.984	5.118
23	107.67	79.00	93.33	19.505	19.090	19.298	5.547	4.980	5.264
24	115.33	67.67	91.50	17.707	14.387	16.047	5.437	3.182	4.309
25	107.00	81.33	94.17	26.975	17.430	22.203	9.546	4.759	7.152
26	90.67	70.37	80.67	18.813	17.015	17.914	6.516	3.735	5.125
27	92.67	64.67	78.67	21.995	13.003	17.499	6.640	3.154	4.897
28	104.00	77.33	90.67	21.580	16.323	18.952	5.810	3.818	4.814
29	114.00	92.67	103.33	20.473	22.133	21.303	6.363	4.565	5.464
Giza 125	111.33	79.67	95.50	22.410	13.833	18.122	5.935	2.794	4.364
31	103.33	80.33	91.83	24.208	22.825	23.517	8.162	5.298	6.730
32	102.67	77.33	90.00	23.517	15.493	19.505	8.134	3.528	5.831
33	107.67	77.67	92.67	18.952	11.482	15.217	5.990	3.258	4.624
34	85.33	62.00	73.67	18.675	14.802	16.738	6.101	4.205	5.153
35	91.67	79.00	85.33	18.122	14.802	16.462	5.035	3.362	4.198
36	105.33	74.33	89.83	17.153	13.557	15.355	4.980	2.310	3.645
37	102.67	83.00	92.83	19.090	13.557	16.323	6.142	3.002	4.572
38	111.33	84.33	97.83	23.378	15.078	19.228	7.303	3.555	5.429
39	85.67	60.33	73.00	14.387	10.790	12.588	4.288	3.279	3.783
Giza 126	98.33	74.00	86.17	20.197	14.387	17.292	6.156	2.158	4.157
41	105.00	76.67	90.83	17.153	14.110	15.632	5.257	2.753	4.005
42	109.00	70.33	89.67	18.398	11.067	14.733	5.989	2.006	3.997
43	97.67	72.00	84.83	20.335	15.493	17.914	4.721	3.749	4.235
44	95.00	82.00	88.50	18.952	17.983	18.468	6.834	2.366	4.606
45	82.67	51.67	67.17	14.525	10.098	12.312	4.192	3.140	3.666
46	105.67	72.67	89.17	19.920	18.537	19.228	6.225	3.569	4.897
47	107.33	76.00	91.67	22.825	15.078	18.952	7.346	3.334	5.340
48	120.67	82.00	101.33	21.027	17.983	19.505	6.737	3.569	5.153
49	110.33	75.33	92.83	21.027	15.770	18.398	5.713	3.749	4.731
Giza 2000	101.00	75.67	88.33	16.185	14.525	15.355	5.049	3.611	4.330
51	114.67	91.67	103.17	21.303	17.153	19.228	5.367	3.804	4.586
52	93.67	78.33	86.00	19.920	16.600	18.250	6.405	3.458	4.932
53	99.67	68.33	84.00	20.888	13.972	17.430	6.128	2.843	4.486
54	95.00	74.00	84.50	19.090	12.173	15.632	5.921	2.739	4.330
55	105.67	61.00	83.33	22.410	7.608	15.009	8.211	1.439	3.825
56	101.00	72.33	86.67	18.398	13.833	16.116	5.360	2.794	4.077
57	91.00	75.67	83.33	17.983	18.537	18.260	6.018	4.551	5.284
58	99.67	74.33	87.00	19.643	14.802	17.223	6.350	2.898	4.624
59	93.00	59.33	76.17	17.707	11.897	14.802	5.644	3.666	4.655
60	101.67	79.67	90.67	18.537	14.110	16.323	6.294	2.947	4.620
61	123.00	82.67	102.83	22.548	16.462	19.505	6.557	4.510	5.533
62	109.00	84.33	96.67	18.537	18.675	18.606	5.962	4.510	5.236
63	106.33	86.67	96.50	16.877	18.952	17.914	5.547	2.981	4.264
64	107.67	75.00	91.33	20.888	14.940	17.914	5.810	3.597	4.703
65	101.00	68.33	84.67	23.932	14.110	19.021	7.512	3.500	5.506
66	110.67	80.33	95.50	20.473	16.877	18.675	6.391	3.666	5.028
67	93.33	75.67	84.50	17.983	15.908	16.946	5.780	4.081	4.930
68	114.00	69.33	91.67	20.888	11.343	16.116	5.284	2.947	4.115
69	106.33	76.00	91.17	18.260	13.142	15.701	5.201	2.974	4.088
70	78.67	59.67	69.17	18.675	9.683	14.179	5.659	1.888	3.774
71	114.00	88.67	101.33	18.122	16.738	17.430	5.492	3.258	4.375
72	109.67	81.00	95.33	22.133	11.482	16.808	7.207	2.462	4.835
	102.72	75.99		20.440	15.564	17.793	6.271	3.620	

LSD at 5% for Genotypes (G) 12.34
 Locations (L) N.S.
 L x G N.S.

The second experiment (B-Yield Trial) was conducted at three locations, i.e. El-Serw, El-Hamoul and Tag El-Ez. Plant height ranged from 67.33 to 116.00, 57.33 to 97.33 and 41.33 to 103.00 cm at El-Serw, El-Hamoul and Tag El-Ez, respectively. The respective values at the three location for biological yield were 7.037 to 17.35, 8.222 to 22.33 ton/ha and 2.54 to 15.43 and for grain yield were 1.931 to 5.462, 2.422 to 5.699 and 1.931 to 5.462 ton/ha. Among genotypes, it could identified some genotype (Nos. 6, 9, 11, 17 and 39) which produced higher values of plant height, biological yield and grain yield than that of the commercial cultivar Giza 123.

Table 2: Plant height, biological and grain yield of 48 barley genotypes evaluated in B-Yield Trial under saline soils in 1999/2000 growing season.

Genotype No	Plant height (cm)				Biological yield (ton/ha)				Grain yield (ton/ha)			
	El-Serw	El-Hamoul	Tag El-Ez	Mean	El-Serw	El-Hamoul	Tag El-Ez	Mean	El-Serw	El-Hamoul	Tag El-Ez	Mean
1	85.00	66.33	88.33	79.89	10.093	13.111	14.667	12.623	3.324	4.133	3.133	3.530
2	100.00	85.67	95.33	93.67	12.222	13.556	13.839	13.205	3.991	4.011	3.763	3.922
3	94.67	82.67	80.00	85.78	11.296	16.667	12.190	13.384	3.278	4.389	3.705	3.790
4	108.67	77.33	93.00	93.00	15.000	12.556	14.157	13.904	3.676	4.732	3.975	4.128
5	76.00	66.00	74.00	72.00	14.074	8.222	14.286	12.194	4.722	2.633	3.984	3.780
6	104.00	97.33	113.33	104.89	15.149	20.444	19.429	18.341	4.627	5.133	3.790	4.517
7	115.00	92.67	84.67	97.44	17.350	17.111	8.762	14.408	5.462	4.856	1.895	4.071
Giza 123	103.00	88.67	121.33	104.33	13.834	15.556	20.668	16.686	4.665	3.844	4.582	4.364
9	93.00	88.33	92.33	91.22	11.741	16.778	16.190	14.903	3.920	4.610	4.686	4.405
10	107.00	94.00	108.67	103.22	11.944	13.556	20.667	15.389	3.454	4.311	4.314	4.026
11	88.00	97.00	104.67	96.56	12.222	22.333	18.000	17.519	4.204	4.678	5.026	4.636
12	82.67	86.33	89.67	86.22	10.000	13.222	12.762	11.995	3.111	4.411	3.852	3.792
13	90.33	82.00	97.33	89.89	11.111	15.778	15.333	14.074	3.463	4.911	3.638	4.004
14	99.00	83.00	101.67	94.56	13.241	12.667	19.333	15.080	3.222	3.222	4.448	3.631
15	96.00	84.67	85.67	88.78	13.056	12.889	11.714	12.553	3.991	3.767	3.544	3.767
Giza 124	94.67	89.67	91.67	92.00	14.630	17.000	14.857	15.496	4.324	4.678	4.048	4.350
17	85.33	82.67	109.00	92.33	13.443	19.667	21.561	18.224	4.010	5.511	4.913	4.812
18	96.00	81.33	85.33	87.56	13.611	10.111	10.190	11.304	4.389	2.411	2.838	3.213
19	83.00	82.33	62.33	75.89	9.444	13.444	8.952	10.614	2.870	4.244	2.386	3.167
20	97.00	87.00	66.00	83.33	11.204	17.446	8.952	12.534	3.917	5.699	2.514	4.043
21	91.33	95.33	77.00	87.89	11.648	14.444	12.190	12.761	3.948	4.311	3.786	4.015
22	96.67	83.67	77.33	85.89	11.759	19.111	9.524	13.465	4.194	5.344	2.519	4.019
23	87.00	84.67	81.00	84.22	10.000	15.333	11.048	12.127	3.292	4.467	3.381	3.713
Giza 125	99.67	84.67	96.00	93.44	10.648	17.111	16.286	14.682	3.287	4.878	3.990	4.051
25	91.33	85.67	60.67	79.22	8.511	14.444	5.810	9.622	2.981	3.700	1.729	2.803
26	87.00	92.33	76.67	85.33	9.630	15.808	10.618	12.018	3.648	4.344	3.153	3.715
27	79.00	57.33	71.33	69.22	7.037	12.333	9.284	9.552	1.931	2.711	2.598	2.413
28	102.00	81.67	88.33	90.67	10.556	11.333	12.428	11.439	3.562	3.567	3.877	3.669
29	88.33	83.33	71.67	81.11	10.741	15.000	4.952	10.231	3.023	3.911	1.257	2.730
30	89.33	78.67	89.33	85.78	11.389	14.556	13.428	13.124	3.435	4.422	2.729	3.529
31	79.67	96.67	72.33	82.89	11.019	16.556	8.000	11.858	3.852	4.532	2.429	3.604
Giza 126	91.00	94.33	94.00	93.11	12.593	20.556	14.475	15.875	3.602	5.489	3.671	4.254
33	94.00	75.00	70.67	79.89	11.204	12.333	9.190	10.909	3.250	3.089	2.514	2.951
34	84.67	80.33	71.33	78.78	14.259	15.111	7.810	12.393	4.602	4.789	2.333	3.908
35	89.67	95.00	97.00	93.89	10.185	20.000	11.238	13.808	2.963	5.000	3.429	3.797
36	86.00	76.00	99.33	87.11	13.519	13.111	15.141	13.924	3.935	3.978	4.254	4.056
37	74.33	75.00	59.00	69.44	12.130	13.778	9.429	11.779	3.574	4.222	2.429	3.408
38	67.33	71.00	81.33	73.22	11.204	13.222	13.572	12.666	3.139	3.867	3.600	3.535
39	97.33	94.33	87.67	93.11	13.889	18.557	15.048	15.831	4.120	5.501	3.771	4.464
Giza 2000	88.00	85.00	103.00	92.00	10.556	14.889	14.475	13.307	3.296	4.344	3.324	3.655
41	84.00	74.67	63.67	74.11	13.704	13.556	6.571	11.277	3.741	3.322	1.876	2.980
42	100.33	81.33	96.33	90.67	11.481	13.333	12.095	12.303	3.750	3.785	3.210	3.583
43	70.67	69.67	60.67	67.00	9.352	14.500	6.286	10.046	2.981	4.768	1.952	3.234
44	86.67	87.33	95.33	89.78	10.813	17.023	13.905	13.914	3.559	4.890	3.276	3.908
45	92.67	89.67	81.33	87.89	10.370	14.222	7.905	10.832	3.462	4.644	1.933	3.347
46	84.00	92.33	97.67	91.33	12.037	14.446	15.429	13.970	3.999	4.108	3.267	3.791
California Manout	85.33	92.33	70.00	82.56	9.815	18.389	9.333	12.512	2.731	4.732	2.629	3.364
48	71.67	86.33	92.33	84.11	10.000	14.889	12.952	12.614	3.037	4.767	3.719	3.841
	90.36	84.18	85.85		11.767	15.210	12.603		3.657	4.327	3.285	
LSD at 5% for	Locations (L)	4.00					1.144				0.297	
	Genotypes (G)	15.99					4.527				1.188	
	L x G	NS					NS				NS	

D-Yield Trial data showed that El-Hamoul location produced significantly lower values for plant height, biological and grains yields than that of El-Serw. This means that soil salinity was more higher at El-Hamoul area. Among the twenty-four genotypes evaluated for their salt tolerance, genotypes numbers 2, 14, 18, 19, 20, 21, 22 and 24 were identified as tolerant genotypes and should promoted to the final step of yield testing.

Table 3: Plant height, biological and grain yield of 24 barley genotypes evaluated in D-Yield Trial under saline soils in 1999/2000 growing season.

	Plant height			Biological yield			Grain yield		
	El-Serw	El-Hamoul	Mean	El-Serw	El-Hamoul	Mean	El-Serw	El-Hamoul	Mean
1	109.33	80.50	94.92	22.533	12.667	17.600	5.884	4.873	5.379
2	111.33	91.00	101.17	20.400	17.333	18.767	6.924	6.413	6.669
3	97.00	71.67	84.33	22.222	9.778	16.000	7.764	3.951	5.858
Giza 123	113.33	78.00	95.67	20.044	12.667	16.356	6.022	4.538	5.280
5	100.67	72.33	86.50	20.756	11.289	16.022	5.960	3.542	4.751
6	112.33	72.00	92.17	25.111	8.756	16.933	7.360	2.711	5.036
7	100.67	67.50	84.08	22.089	8.000	15.044	6.871	2.920	4.896
Giza 124	108.00	71.50	89.75	20.800	10.667	15.733	6.027	3.870	4.948
9	118.67	86.33	102.50	21.111	10.444	15.778	6.840	3.182	5.011
10	123.33	85.00	104.17	22.222	8.800	15.511	6.384	3.587	4.986
11	104.00	80.00	92.00	18.844	12.711	15.778	5.218	4.542	4.880
Giza 125	115.67	80.00	97.83	23.200	9.778	16.489	5.787	2.907	4.347
13	97.67	83.67	90.67	19.778	9.778	14.778	6.067	3.491	4.779
14	99.33	77.33	88.33	18.578	14.000	16.289	5.640	4.942	5.291
15	101.00	76.67	88.83	19.778	11.022	15.400	5.262	4.053	4.658
Giza 126	103.33	84.67	94.00	19.689	12.222	15.956	5.373	4.400	4.887
17	102.00	80.67	91.33	26.444	9.778	18.111	7.524	4.356	5.940
18	102.67	96.00	99.33	19.378	13.602	16.490	5.729	5.111	5.420
19	106.33	92.33	99.33	21.156	17.111	19.133	5.424	5.111	5.268
Giza 2000	104.67	87.00	95.83	20.044	16.444	18.244	5.689	5.378	5.533
21	111.67	79.00	95.33	23.511	13.778	18.644	6.798	5.124	5.961
22	125.00	104.33	114.67	22.578	16.089	19.333	6.131	5.453	5.792
23	100.33	83.33	91.83	18.844	12.444	15.644	5.591	4.453	5.022
24	102.00	90.00	96.00	19.200	14.622	16.911	6.240	5.342	5.791
Mean	107.10	82.12		21.180	12.233		6.188	4.344	
LSD at 5% for	Locations (L)	2.88		1.090			0.350		
	Genotypes (G)	3.82		NS			NS		
	L x G	5.22		5.358			1.713		

The fourth experiment (E-Yield Trial), showed that El-Hamoul location produced significantly lower values for plant height, biological and grains yields than those of El-Serw and Tag El-Ez. This means that soil salinity was more higher at El-Hamoul area. Plant height ranged from 89.33 to 115.33, 69.67 to 89.33 and 90.44 to 105.22 cm at El-Serw, El-Hamoul and Tag El-Ez, respectively. Biological yield ranged from 7.037 to 17.35, 8.222 to 22.33 ton/ha and 2.54 to 15.43 for the three locations, respectively, while the respective values for grain yield were 4.012 to 5.895, 2.348 to 4.821 and 3.263 to 5.060 ton/ha. Among tested genotypes, genotype numbers 3 produced higher values of plant height, and grain yield than that of the commercial cultivar Giza 123. This genotype is of great importance from a breeding point of view and should be included in crossing program as source of tolerance to saline conditions.

As conclusion from the first season data, it was possible to identify some barley genotypes that could survive under salt stress conditions. Under such conditions, for the first experiment (A-Yield Trial), genotypes No. 1, 7, 9, 11, 13, 17, 19, 21 29 outyielded the national check variety Giza 123 in plant

height, total biological yield and grain yield. Regarding B-Yield Trial, genotype No. 6, 9, 11, 17 and 39 gave the highest values of plant height, biological yield and grain yield under saline condition. From D-Yield Trial, it could be concluded that genotype No. 2, 14, 18, 19, 20, 21, 22 and 24 proved to be salt tolerance since it ranked first, second and first in case of plant height, biological yield and grain yield under saline conditions at El-Hamoul location. As for last step of evaluation (E-Yield Trial), genotype No. 3 outyielded the check cultivar Giza 123, under saline condition. Therefore, those genotypes are of great importance in future programs for salt stress programs.

Table 4: Plant height, biological and grain yield of 12 promising barley genotypes evaluated in E-Yield Trial under saline soils in 1999/2000 growing season.

Genotype No.	Plant height (cm)				Biological yield (ton/ha)				Grain yield (ton/ha)			
	El-Serw	El-Hamoul	Tag	Mean	El-Serw	El-Hamoul	Tag	Mean	El-Serw	El-Hamoul	Tag	Mean
	Giza 123	95.33	88.00	110.33	97.89	16.810	14.893	20.626	17.443	4.100	4.643	4.000
Giza 124	104.33	80.00	115.67	100.00	14.595	11.262	19.374	15.077	4.074	3.310	3.701	3.695
3	115.33	89.33	103.00	102.56	21.190	14.143	18.667	18.000	5.895	4.821	4.463	5.060
4	102.33	73.33	103.67	93.11	18.381	11.095	18.449	15.975	5.881	3.464	3.891	4.412
5	108.67	88.67	109.67	102.33	19.690	13.095	18.776	17.187	5.152	4.590	4.463	4.735
Giza 125	112.67	79.67	114.33	102.22	19.048	10.238	20.653	16.646	4.857	3.071	4.626	4.185
Giza 126	108.67	88.33	118.67	105.22	19.762	12.619	15.918	16.100	5.348	4.560	3.619	4.509
8	89.33	73.67	108.33	90.44	17.262	9.405	19.537	15.401	4.833	3.248	4.163	4.081
9	110.67	69.67	120.33	100.22	15.810	8.976	18.340	14.375	4.502	2.548	3.293	3.448
10	105.00	86.67	117.00	102.89	18.071	11.167	22.993	17.410	5.831	3.369	4.463	4.554
Giza 2000	109.67	73.33	121.33	101.44	14.619	8.143	20.381	14.381	4.012	2.348	3.429	3.263
12	101.00	84.33	123.67	103.00	15.000	9.238	21.578	15.272	4.698	3.262	4.327	4.095
Mean	105.25	81.25	113.83		17.520	11.189	19.608		4.932	3.603	4.036	
LSD at 5% for	Locations (L)	5.04			1.432			0.505				
	Genotypes (G)	NS			NS			1.011				
	L x G	NS			NS			NS				

Second season experiments:

In 2000/2001 growing season, four field experiments were conducted in salien soils at three locations (El-Hamoul, El-Noubaria and El-Serw) as well as at El-Gemmeiza as a control. Data presented in Tables (5, 6, 7 and 8) show that marked variation with regular decrease in plant height, biological yield and grain yield. But grain yield got decreased seriously more than other traits.

Obtained results from A-Yield Trial (Table 5) revealed that the differences between locations, genotypes and the interaction between them reached the level of significance for plant height, total biological and grain yields. The average performances for plant height at the four locations were 53.3, 56.9, 96.8 and 93.6 cm with significant differences between the four locations.

Table 5: Mean performances of plant height, biological yield and grain yield for 64 barley genotypes evaluated for salt tolerance at four locations in 2000/2001.

No	Plant height (cm)					Biological yield (ton/ha)					Grain yield (ton/ha)				
	El-Hamoul	Noubaria	El-Serw	Gemm-eiza	Mean	El-Hamoul	Noubaria	El-Serw	Gemm-eiza	Mean	El-Hamoul	Noubaria	El-Serw	Gemm-eiza	Mean
	1	52.0	65.3	90.7	99.5	76.9	7.05	5.22	11.07	17.44	10.20	1.32	1.33	3.46	4.57
2	47.0	42.7	94.7	92.2	69.1	4.08	4.33	12.93	13.44	8.70	0.83	1.00	4.38	4.38	2.65
3	49.0	60.3	90.7	100.3	75.1	3.78	5.44	12.30	20.11	10.41	0.63	1.72	3.08	4.62	2.51
4	60.0	44.7	100.3	102.5	76.9	3.82	3.33	9.43	16.33	8.23	0.79	0.94	3.25	4.42	2.35
5	55.7	64.7	89.7	96.3	76.6	1.85	5.11	10.23	17.33	8.63	1.21	1.11	2.98	4.36	2.41
6	53.3	64.3	95.7	105.5	79.7	6.17	3.89	15.50	19.00	11.14	1.36	1.33	5.50	5.38	3.39
7	54.7	59.7	103.0	92.2	77.4	3.57	4.22	12.42	19.78	10.00	0.52	1.28	3.93	4.16	2.47
8	54.0	57.3	100.0	99.6	77.7	3.88	3.61	13.58	14.00	8.77	0.54	0.89	4.25	4.59	2.57
9	44.7	64.3	96.3	93.3	74.7	4.69	3.56	11.25	18.67	9.54	0.79	0.94	3.10	4.44	2.32
G 123	54.0	44.0	102.7	89.2	72.5	4.31	2.83	14.63	15.44	9.31	0.79	0.72	5.13	5.23	2.97
11	54.7	56.0	95.7	90.6	74.2	5.98	3.89	14.67	18.67	10.80	1.16	1.00	4.22	4.62	2.75
12	42.3	49.7	97.0	86.5	68.9	2.38	4.56	11.40	19.33	9.42	0.43	1.17	4.05	6.33	2.99
13	57.0	68.7	102.0	87.9	78.9	7.43	5.44	14.00	18.78	11.41	1.27	1.00	4.03	5.83	3.03
14	53.3	48.7	98.7	104.4	76.3	4.74	1.67	11.55	17.00	8.74	1.18	0.56	4.02	4.10	2.46
15	61.7	42.0	86.7	86.7	69.3	8.83	1.83	13.42	18.78	10.72	1.70	0.69	3.95	6.30	3.16
16	58.3	64.0	103.0	105.7	82.8	5.89	2.78	10.91	17.00	9.14	1.10	0.78	4.56	4.74	2.79
17	43.3	52.3	88.7	87.5	68.0	3.90	3.33	13.20	14.44	8.72	0.68	0.94	4.18	5.16	2.74
18	54.7	55.3	95.7	99.5	76.3	4.78	2.56	10.32	17.78	8.86	0.76	0.72	3.39	4.32	2.30
19	56.0	61.0	100.0	96.7	78.4	4.06	2.44	13.41	18.00	9.48	0.68	1.06	4.19	3.60	2.38
G 124	64.0	60.0	91.7	87.1	75.7	6.16	3.67	12.22	17.22	9.82	1.37	0.83	4.42	3.78	2.60
21	63.3	62.3	102.3	95.8	81.0	5.75	3.67	12.22	18.78	10.10	0.77	1.22	3.83	4.29	2.53
22	64.3	70.0	91.7	101.1	81.8	6.64	6.67	16.00	19.22	12.13	1.41	1.50	4.95	4.80	3.16
23	53.0	56.3	109.0	90.5	77.2	8.17	3.67	11.62	21.56	11.25	1.11	1.06	3.96	6.72	3.21
24	62.0	71.7	105.3	88.9	82.0	4.89	3.22	10.00	18.67	9.19	0.81	0.78	2.80	4.33	2.18
25	63.0	62.7	96.3	105.1	81.8	8.84	1.11	10.29	16.78	9.26	2.06	1.00	3.42	4.57	2.76
26	56.3	72.7	104.3	99.5	83.2	5.11	3.72	12.03	17.22	9.52	0.97	0.89	3.97	4.28	2.53
27	48.7	63.7	103.3	97.5	78.3	4.22	5.11	11.17	17.78	9.57	0.63	1.22	3.55	3.96	2.34
28	54.0	63.3	90.3	82.7	72.6	3.83	4.22	8.92	14.56	7.88	0.47	0.89	3.15	5.11	2.40
29	55.3	53.3	88.0	90.1	71.7	6.89	5.33	11.07	15.67	9.74	1.59	1.44	3.00	4.81	2.59
G 125	55.3	59.3	101.0	82.7	74.6	4.74	2.78	13.30	15.22	9.01	1.10	0.72	3.96	4.19	2.49
31	51.0	67.3	97.0	97.4	78.2	4.01	4.67	12.85	15.56	9.27	0.52	0.94	4.20	3.69	2.34
32	68.3	48.7	102.3	97.5	79.2	8.67	2.00	13.03	18.11	10.45	1.88	0.56	4.47	5.58	3.12
33	56.0	61.3	87.0	88.4	73.2	6.93	2.33	10.02	17.11	9.10	1.21	0.53	3.23	4.81	2.45
34	58.7	69.7	98.7	86.9	78.5	7.98	3.56	13.17	16.67	10.34	1.40	1.06	4.13	4.72	2.83
35	62.0	60.0	93.0	95.5	77.6	5.75	3.44	10.47	13.78	8.36	1.51	0.89	2.89	4.08	2.34
36	53.3	61.7	96.0	79.9	72.7	5.06	2.11	12.62	13.56	8.34	1.32	0.72	4.83	4.82	2.93
37	53.0	54.3	100.0	99.9	76.8	4.56	4.00	14.25	17.00	9.95	0.96	1.17	4.75	4.13	2.75
38	55.7	48.3	99.3	99.9	75.8	2.67	4.22	15.37	17.44	9.93	0.48	1.00	5.73	6.23	3.36
39	50.7	66.7	95.0	92.7	76.3	3.28	3.56	10.20	17.89	8.73	0.69	1.17	3.77	4.99	2.65
G 126	59.0	58.3	99.0	99.1	78.9	7.36	4.33	13.08	15.67	10.11	1.45	1.22	4.56	5.23	3.12
41	55.3	57.7	93.3	88.9	73.8	5.33	3.33	17.10	14.56	10.08	0.74	1.03	4.22	3.79	2.45
42	56.0	50.0	90.0	95.4	72.9	4.58	3.78	11.78	14.22	8.59	0.67	1.00	3.79	4.16	2.41
43	63.0	63.3	102.7	99.7	82.2	5.00	5.00	13.27	16.44	9.93	0.70	1.33	3.85	4.14	2.51
44	47.0	66.7	105.3	100.8	80.0	2.06	3.67	13.67	15.22	8.65	0.37	0.83	4.77	4.74	2.68
45	53.0	62.3	106.3	92.9	78.6	3.03	3.56	11.31	12.67	7.64	0.37	0.76	3.76	3.98	2.22
46	42.7	57.0	97.0	103.0	74.9	2.59	4.44	12.65	14.33	8.50	0.36	1.00	4.43	4.18	2.49
47	61.0	67.3	94.0	89.7	78.0	4.80	3.00	13.83	17.89	9.88	0.64	1.00	4.73	5.14	2.88
48	34.7	61.7	94.0	92.2	70.6	5.73	3.22	16.23	14.11	9.83	0.90	1.00	5.31	4.02	2.81
49	56.3	57.3	91.9	105.0	77.6	3.47	2.11	13.40	16.67	8.91	0.73	0.72	5.65	5.19	3.07
G 2000	52.7	52.0	103.7	97.7	76.5	6.00	3.83	14.42	15.78	10.01	0.99	1.00	4.72	5.17	2.97
51	50.3	58.0	101.7	92.3	75.6	2.71	3.72	12.77	14.67	8.47	0.32	1.00	4.33	5.54	2.80
52	48.0	49.0	98.0	85.2	70.1	3.74	1.89	12.60	15.56	8.45	0.63	0.60	5.17	4.53	2.73
53	53.3	40.7	91.0	92.0	69.3	3.59	2.11	17.00	15.44	9.54	0.75	0.67	5.75	5.88	3.26
54	44.7	45.3	103.0	93.2	71.6	2.06	2.17	14.03	15.22	8.37	0.51	0.61	5.11	4.72	2.74
55	52.7	52.3	100.3	93.1	74.6	2.04	1.94	14.52	15.33	8.46	0.51	0.80	5.33	5.24	2.97
56	56.0	56.3	90.7	99.5	75.6	1.20	2.39	12.35	16.44	8.10	0.32	0.72	4.93	5.43	2.85
57	49.3	46.7	89.7	88.4	68.5	2.93	1.61	13.67	14.56	8.19	0.47	1.00	4.58	4.54	2.67
58	54.0	53.0	102.0	94.8	76.0	2.99	3.61	12.25	18.56	9.35	0.67	1.00	4.89	5.49	3.01
59	47.3	46.0	94.0	77.7	66.3	5.42	2.89	14.55	15.67	9.63	1.11	1.17	4.55	4.54	2.87
60	52.7	50.0	99.0	86.9	72.2	4.09	3.44	14.40	15.22	9.29	0.60	0.93	4.93	4.32	2.70
61	51.7	49.7	94.9	94.9	72.8	3.88	3.61	14.43	17.44	9.84	0.43	1.11	4.58	5.43	2.89
62	37.0	43.3	92.3	79.2	63.0	3.39	2.39	13.18	17.00	8.99	0.54	0.50	3.96	3.90	2.22
63	45.3	53.3	89.0	85.8	68.4	2.58	5.06	13.07	17.78	9.62	0.46	1.63	3.94	5.06	2.77
64	37.7	48.3	88.7	87.3	65.5	3.60	2.33	16.33	17.78	10.01	0.43	0.78	5.35	5.12	2.92
Mean	53.3	56.9	96.8	93.6		4.68	3.48	12.86	16.65		0.86	0.97	4.25	4.76	
LSD at 0.05 level	Plant height					Biological yield					Grain yield				
Locations	1.89					0.418					0.109				
Genotypes	7.55					1.673					0.473				
L x G	15.11					3.347					0.974				

These mean that both El-Hamoul and El-Noubaria soils were seriously affected by soil salinity than the other two locations, El-Serw and El-Gemmeiza. Genotypes numbers 26, 24, 22, 34 at El-Noubaria and genotypes numbers 32, 22, 20, 21, and 25 at El-Hamoul produced the tallest plants. Genotype No. 22 seemed to be the most stable genotypes under salinity stress since it ranked second and third at both locations, respectively. The averages of biological yield ranged from 1.20 to 8.844; 1.11 to 6.67; 8.92 to 17.10 and 12.67 to 21.56 ton/ha for El-Hamoul, El-Noubaria, El-Serw and El-Gemmeiza in respective order. El-Noubaria soils seemed to be the most affected soil with salinity since it gave the lowest biological yield (3.477 ton/ha) followed by El-Hamoul (4.680 ton/ha) with significant difference between the two locations. The highest values of biological yield were obtained from genotypes numbers 25, 15, 32, 23, 34, 13, 40, 1, 33, 29, and 22 at El-Hamoul, while genotypes numbers 22, 3, 13, 29, 1, 5, 27, 63, 43, 31, 12 and 46, produced higher biological yield at El-Noubaria. From these data, it could be concluded that genotypes 13, 29 and 22 proved to be salt tolerant genotypes since they were among the higher genotypes in both locations.

The mean performances of grain yield at the four locations were 0.862, 0.972, 4.249 and 4.760 ton/ha for El-Hamoul, El-Noubaria, El-Serw and El-Gemmeiza, respectively. The grain yield at both El-Hamoul and El-Noubaria seriously affected by soil salinity. The average grain yield ranged from 0.317 to 2.056 at El-Hamoul, and from 0.500 to 1.722 at El-Noubaria compared to 3.600 to 6.717 ton/ha at El-Gemmeiza. Genotypes numbers 25, 32, 15, 35, 40, 22, 34, 20, 6, 36, 1, 13 and 5 at El-Hamoul and genotypes numbers 3, 63, 22, 29, 1, 6, 43, 7, 21, 27, 40, 12 and 37 at El-Noubaria ranked the first positions in grain yield. It noticed that genotypes 1, 6, 22 and Giza 126 gave higher grain yield under both locations (high level of soil salinity) and proved to be the most stable genotypes under saline soils.

Data of B-Yield Trial are presented in Table (6). Data obtained revealed that significant differences were detected among locations, genotypes and their interactions for the three characters. The average performances for plant height, biological yield and grain yield, were (57.4, 68.8, 85.5 & 88.4 cm), (5.315, 4.898, 12.237 & 17.376 ton/ha) and (1.105, 0.954, 3.814 & 4.356 ton/ha) for El-Hamoul, El-Noubaria, El-Serw and El-Gemmeiza, respectively. It is clear that both El-Hamoul and El-Noubaria were seriously affected with saline problem since they gave a reduction of 35.07, 22.17%; 69.41, 71.81% and 74.63, 78.10% less than the optimum location (El-Gemmeiza) in plant height, biological yield and grain yield, respectively. For plant height, genotypes No. 3 and 4 gave higher plants under both locations, El-Hamoul and El-Noubaria, and could be selected as taller genotypes under saline conditions. Regarding biological yield genotypes No. 14, 5, 4, 28, 2, 3, and 19 outyielded significantly Giza 123 at EL-Hamoul, while at El-Noubaria the new cultivar Giza 2000 outyielded significantly the national check Giza 123 in biological yield. In the same time, non of the evaluated genotypes outyielded the check cultivar Giza 2000 in biological yield. As for grain yield, Giza 123 ranked 24th and 20th at El-Hamoul and Noubaria, respectively. At El-Hamoul, the genotype No. 14 produced the highest grain yield (3.191 ton/ha) followed by genotypes numbers 4, 5, 16, 2, 28, 3, 15 and 23 with significant

differences compared to the national check Giza 123. As in biological yield at El-Noubaria, non-of tested genotypes gave better grain yield than that of Giza 2000. From the above mentioned results, it could be concluded that genotypes numbers 3, 4, 5 and 14 achieved one of our goals in order to developed high yielding varieties with more grain and straw. This type of genotypes is important from the breeding point of view.

Concerning D-Barley Yield Trial, significant differences among locations, genotypes and their interaction were detected for plant height, biological yield and grain yield (Table 7). Comparing the locations mean performances, El-Hamoul location gave the shortest plants (62.50 cm), which indicated that this locations was the most affected location by soil salinity.

Table 6: Mean performances of plant height, biological yield and grain yield for 32 barley genotypes evaluated for salt tolerance at four locations in 2000/2001.

No.	Plant height (cm)				Biological yield (ton/ha)				Grain yield (ton/ha)						
	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean			
1	56.3	68.3	85.9	88.5	74.8	4.17	4.37	11.91	20.87	10.33	0.73	0.87	4.02	5.29	2.73
2	54.0	65.0	87.6	94.1	75.2	8.33	5.04	14.61	19.29	11.82	1.93	0.91	4.65	5.41	3.23
3	65.0	91.7	87.0	95.1	84.7	7.38	5.64	11.61	16.43	10.26	1.45	0.91	3.29	4.14	2.45
4	68.0	77.3	86.1	94.1	81.4	9.05	3.89	11.91	15.00	9.96	2.17	0.83	3.61	4.47	2.77
5	80.0	60.0	87.8	78.6	76.6	9.88	4.60	14.17	19.60	12.06	2.11	0.88	4.08	4.63	2.92
6	58.0	73.3	93.5	98.6	80.9	4.53	5.37	14.29	17.46	10.41	0.84	0.99	4.35	4.50	2.67
7	44.3	70.0	85.3	86.7	71.6	5.10	5.64	9.41	16.83	9.24	0.60	1.43	3.42	3.92	2.34
8	52.3	75.0	82.2	85.5	73.8	5.44	5.56	12.38	15.32	9.67	0.52	0.99	3.68	4.05	2.31
9	51.3	71.7	87.0	92.2	75.5	2.50	5.08	10.54	18.41	9.13	0.45	1.15	3.48	4.59	2.42
G.123	45.0	56.3	80.5	82.1	66.0	3.81	4.17	13.72	14.44	9.04	0.64	0.87	4.21	3.47	2.30
11	50.0	73.3	85.3	92.5	75.3	3.81	3.97	10.95	16.98	8.93	0.63	0.68	3.83	4.73	2.47
12	47.5	76.7	85.3	91.7	75.3	1.55	4.52	13.51	12.94	8.13	0.25	0.83	3.24	2.94	1.82
13	67.0	71.7	82.5	86.1	76.8	6.19	6.11	12.16	18.65	10.78	1.39	0.75	4.14	4.35	2.66
14	87.0	60.0	88.1	88.4	80.9	10.67	2.78	10.49	16.75	10.17	3.19	0.71	3.46	3.73	2.77
15	56.0	66.7	82.7	91.2	74.2	5.21	3.41	11.43	15.24	8.82	1.44	0.91	3.53	3.96	2.46
16	55.7	51.7	80.5	90.9	69.7	5.78	3.33	13.10	17.94	10.04	2.00	0.79	4.22	4.14	2.79
17	51.0	51.7	80.5	83.5	66.7	4.14	3.65	12.90	16.75	9.38	0.88	0.87	4.34	4.06	2.54
18	51.0	57.3	85.0	83.0	69.1	2.86	3.29	10.42	12.38	7.24	0.33	0.56	3.23	2.91	1.76
19	60.5	66.7	86.1	81.3	73.6	7.08	4.76	10.48	12.14	8.62	1.29	1.11	3.36	2.80	2.14
G.126	49.0	68.3	91.0	83.8	73.0	3.33	4.84	12.56	19.29	10.01	0.64	0.99	4.04	4.83	2.63
21	59.5	78.3	87.0	92.7	79.4	5.75	4.05	11.13	15.24	9.04	1.16	0.65	2.97	3.94	2.18
22	59.5	73.3	84.4	95.2	78.1	4.46	4.76	13.69	12.78	8.92	0.89	0.99	4.17	3.05	2.28
23	64.0	66.7	87.6	84.9	75.8	4.82	5.24	12.08	18.18	10.08	1.40	1.27	3.71	4.49	2.72
24	56.0	73.3	89.0	84.3	75.7	4.36	5.87	12.32	19.05	10.40	0.66	0.99	3.38	5.36	2.60
25	62.0	61.7	86.1	89.0	74.7	4.64	4.64	9.44	19.92	9.66	0.92	0.75	3.14	5.76	2.64
26	58.5	71.7	83.6	82.5	74.1	5.06	6.27	13.39	19.92	11.16	1.18	1.39	4.13	4.14	2.71
27	54.0	73.3	82.2	89.4	74.7	5.95	4.92	12.74	17.86	10.37	0.86	0.95	4.51	4.29	2.65
28	60.3	70.0	86.7	90.3	76.8	8.91	4.68	12.44	19.52	11.39	1.60	1.15	3.61	4.21	2.64
29	54.7	65.0	83.9	85.2	72.2	3.95	6.16	13.63	21.19	11.24	1.02	0.71	3.80	4.99	2.63
G 2000	53.0	76.7	91.0	95.3	79.0	4.15	7.44	12.50	19.44	10.88	1.20	1.55	4.05	5.25	3.01
31	62.0	76.7	88.4	87.8	78.7	4.48	6.51	12.26	19.29	10.64	0.66	1.19	3.83	4.90	2.64
32	44.0	63.3	77.9	85.3	67.6	2.74	6.19	13.38	20.95	10.82	0.33	0.87	4.61	6.11	2.98
Mean	57.4	68.8	85.5	88.4		5.32	4.90	12.24	17.38		1.11	0.95	3.81	4.36	

LSD at 0.05 level	Plant height	Biological yield	Grain yield
Locations	2.56	0.643	0.160
Genotypes	7.23	1.818	0.452
L x G	14.46	3.148	0.904

At El- Hamoul, plant height ranged from 45.0 to 80.0 cm with an average of 62.5 cm. Seven genotypes gave higher plants than that of Giza 123, but only genotype No. 2 (80.0 cm) significantly exceeded that of Giza 123. Genotypes No. 2 and 3 seemed to be the most staple genotypes at both El-Hamoul and El-Noubaria. Regarding biological yield, data showed that genotypes No. 14, 2, Giza 2000, 8 and 13, at El-Hamoul and 2, 14, 4, 13, 9, 3 and 10 non-significantly exceeded Giza 123 in biological yield at El-Noubaria. It worthy to mentioned that genotypes No. 14 and 2 ranked first, second and second and first at El-Hamoul and El-Noubaria, respectively. Obtained result revealed that El-Hamoul gave the lowest grain yield, which means that El-Hamoul was the most seriously affected location by soil salinity among the four locations. Six genotypes significantly exceeded Giza 123 at El-Hamoul in grain yield. Genotypes 13, 14 ranked first and second in grain yield at El-Noubaria. From the above mentioned discussion, it could be concluded that genotypes No. 2, 13 and 14 proved to be salt tolerant since were among the highest three genotypes in plant height, biological yield and grain yield under saline conditions at El-Hamoul and El-Noubaria locations.

From Table (8) it could be concluded that significant differences were detected between genotypes, which show marked variation with regular decrease in plant height, total biological yield, and grain yield due to the soil salinity problems. When comparing between locations, data showed that El-Hamoul scored the lowest values for plant height, biological and grain yield being 58.4 cm, 3.238 ton/ha and 0.737 ton/ha with an average decrease of 37.27, 68.35 and 69.61% than that of the optimum condition at El-Gemmeiza. At El- Hamoul, plant height ranged from 50.0 (genotype No. 10) to 65.0 (genotype No. 4). Two genotypes (numbers 4 and 8) produced higher plants than that of Giza 123. Concerning total biological yield, data showed that biological yield ranged from 1.867 to 4.350; 8.113 to 10.375, 7.100 to 11.733 and 7.900 to 12.017 at El-Hamoul, El-Noubaria, El-Serw and El-Gemmeiza with an average of 3.238, 9.033, 9.297 and 10.230 ton/ha, respectively. At high salinity level (El-Hamoul location), non of the tested genotypes exceeded the national check Giza 123 in biological yield. The highest value of biological yield was obtained from Giza 123 followed by genotype No. 8 and genotype No. 2. As for grain yield, the average grain yield at El-Hamoul ranged from 0.583 (genotype No. 5) to 0.908 ton/ha (genotype No. 4). Genotypes numbers (4, 8, Giza 123 and No. 7) ranked the first position at El-Hamoul location.

Table 7: Mean performances of plant height, biological yield and grain yield for 16 barley genotypes evaluated for salt tolerance at four locations in 2000/2001.

No.	Plant height (cm)				Biological yield (ton/ha)				Grain yield (ton/ha)						
	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean			
1	56.7	75.7	68.3	78.3	69.7	4.41	6.93	5.70	7.56	6.15	0.94	2.19	1.87	2.16	1.79
2	80.0	89.5	81.3	99.3	87.5	8.41	9.42	7.77	7.30	8.23	1.97	2.32	2.49	2.06	2.21
3	75.0	83.9	76.9	84.7	80.1	5.52	7.77	6.61	7.91	6.95	1.22	2.30	2.06	2.18	1.94
4	60.0	90.0	73.9	82.3	76.6	2.35	8.10	7.24	7.62	6.33	1.30	2.66	2.79	2.25	2.25
G.123	63.3	81.6	69.6	79.3	73.5	5.18	6.91	6.73	6.60	6.36	1.22	1.89	2.10	1.85	1.77
6	45.0	65.7	64.6	83.3	64.7	2.10	6.91	6.90	9.14	6.26	0.62	2.62	2.35	2.84	2.11
7	50.0	74.1	60.7	69.7	63.6	2.48	7.08	6.59	7.91	6.01	0.55	2.51	2.05	2.17	1.82
8	74.3	65.7	67.6	88.7	74.1	7.76	6.90	6.04	8.98	7.42	1.83	2.53	2.26	2.49	2.28
9	63.3	80.5	60.1	86.3	72.6	5.08	7.93	5.87	7.84	6.68	1.35	2.43	2.13	2.24	2.04
10	46.7	82.7	73.9	77.7	70.2	3.30	7.29	6.53	7.21	6.08	0.67	2.06	2.17	1.81	1.68
11	51.7	74.8	60.2	75.3	65.5	3.68	6.22	5.26	7.62	5.70	1.08	2.28	2.04	2.16	1.89
12	65.0	74.8	72.2	83.3	73.8	6.35	5.96	6.78	9.87	7.24	1.59	2.51	2.60	3.32	2.50
13	58.3	78.2	65.9	79.3	70.4	7.37	7.97	5.39	5.05	6.44	1.71	2.83	2.00	1.37	1.98
14	72.3	73.4	67.0	82.0	73.7	9.05	8.45	5.82	8.70	8.00	1.92	2.77	1.96	2.31	2.24
G.2000	72.3	87.3	68.3	93.0	80.2	7.11	7.01	8.17	7.27	7.39	1.60	2.19	2.73	1.99	2.13
16	66.7	77.8	62.8	75.0	70.6	6.76	6.41	6.75	6.19	6.53	1.65	2.33	2.50	1.84	2.08
Mean	62.5	78.5	68.3	82.4		5.43	7.33	6.51	7.67		1.33	2.40	2.26	2.19	

LSD at 0.05 level	Plant height	Biological yield	Grain yield
Locations	2.95	0.624	0.186
Genotypes	5.90	1.249	0.373
L x G	11.79	2.497	0.746

Table 8: Mean performances of plant height, biological yield and grain yield for 10 promising barley genotypes evaluated for salt tolerance at four locations in 2000/2001.

No.	Plant height (cm)				Biological yield (ton/ha)				Grain yield (ton/ha)						
	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean	El- Noubaria Hamoul	El- Serw	Gemm-eiza	Mean			
1	60.7	84.9	78.6	98.0	80.6	3.42	8.82	7.10	11.75	7.77	0.67	2.24	1.80	3.18	1.97
2	55.0	80.5	69.7	93.9	74.8	3.77	8.79	9.18	10.65	8.10	0.67	2.44	2.23	2.48	1.96
G.123	61.7	81.2	87.8	93.0	80.9	4.35	8.88	8.32	7.90	7.36	0.88	2.16	2.10	1.92	1.76
4	65.0	93.3	83.5	92.0	83.4	3.47	8.11	8.23	11.42	7.81	0.91	2.40	2.05	2.32	1.92
5	56.7	78.8	80.3	86.3	75.5	2.15	8.55	10.30	8.67	7.42	0.58	2.16	2.30	2.33	1.84
G.126	58.3	91.5	77.3	95.2	80.6	2.95	9.55	11.73	10.65	8.72	0.67	2.08	2.88	2.42	2.01
7	56.7	75.3	86.8	93.0	77.9	3.53	8.86	9.13	9.28	7.70	0.74	2.14	2.20	2.18	1.82
8	63.3	80.2	86.3	87.6	79.3	4.03	10.38	10.20	9.42	8.51	0.91	2.31	2.45	2.18	1.96
G.2000	56.7	87.4	89.8	91.7	81.4	2.85	9.31	8.85	10.55	7.89	0.72	2.14	2.05	2.30	1.80
10	50.0	76.9	83.3	99.9	77.5	1.87	9.09	9.92	12.02	8.22	0.63	2.14	2.73	2.93	2.11
	58.4	83.0	82.3	93.1		3.24	9.03	9.30	10.23		0.74	2.22	2.28	2.43	
Mean	53.3	56.9	96.8	93.6		4.68	3.48	12.86	16.65		0.86	0.97	4.25	4.76	

LSD at 0.05 level	Plant height	Biological yield	Grain yield
Locations	3.253	0.507	0.135
Genotypes	5.144	0.801	0.214
L x G	10.290	1.603	0.427

As conclusion from the second season, it was possible to identify some barley genotypes that could survive under salt stress conditions. Genotypes number 22; 3, 4, 5, & 14; 2, 13 & 14 and 2, 4 and 8 outyielded the national check variety Giza 123 in the three studied traits in A, B, D and E-Yield Trials, respectively. Those genotypes are of great importance in future programs for salt stress programs.

Stability studies

The selected entries from both seasons besides another high yielding genotypes and the five commercial barley cultivars were chosen to build up a study to investigate their grain yield stability under five environments where saline soils are prevailing.

Highly significant values of mean squares due to genotypes (Table 9) reveal that presence of genetic variability in grain yield for the studied genotypes. Differences between environments were indicated highly significant mean square. Pooled analysis of variance further revealed the presence of GE interactions which indicate that genotypes differed considerably with respect to their stability.

Stability parameters for grain yield were estimated by the method described by Eberhart and Russell (1966). This method defines a stable genotype as one which had a regression coefficient of 1.0 and no deviation from regression mean square. Accordingly, an ideal genotype would have both a high average performance over a wide range of environments plus stability. Variability among environments is an important factor and in large part determines the usefulness of b values (Pfahler and Linskens, 1979). Statistically significant environmental effects indicated that variability among environments was large enough for a proper estimation of b values. Individual parameters of yield stability for the sixty genotypes are shown in Table (9). The regression coefficient b values of the sixty genotypes used in this study ranged from 0.206 to 1.553, which suggested that the tested genotypes responded differently to the different environments. A total of 44 genotypes had significant S²d values. Eighteen genotypes showed above average grain yield, out of them ten genotypes (1, 5, 6, 8, 9, 12, 28, 29, 30, and 32) produced higher grain yield and nonsignificant S²d values. The names and pedigree of those promising genotypes are listed in Table (10).

These genotypes appeared to be the most stable genotypes and could tolerate saline stress. Those genotypes are of great important in breeding point of view and should incorporate in the national breeding program for salt tolerance.

Table 9: Mean performances and grain yield stability of 650 barley genotypes evaluated at five environments during 1999/2000 and 2000/2001 growing seasons.

No	Environments					Yield stability parameters			
	El-Serw 99/2000	El-Hamoul 99/2000	El-Hamoul 2000/2001	Noubaria 2000/2001	El-Serw 2000/2001	Mean	b	S ² d	r ²
1	6.516	5.354	1.317	1.333	3.458	3.596	1.248	0.003	0.963
2	6.626	3.611	0.628	1.722	3.083	3.134	1.192	0.211**	0.931
3	4.828	4.704	1.211	1.111	2.975	2.966	0.935	0.118*	0.955
4	8.333	4.219	1.356	1.333	5.500	4.148	1.548	0.535**	0.963
5	6.252	3.984	0.789	0.945	3.100	3.014	1.227	-0.087	0.989
6	6.516	3.735	1.156	1.000	4.217	3.325	1.229	-0.007	0.964
7	6.640	3.154	0.428	1.167	4.050	3.088	1.290	0.312**	0.929
8	5.810	3.818	1.257	1.000	4.025	3.184	1.087	-0.125	0.975
9	6.101	4.205	1.700	0.889	3.950	3.329	1.141	0.001	0.957
10	6.142	3.002	1.100	0.778	4.558	3.116	1.160	0.581**	0.878
11	5.921	2.739	0.767	1.222	3.833	2.896	1.074	0.230**	0.899
12	5.947	2.981	1.405	1.500	4.950	3.277	0.926	0.759**	0.791
13	5.810	3.597	1.106	1.055	3.958	3.105	1.087	-0.108	0.972
14	6.391	3.666	0.805	0.778	2.800	2.888	1.243	-0.022	0.966
15	5.284	2.947	2.056	1.000	3.417	2.941	0.808	0.205**	0.863
16	6.502	3.168	1.094	1.455	3.000	3.042	1.108	0.293**	0.909
17	5.437	3.182	0.522	0.944	4.200	2.857	1.096	0.193**	0.922
18	6.405	3.459	1.400	1.055	4.133	3.290	1.147	0.123*	0.939
19	5.780	4.081	1.506	0.889	2.892	3.029	1.049	-0.045	0.958
20	5.810	3.182	0.672	1.000	3.792	2.891	1.124	-0.002	0.956
21	7.303	3.556	0.700	1.334	3.850	3.348	1.370	0.255**	0.942
22	7.456	4.067	1.445	0.913	3.525	3.481	1.371	0.205**	0.942
23	8.521	4.607	1.996	0.794	4.222	4.028	1.552	0.560**	0.930
24	6.875	3.016	0.333	0.556	3.230	2.802	1.394	0.272*	0.942
25	5.658	5.215	1.286	1.111	3.364	3.327	1.117	0.123*	0.936
26	3.521	2.947	1.159	0.651	2.973	2.250	0.653	-0.070*	0.908
27	8.190	1.716	0.893	0.992	4.168	3.192	1.433	0.192**	0.729
28	5.637	4.814	1.397	1.270	3.707	3.365	1.060	-0.127	0.974
29	7.159	5.644	0.663	0.992	3.375	3.567	1.517	0.101	0.966
30	8.162	5.298	1.183	1.389	4.125	4.031	1.509	-0.137	0.989
31	5.989	2.006	1.599	1.190	3.825	2.871	0.923	1.080**	0.741
32	6.557	4.510	0.655	1.190	3.825	3.347	1.323	-0.249	0.998
33	7.512	3.500	0.333	0.873	4.607	3.365	1.535	0.468**	0.936
34	3.278	4.389	0.726	0.873	4.018	2.657	0.764	1.143**	0.652
35	4.627	5.133	1.933	0.913	4.650	3.451	0.895	0.913**	0.755
36	3.454	4.311	1.452	0.913	3.289	2.684	0.663	0.499**	0.726
37	3.222	3.222	2.167	0.833	3.611	2.611	0.468*	0.445**	0.583
38	4.010	5.511	2.107	0.881	4.082	3.318	0.774	1.455**	0.611
39	4.389	2.411	0.841	0.992	4.350	2.597	0.811	0.753**	0.745
40	3.948	4.311	0.595	1.429	3.418	2.740	0.810	0.337**	0.831
41	2.963	5.000	0.250	0.833	3.236	2.456	0.800	1.788**	0.585
42	3.559	4.890	1.393	0.754	4.141	2.947	0.772	1.310**	0.631
43	3.037	4.767	3.191	0.714	3.455	3.033	0.402*	1.866**	0.255
44	3.435	4.422	0.917	0.754	3.139	2.533	0.760	0.635**	0.743
45	3.676	4.732	0.619	2.623	2.354	2.801	0.603	1.253**	0.520
46	3.920	4.610	1.833	2.526	2.260	3.030	1.553	0.564**	0.554
47	4.194	5.344	1.349	2.429	2.128	3.089	0.651	1.381**	0.538
48	3.562	3.567	1.537	2.510	2.600	2.765	0.390*	-0.035	0.750
49	3.852	4.532	1.714	2.833	2.004	2.987	0.430*	0.815**	0.436
50	3.250	3.089	1.921	2.769	1.959	2.597	0.206*	0.064	0.667
51	2.981	4.768	1.651	2.331	2.500	2.846	0.376*	0.936**	0.348
52	6.385	3.587	1.968	2.315	2.492	3.349	0.865	0.680**	0.782
53	5.884	4.873	0.908	2.400	2.050	3.223	0.987	1.069**	0.768
54	6.871	2.920	0.742	2.137	2.200	2.974	1.097	1.447**	0.761
55	5.218	4.542	0.968	2.312	2.450	3.086	0.868	0.464**	0.824
56	7.524	4.355	0.633	2.139	2.733	3.477	1.337	0.842**	0.880
57	5.152	4.590	0.667	2.239	1.800	3.890	0.886	1.041**	0.731
58	5.895	4.821	0.667	2.439	2.233	3.211	1.020	0.975**	0.791
Giza 123	6.875	3.016	0.789	0.722	5.133	3.307	1.358	1.117**	0.858
Giza 2000	5.049	3.611	0.989	1.000	4.717	3.073	0.995	0.435**	0.865
Mean	5.523	3.983	1.174	1.347	3.458	3.097			

LSD for
 Environments 5% 0.185 1% 0.243
 Genotypes 0.640 0.842
 E x G 1.431 1.883

Table (10): Names and pedigree of the most high yielding and stable genotypes selected for saline environments.

No.	Variety and Pedigree	
1	CI 9650/4/Gloria-Bar/Come-B//Lignee 640/3	CMB 90-A-1016-Z-1M-2Y-2M-0Y
5	Deir Alla 106/3/As46//Avt/Aths/5/As46/Pro//Pro//Bal.16/ Api/3/Mat.Rass 209/4 Ager/6/BF891M-582	ICB94-0884-0AP
6	F2CC33MS/CI 07555/5/Zafraal/4/Arizona 5908/Aths//Asse/3/F208-74	ICB94-0534-0AP
8	Algerian Selection Plot 809//Gloria 'S'/Copal 'S'	ICB94-0835-0AP
9	Quina/Matico 'S'	
13	M64-76/Bon//Jo/York/3/M5/Galt/As46/4/Hj34-80/Astrix/5/NK1272	ICB84-0156-0AP
28	Scotia 1/WA1356.70/WA1245.68/Boyer/3/ . . .	CMB 92A. 1325-B-4M-1Y-1B-0Y
29	Kitchin/SLB 60-35	ICB94-0825-0AP
30	Cln-B/80.5138//Gloria-Bar/Copa/73/Sen/4 . . .	CMB 92A.1358-G-6M-1Y-1B-0Y
32	Alanda01-14/WI2291/3/Api/CM67//L2966-69/5/Barbara	ICB95-0573-0AP

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دراسة صفة تحمل الملوحة في الشعير: مصادر التحمل وثبات محصول الحبوب .
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أجريت هذه الدراسة خلال موسمي الزراعة ١٩٩٩/٢٠٠٠ و ٢٠٠٠/٢٠٠١ حيث تم تقييم ١٣٦ و ١٠٨ صنف وسلالة من الشعير في كل موسم بالإضافة إلى خمسة أصناف تجارية وذلك لتعريف الأصناف المتحملة للملوحة والتي تتميز بثبات الإنتاجية. أجريت الدراسة في ثلاثة مناطق بشمال الدلتا حيث تمثل ملوحة التربة أحد المشاكل الرئيسية المعوقة لزيادة الإنتاج حيث تمت الدراسة في مناطق السرو بمحافظة دمياط والحامول بمحافظة كفر الشيخ في الموسم الأول ومناطق السرو والحامول وتاج العز في الموسم الثاني كما نفذت التجارب الحقلية بنحطة بحوث الجميزة كمقارنة. نفذت أربعة تجارب محصولية في كل منطقة.

أظهرت النتائج المتحصل عليها إختلافات معنوية بين مناطق الدراسة كذلك وجدت إختلافات معنوية بين أصناف وسلالات الشعير المختبرة لصفات طول النبات - المحصول البيولوجي ومحصول الحبوب. ولقد أمكن التعرف على بعض السلالات والأصناف لمحصول الشعير تتميز بتحملها لملوحة التربة وإرتفاع إنتاجيتها تحت هذه الظروف. من النتائج المتحصل عليها من التجارب المحصولية في الثلاث مناطق خلال سنتي الدراسة تم تحديد ستون صنفاً وسلالة من الأصناف المختبرة وذلك لدراسة مكونات الثبات المحصولي لها. وقد أمكن تحديد عشرة سلالات من الشعير تتميز بإرتفاع محصول الحبوب مع ثبات صفة المحصول. وتعتبر هذه السلالات من الأهمية بمكان ويجب أن تحظى باهتمام القائمون على البرنامج القومي لتربية الشعير حيث يجب إستخدامها كمصادر للمقاومة للملوحة والمحصول العالى.