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DROUGHT TOLERANT BARLEY GENOTYPES FOR RAINFED AREAS IN EGYPT

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Abstract

A field experiment including fifty barley (Hordeum vulgare L.) genotypes from different sources selected from local and exotic materials was conducted as Preliminary Screening Nursery (PSN) at five locations in the North Coastal area. Each entry was planted in four-row plot with two replications. The other experiment named Local Barley Yield Trial (LBYT) including 24 barley genotypes was grown at three locations in the Northwest coast and two locations in North Sinai under rainfed condition in 1994/95 growing season. Each entry was planted in six-row plots with three replications. In addition to these two experiments, eight advanced barley genotypes which have been selected a year before from LBYT for being high drought tolerant and stable in production under low rainfed areas were grown in a field experiment, Advanced Barley Yield Traial (ABYT), in larger scale at five locations in the North Coastal area under rainfed condition. Results showed that in the first experiment (PSN), none of the genotypes in this experiment exceeded the old check, G.123 or the new check, G.125 in GY significantly. However, three high yielding genotypes with high stability of production under different environments were identified in each of LBYT and ABYT experiments. Giza 126, the new drought tolerant cultivar proved to be superior in GY, BY, SY, and exhibited wide adaptability across different environments under rainfed conditions. In general, it seems that high grain yielding genotypes, to a large extent, give high biomass or straw which is a favorable product to farmers (Bedouins) that can be used as forage or as animal feed or grazing especially during severe droughty seasons. These results are encouraging to the breeders, not only to develop high yielding barley cultivars, but also for high adaptability under wide range of environments to maintain stability of production under these very unpredictable conditions.

INTRODUCTION

Barley production area in Egypt is located mainly in the North Coastal region under rainfed condition and in some area under sprinkler irrigation in the newly reclaimed lands. Most of these area are planted with local types of barley which are low yielders and are more vulnerable and sensitive to diseases and insects than the improved recommended barley cultivars. Therefore, using drought tolerant barley varieties having high levels of disease and insect tolerance in such area should have great advantage over the traditional farmers' varieties. Noaman *et al.* (1989 and 1990 a and b, and 1993) concluded the possibility of having some barley genotypes that have high yielding potential under mild and severe drought stress with high average stability.

Although the genetic yield potential of a crop is determined by its genetic make-up, the measured yield potential, i.e. the maximum observed yield, is a characteristic of both the genotype and the surrounding environment. However, yield potential of a crop or genotype should be defined as the maximum yield attainable under a given environment in which several factors make up the environment of a crop and determine its maximum yield. In this regard, Eberhart and Russel (1966) calculated a parameter called environmental index for each of the environments used as the mean of all varieties at one environment minus the grand mean of all environments of the trials. They concluded that both regression coefficient (b) and the mean square of the deviation from regression (s2d) are good parameters for measuring stability of a variety. Thus, the perfect stable variety will be the one with b = 1.0 and s2d = 0.

The objective of this research was to identify and develop barley genotypes having high yieiding potential with high stability of production under rainfed conditions in which water deficit is the most limiting factor.

MATERIALS AND METHODS

A field experiment including fifty barley (Hordeum vulgare L.) genotypes from different sources selected from local and exotic materials was carried-out as Preliminary Screening Nursery (PSN) at five locations in the North Coastal area (3 in the NWC; Sidi Barani, El-Mathani, and El-Kasr and 2 in North Sinai, El-Gora and Rafah) during 1994-95 growing seaon. Each entry was planted in four-row plots 3 m

long and 20 cm apart in a randomized complete block design with two replications.

The second experiment named Local Barley Yield Trial (LBYT) including 24 barley genotypes was grown at three locations in the Northwest, El-Kasr Farm (Marsa Matrouh Agric. Experiment Station), El-Mathani and Sidi Barani (West of Matrouh), and two in North Sinai (Rafah and El-Gora) under rainfed condition to represent wide range of variability of the environments and other agro-climatological parameters such as soil type, soil fertility, precipitation, temperature, etc. Each entry of LBYT was planted in six-row plots, 3 m long and 20 cm apart where the outer two rows were used as borders while the inner four rows for yield evaluation. The experiments were laid down in a randomized complete block design with three replications.

In addition to these two experiments, eight advanced barley genotypes which have been selected a year before from LBYT for being high tolerant and stable in production under low rainfed area were grown in a field experiment, advanced Barley Yield Trial (ABYT), in larger scale in the North Coastal area under rainfed condition as a final step of releasing the best genotypes out of these eight promising lines. Each entry was sown as broadcast in 3.5 x 3 m plots with three replications in RCB design. Names and pedigree of the above mentioned experiments are presented in Tables 1 and 2. The seeding rate of all experiments was 35 kg seed/fed (83.3 kg/ha). No irrigation or fertilizers of any kind was applied to the plots.

Standard analysis of variance using least significant difference was performed (Steel and Torrie, 1980). In the analysis of the data, the varieties were treated as fixed variables, while environments were considered as random variables. In addition, standard analysis of variance and combined analysis overall environments for estimating stability parameters were performed according to Eberhart and Russel (1966).

Data recorded and abbreviations used in the text

Biological yield (BY): Weight of biomass (grain yield + straw) per plot in grams converted into kg/ha.

Grain yield (GY) : Weight of clean grains of plot in grams converted into kg/ha.

Straw yield (SY) : Weight of straw of plot in grams converted into kg/ha by subtracting grain yield from biological yield.

Table 1. Names and pedigree of Preliminary Screening Nursery (PSN) of barley genotypes grown in the North Coastal area under rainfed conditions, 1994/95.

Ent No	Name/Pedigree
1	Giza 123
2	Giza 124
3	Giza 125
4	Giza 126
5	Pld 10342//Cr.115/Por/3/Bahtim9/4/Ds/Pro/5/WI2291/6/Badia ICB86-0545-OAP-3KSR-1KSR-OGZ-OKSR
6	Pld 10342//Cr.Por/3/Bahtim9/4/Ds/Pro/5/WI2291/6/Badia ICB86-0545-OAP-3KSR-2KSR-OGZ-OKSR
7	Pld 10342//Cr.Por/3/Bahtim9/4/Ds/Pro/5/WI2291/6/Badia ICB86-0545-OAP-3KSR-2KSR-OGZ-OKSR
8	Arar/4/CM/3/Api/CM67//Mona ICB86-0711-OAP-3KSR-1KSR-OKSR
9	Arar/4/CM/3/Api/CM67//Mona ICB86-0711-OAP-3KSR-2KSR-OGZ-OKSR
10	Pm B/Aths/BC/3/80-5145 ICB86-0746-OAP-2KSR-OGZ-OKSR
11	Nigrate/5/WI2198/4/Avt/Ki//Avt/Toll/3/B2/Vt ICB86-0329-OAP-2KSR-IGZ-OKSR
12	Arar/Lignee 527 ICB85-0625-6AP-OAP-29 APH-OAP
13	MD ATL/CM5S-3W-B/6/MD ATL/CM-B-4-2-1-B-B/5/Cer/Por//Tb/3/ Pro/4/DL75 ICB85-0587-5AP-2AP-2TR-5AP-OTR-OAP
14	Arar/Lignee 527 ICB85-0625-6AP-OAP-18APH-OAP
15	Harma-02//11012-2/Mzq/3Arar/4/Harma-02//11012-2/Mzq/3/Lingee 527ICB85-1152-2AP-4AP-OAP-OTR-2AP-OTR-OAP
16	Harma-02//11012-2/Mzq/3/Arar/4/Harma-02//11012-2/Mzq/3/Lingee 527 ICB85-1152-2AP-5AP-OTR-1AP-OTR-OAP
17	As46//Deir Alla 106/Strain205 ICB85-0383-1AP-4AP-OTR-1AP-OTR-OAP
18	Apm/RL/4/Api/EB 489-8-2-15-4//Por/U.Sask. 1766/3/Cel/CI 0309-2 ICB84-0675-1AP-oAP-15APH-OAP
19	Api/CM67//Mona/3/DI//Asse/CM65-1W-B/4/Assala-02 IcB84-0225-2AP-3AP-OTR-1AP-OTR-OAP
20	Giza 121/CI 06248/4/Apm. IB65//11012-2/3/Api/CM67//Ds/Apro/5/ Aths ICB85-0177-2AP-4AP-3TR-2AP-OTR-OAP
21	Tern 78/4/Api/CM67//DL71/3/Maswi/Bon ICB84-0545-1Ap-OAP-6APH-OAP
22	Gerbel(C)/3/Harbing/Avt//AthsICB85-1003-4AP-1AP-OTR-4AP-OTR-OAP
23	Kenya Research/Belle//As46/Aths*2 IcB85-0229-1AP-3AP-OTR-2aP-OTR-OAP
24	Badia/Assala-02 ICB85-1117-2AP-2AP-2AP-OTR-2AP-OTR-OAP
25	Lignee640/Bgs//CelICB82-0440-2AP-OAP-19AP-OTR
26	Rihane/Badia ICB82-0902-OAP-OAP-OAP-10AP-OAP
27	Quinn/Rihane//Quinn/Lignee 640 ICB83-1134-OAP-OAP-OAP-4AP-OAP
28	M64-76/Bon//Jo/York/3/M5/Galt//As46/4/Hj34-80/Astrix/5/CN42/ CI 07772//Fun/3/Fun/Tch/4/Fun/Ki ICB84-1498-1AP-4AP-1AP-OTR.

Preliminary Screening Nursery, 1994/95 (Cont'd)

Ent No	Name/Pedigree
29	Bco.Mr/Avt//Cel/3/Line 257-14-4/Rihane's'-5 ICB84-0688-1AP-3AP-OTR-4AP-OTR
30	Lignee 527//Aths CYP-3191-OD-1AP-3AP-O1TR-3AP-OTR-OAP
31	80-5013/5/Cr. 115/Pro//Bc/3/Api/CM67/4/Giza 120
32	Lignee 527/NK 1272
33	Chaaran-01/3/Arizona 5908/Aths//Bgs ICB79-1328-OSH-2AP-3AP
34	(34 MSU, Giza 89/90)
35	Acsad 618
36	7-INC-TH90
37	10-INC-TH90
38	6-MaltB-IN-92
39	9-MaltB-INC-92
40	Rihane//BC/Coho ICB83-1488-2AP-OAP-1AP-1APH
41	Avt/Aths//Matnan-05 ICB85-0782-OAP
42	L.91-5 Unknown (No.30, Expt I, Sakha, Strees Prog.)
43	Nigrate/5/W12198/4/Attiki//Avt/Toil/3/82/Vt (Sel. 2.2) ICB86-0329-OAP
44	L 6R-93/1
45	L 6 R-93/2
46	M 88-599 (Rasmusson, 1993/94)
47	M 88-598 (Rasmusson, 1993/94)
48	M 60 (Rasmusson, 1993/94)
49	M 88-11 (Rasmusson, 1993/94)
50	M 66 (Rasmusson, 1993/94)

Harvest index (HI) : Grain yield divided by biological yield.

RESULTS AND DISCUSSION

1. Preliminary Screening Nursery (PSN)

Table 3 shows the means of BY, GY, SY, and HI of fifty barley genotypes grown at five locations in the North Coastal area. Significant differences ($P<0.05$) for GY were detected among genotypes at all environments (Table 3). Wide range of variability in GY was observed among different locations ranged from 260 kg/ha (entry No 25 at El-Gora) to 5275 kg/ha (entry No 22 at Rafah). The varietal average for GY at the five locations were 468, 1319, 2206,923, and 2240 kg/ha for Sidi Barani, El-Mathani, El-Kasr, El-Gora, and Rafah, respectively. Grain yield at Sidi Barani was the lowest of the five whereas Rafah and El-Kasr gave the highest GY values.

On the other hand, By and SY followed similar trend with El-Kasr having the highest By and SY compared to the other locations. The differences observed among locations for most of the characters were significant ($P<0.05$). Harvest index, however, was highest at Rafah (0.374) and was the lowest at El-Kasr (0.14), that is because BY at El-Kasr was very high (10477 kg/ha) compared to other locations which reduced the HI values accordingly (Table 3). These results are important to the Bedouins who are looking for both BY and SY which are as important as GY and sometimes are more important than GY where there is droughty season. Thus, our em phasis in barley breeding program is to breed and develop barley genotypes having both high GY and high SY under these conditions in order to satisfy farmers' needs.

Table 4 shows the mean of BY, GY, SY, and HI of 50 barley genotypes in the PSN trial combined over locations in the North Coastal area. It was concluded that none of the genotypes in this experiment exceeded the old check, G. 123, in GY significantly with % increase ranged from 0.6 tto 10%. However, By and SY which are as important as GY especially in some locations where severe drought occurs showed that genotype No 16 had the highest value of these two traits with relatively low GY compared to G. 123. This indicates that this genotype could be used for feed especially under severe drought stressed area for grazing and/or for straw feeding.

Table 3. Mean of biological yield (BY), grain yield (GY), straw yield (SY), and harvest index (HI) of barle, genotypes in the preliminary Screening Nursery grown at five locations in the North Coastal area under rainfed conditions, 1994-1995.

Ent No	Sidi Barani				El-Mathani				El-Kasr				El-Gora				Rafah			
	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi
1	1249	464	785	0.37	4463	1731	2731	0.38	10713	1999	8713	0.18	5500	1735	3765	0.31	6125	2180	3945	0.36
2	2678	714	1964	0.27	3749	1374	2374	0.37	10177	1785	8391	0.17	5375	1665	3710	0.31	8250	2785	5465	0.32
3	2678	607	2071	0.22	4820	1535	3285	0.31	10891	1964	8927	0.19	3000	880	2120	0.28	10375	3330	7045	0.30
4	3213	1196	2017	0.37	3571	1089	2481	0.31	10891	2838	8052	0.26	4125	1280	2845	0.31	8250	2525	5725	0.35
5	2321	803	1517	0.34	4106	1374	2731	0.33	9106	2392	6713	0.26	4625	1630	2995	0.34	6000	2075	3925	0.33
6	2142	7676	1374	0.36	3035	982	2053	0.32	11427	2249	9177	0.20	2750	1025	1725	0.37	4000	1670	2330	0.41
7	2678	964	1714	0.36	4285	1374	2910	0.31	11070	1928	9141	0.17	3125	1115	2010	0.35	3625	900	2725	0.30
8	1785	642	1142	0.35	4820	1642	3178	0.35	9641	2463	7177	0.26	2125	965	1160	0.43	5750	2165	3585	0.37
9	1606	589	1017	0.36	3928	1142	2785	0.29	12141	2856	9284	0.23	3125	1380	1745	0.42	7125	2310	4815	0.32
10	1606	517	1089	0.31	3928	1374	2553	0.34	12141	3213	8570	0.27	4250	1365	2885	0.32	4375	1430	2945	0.34
11	1249	339	910	0.27	3556	1499	3856	0.28	11784	2214	7070	0.23	3625	960	2665	0.27	3500	1200	2300	0.36
12	2142	499	1642	0.27	3928	1285	2642	0.32	9284	2713	8177	0.24	3000	1035	1965	0.34	4750	1880	2870	0.37
13	2499	946	1535	0.39	3213	1053	2160	0.32	10891	3071	6570	0.32	2000	860	1140	0.41	5625	1915	3710	0.33
14	2321	982	1339	0.42	4463	1392	3071	0.31	9641	3249	6362	0.34	1625	665	960	0.40	5125	1330	3795	0.25
15	2142	571	1571	0.27	5713	1642	4070	0.28	10713	2385	8327	0.22	2250	580	1670	0.25	7125	2250	4875	0.32
16	1785	482	1303	0.26	4642	1214	3428	0.26	13212	1535	11677	0.11	4750	1335	3415	0.27	8625	2370	6255	0.27
17	3571	964	2606	0.67	4642	1374	3267	0.30	9998	1589	8409	0.15	3750	1020	2730	0.26	7375	2270	5105	0.32
18	1964	803	1160	0.41	7320	1499	5820	0.20	8748	2481	6267	0.27	2750	1000	1750	0.35	3250	1370	1880	0.44
19	1785	482	1303	0.28	4463	1303	3160	0.29	9998	2749	7249	0.27	2000	535	1465	0.26	5750	2195	3555	0.36
20	1249	428	821	0.34	2856	1196	1660	0.42	10534	2856	7677	0.27	3375	1220	2155	0.36	7250	2455	479	0.33
21	1606	660	946	0.41	5356	1285	4070	0.26	9284	1589	7695	0.17	1750	475	1275	0.26	8625	3125	5500	0.34
22	2321	517	1803	0.22	4106	1142	2963	0.30	8391	1214	7177	0.14	1500	490	1010	0.32	15500	5275	10225	0.34
23	1964	535	1428	0.28	3392	1107	2285	0.32	11784	2624	9159	0.23	1750	585	1165	0.33	5500	2080	3420	0.38
24	2321	892	1428	38	4999	1517	3481	0.31	12855	2374	10480	0.18	2375	750	1625	0.32	6875	2105	4770	0.30
25	1785	660	1128	0.37	3749	1285	2463	0.33	7677	1714	5963	0.23	1000	260	740	0.28	6375	2545	3830	0.39
26	1964	553	1410	0.29	3749	1347	2374	0.36	9820	1464	8356	0.14	1875	475	1400	0.023	5625	2700	2925	0.53
27	1606	482	1124	0.29	4999	1464	3535	0.29	11962	2642	9320	0.22	3000	885	2115	0.27	6500	2150	4350	0.37
28	1428	339	1089	0.23	5892	1571	4320	0.26	9641	2214	7427	0.23	3000	700	2300	0.23	3500	1145	2355	0.32
29	1606	482	1124	0.29	3749	1160	2588	0.30	11070	2713	8356	0.24	3750	1340	2410	0.39	6250	2150	4100	0.34
30	1942	607	1356	0.39	5356	1392	3963	0.25	12855	2499	10355	0.19	2625	690	1935	0.33	7250	2800	4450	0.38
31	1964	678	1285	0.31	3571	1321	2249	0.37	11605	2446	9159	0.21	1500	520	980	0.37	7500	2585	4915	0.34
32	2142	678	1464	0.30	3928	1517	2410	0.39	11784	2803	89812	0.23	1625	610	1015	0.28	8375	3055	5320	0.36
33	2321	553	1767	0.23	3392	1231	2160	0.37	12498	1767	10730	0.15	1750	505	1245	0.29	5125	1825	3300	0.35
34	1785	589	1196	0.34	6606	1571	5535	0.28	11070	2339	8731	0.21	2375	695	1680	0.39	7000	2175	4825	0.31
35	2321	999	1321	0.43	4463	1803	2660	0.40	8570	2535	6034	0.29	1875	780	1095	0.33	5375	1630	3745	0.30
36	1785	499	1285	0.31	3035	1214	1821	0.40	8391	2214	6177	0.26	2000	695	1355	0.39	6325	1765	4560	0.24
37	2856	1214	1642	0.42	4106	1553	2553	0.37	11248	3017	8231	0.26	2125	780	1290	0.30	4125	1345	2780	0.36
38	2321	928	1392	0.39	2856	714	2142	0.25	10177	1839	8338	0.18	2750	645	1925	0.31	4000	1165	2835	0.29
39	2142	571	1571	0.25	4463	1071	3392	0.27	9463	1571	7891	0.16	4125	835	2790	0.31	6375	2185	4190	0.34
40	1428	357	1071	0.25	4285	1392	2892	0.0.32	9998	2932	7606	0.23	3750	825	2580	0.34	5500	2010	2955	0.35
41	2499	642	1856	0.25	4642	1196	3446	0.25	11248	2785	8463	0.23	5125	1335	3375	0.47	4625	1670	6225	0.37
42	2142	355	1606	0.25	3213	839	2374	0.25	8570	1428	7142	0.17	1500	1170	795	0.30	11000	4775	4090	0.45
43	2142	821	1321	0.37	3749	1303	2446	0.34	8748	2553	6195	0.29	3500	1750	2320	0.39	5875	1785	4030	0.33
44	2499	589	1910	0.24	5535	1660	3874	0.29	14998	2606	12391	0.17	2500	705	1505	0.31	6250	2220	4225	0.35
45	1785	357	1428	0.20	5356	17831	3624	0.33	8570	1178	7391	0.13	2625	1180	1825	0.27	6250	2025	2430	0.32
46	1964	517	1446	0.27	6070	1428	4642	0.24	7856	946	6909	0.12	2000	995	1495	0.31	3750	1320	1875	0.35
47	1606	571	1035	0.37	3571	989	2571	0.27	9641	607	9034	0.06	2000	800	1370	0.27	2875	1000	1875	0.34
48	1428	374	1053	0.25	3571	714	2856	0.22	11605	1731	9873	0.14	1750	505	1280	0.33	3375	1240	2635	0.36
49	1964	678	1285	0.32	3213	1231	1981	0.38	12855	2285	10570	0.17	3000	630	2015	0.33	3625	1250	2375	0.35
50	1964	732	1231	0.36	3571	1071	2499	0.30	9106	2053	7052	0.22	3500	470	2150	0.38	3750	1530	2220	0.40
X	2046	648	1398	0.31	4317	1319	2998	0.32	10477	2203	8263	0.21	2822	923	1898	0.33	6106	2204	3901	0.37
LSD	989	461	724	0.15	2726	673	2319	0.12	2736	1367	2716	0.12	2703	981	1776	0.09	4931	1942	3337	0.05
CV%	24.1	35.4	25.8	24.3	31.4	25.4	38.5	19.4	13.0	30.7	16.4	29.1	47.6	52.8	46.5	14.0	40.2	45.9	41.4	21.6

Table 4. Means of biological yield (By), grain yield (Gy), straw yield (Sy), and harvest index (HI) in the PSN combined over locations in the North Coastal area under rainfed conditions, 1994-95.

Entry						% increase/decrease	
		By	Gy	Sy	Hi	G. 123	G. 125
1	Giza 123	5610	1622	3988	0.323	---	-2.5
2	Giza 124	6046	1664	4381	0.290	+2.6	+0.1
3	Giza 125	6353	1663	4689	0.266	-2.5	---
4	Giza 126	6010	1785	4224	0.322	+10.0	+7.3
5		5231	1655	3576	0.326	+2.0	-0.5
6		4671	1338	3332	0.336	-17.5	-19.5
7		4956	1256	3700	0.303	-22.6	-24.5
8		4824	1575	3248	0.354	-2.9	-5.3
9		5585	1655	3929	0.329	+2.0	-0.5
10		5188	1580	3608	0.320	-2.6	-5.0
11		4603	1242	3360	0.284	-23.4	-25.3
12		4942	1482	3459	0.313	-8.6	-10.9
13		4596	1572	3023	0.358	-3.1	-5.5
14		4635	1523	3111	0.350	-6.1	-8.4
15		5588	1485	4102	0.272	-8.4	-10.7
16		6603	1387	5215	0.239	-14.5	-16.6
17		5867	1443	4423	0.263	-11.0	-13.2
18		4806	1431	3375	0.339	-11.8	-13.9
19		4799	1453	3346	0.296	-10.4	-12.6
20		5053	1631	3421	0.349	+0.6	-1.9
21		5324	1427	3897	0.292	-12.0	-14.2
22		6363	1727	4635	0.266	+6.5	+3.8
23		4878	1386	3491	0.311	-14.5	-16.7
24		5885	1528	4357	0.301	-5.8	-8.1
25		4117	1293	2824	0.324	-20.3	-22.2
26		4606	1313	3293	0.315	-19.1	-21.0
27		5613	1524	4089	0.293	-6.0	-8.3
28		5692	1193	3498	0.256	-26.4	28.3
29		5285	1569	3715	0.315	-3.3	-5.6
30		6010	1597	4412	0.281	-1.5	-4.0
31		5228	1510	3717	0.318	-6.9	-9.2
32		5571	1732	3838	0.334	+6.8	+4.1
33		5017	1176	3840	0.281	-27.5	-29.3
34		5767	1473	4293	0.286	-9.2	-11.4
35		4521	1549	2971	0.366	-4.5	-6.8
36		4307	1267	3039	0.314	-21.9	-23.8
37		4892	1593	3299	0.364	-1.8	-4.2
38		4421	1094	3326	0.284	-32.6	-34.2
39		5313	1346	3967	0.268	-17.0	-19.1
40		4992	1464	3528	0.297	-9.7	-12.0
41		5628	1608	4019	0.289	-0.9	-3.3
42		5285	1656	3628	0.318	+2.1	-0.4
43		4803	1528	3274	0.329	-5.8	-8.1
44		6356	1614	4742	0.293	-0.5	-2.9
45		4917	1218	3698	0.263	-24.9	-26.7
46		4328	943	3384	0.249	-41.9	-43.3*
47		3938	761	3177	0.269	-53.1*	-54.2*
48		4346	906	3440	0.208	-44.1*	-45.5*
49		4931	1286	3645	0.314	-20.7	-22.7
50		4378	1347	3030	0.334	-16.9	-19.0
X		5153	1441	3714	0.280		
LSD		1353	690	1066	0.110		
CV%		40.5	29.8	31.5	21.4		

In regard to the new released drought tolerant cultivar, G. 125, data showed the superiority of this cultivar overall locations under different levels of drought stress. It was outyielded insignificantly by the other new barley cultivar, G. 126 with about 7%. These two new cultivars were superior in BY and SY with reasonable HI.

Harvest Index as a ratio between GY and BY is one of the characters that indicates the genetic potential of a genotype to translocate the vegetative assimilates to the sink (grain). It is one of the most controversial trait that may mislead the breeder. For instance, selection for high HI may be on the expense of BY or, on the other hand, could lead to increase both BY and GY simulataneously. Therefore, Selction for this character should be taken cautiously. However, the highest value of HI was obtained from entries Nos 35 and 37 having high GY with relatively low SY. On the other hand, entry No 16 which had the highest SY gave relatively low HI (0.239). Thus, during selection procedure we should consider all theşe related characters to avoid any misleading interpretation of the results.

2. Local Barley Yield Trial (LBYT)

Significant differences ($P<0.05$) for GY were detected among genotypes at all five environments (Table 5). The mean GY ranged from 487 kg/ha (Ent. No 16 at Rafah) to 3772 kg/ha (Ent. No 21 at El-Kasr). The varietal average for GY at the five locations were 996, 1087, 2471, 1124, and 920 for Sidi Barani, El-Mathani, El-Kasr, Rafah, and El-Gora, respectively. The lowest GY was reçorded at El-Gora whereas the highest was at El-Kasr. Biological yield and SY were highest at El-Kasr (1970 and8498 kg/ha) as was observed earlier in the PSN trial mentioned above. Regarding HI, the data in Table 5 indicated that the highest value was recorded at El-Mathani because of the low BY at this location. The highest value for BY was obtained from Entry No 8 at El-Kasr (13447 kg/ha) whereas the lowest value was for entry No 20 at El-Gora (1725 kg/ha).

Table 7 shows the means of plant height (PlHt), spike length (SpLn), By, GY, SY and HI of barley genotypes in the LBYT and ABYT experiments combined over five locations in the North Coastal area. On the average, three genotypes, Nos 11, 17, and 18 outyielded the new check G. 125 significantly by about 39.7, 37.5, and 33.9%, respectively. The other new drought tolerant cultivar, G. 126 exceeded G. 126 exceeded G. 125 in GY of 19 genotypes out of 23 over that of G. 125 ranged from 3.7 to 39.7% with differences of 43 to 473 kg/ha, respectively.

Table 5. Mean of biological yield (BY), grain yield (GY), straw yield (SY), and harvest index (HI) of barle, genotypes in the preliminary Screening Nursery grown at five locations in the North Coastal area under rainfed conditions, 1994-1995.

Ent No	Sidi Barani				El-Mathani				El-Kasr				Rafah				El-Gora			
	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi
1	3630	880	2749	0.24	3689	809	2879	0.22	11662	2189	9472	0.18	3966	1047	2918	0.29	3451	899	2551	0.25
2	2856	1005	1850	0.37	3629	1118	2510	0.31	9936	1725	8211	0.17	4601	805	3796	0.20	5890	1389	4500	0.23
3	3451	1309	2142	0.38	3332	1172	2159	0.38	10531	2439	8092	0.22	4978	1164	3813	0.26	4165	1017	3147	0.26
4	2142	904	1237	0.42	2856	1041	1814	0.36	9163	2570	6592	0.27	5057	1600	3456	0.33	2320	1080	1239	0.54
5	2915	975	1939	0.34	3570	1154	2415	0.33	9817	2665	7151	0.27	3014	761	2253	0.30	2796	849	1946	0.31
6	2915	963	1951	0.34	4760	1439	3320	0.36	11959	2344	9615	0.19	5236	1133	4102	0.23	3213	609	2603	0.17
7	2439	1029	1410	0.41	3451	1190	2261	0.35	11007	2463	8544	0.22	3867	1011	2856	0.27	2380	567	1812	0.24
8	3153	934	2219	0.28	3332	886	2445	0.27	13447	2332	11114	0.17	7100	1948	5151	0.29	3480	700	2779	0.20
9	3332	1059	2272	0.32	3986	1255	2731	0.31	10353	2356	7996	0.23	2657	848	1808	0.32	3718	1028	2690	0.26
10	2618	1011	1606	0.38	4046	1142	2903	0.28	12971	3046	9924	0.24	4145	1419	2725	0.35	2528	763	1764	0.29
11	3272	1273	1999	0.38	4046	1386	2659	0.35	12138	3058	9079	0.25	3351	1348	2003	0.41	3094	1076	2017	0.34
12	2677	1063	1612	0.40	3986	1088	2897	0.34	7973	1761	6211	0.22	2558	818	1739	0.34	2469	697	1771	0.28
13	2975	1029	1945	0.34	3748	1225	2522	0.34	12138	2606	9531	0.21	2261	762	1498	0.33	3332	879	2452	0.26
14	3689	1154	2534	0.31	2142	862	1249	0.42	11186	2522	8663	0.22	4561	1658	2902	0.36	3361	998	2363	0.31
15	3034	874	2159	0.28	2142	957	1184	0.45	12852	2439	10412	0.19	1943	684	1249	0.36	4373	1404	2969	0.33
16	2618	1011	1606	0.39	2380	1588	791	0.68	9282	2594	6687	0.28	1527	487	1039	0.32	2945	967	1977	0.33
17	3867	1344	2522	0.34	2975	1255	1719	0.44	12376	3141	9234	0.25	1884	712	1171	0.38	4462	1556	2905	0.34
18	3034	1172	1862	0.39	3391	1213	2177	0.40	11305	2623	8681	0.23	3681	1370	2310	0.40	4075	1420	2654	0.35
19	2737	868	1868	0.31	2677	1225	1451	0.45	10829	2011	8817	0.19	7298	2152	5146	0.30	4462	1092	3370	0.24
20	1963	731	1231	0.36	1904	922	981	0.48	11067	2677	8389	0.25	2447	911	1535	0.38	1725	518	1206	0.28
21	3094	1017	2076	0.33	2261	815	1445	0.36	12257	3772	8484	0.31	3213	1090	2122	0.34	3266	784	2482	0.24
22	2618	1053	1564	0.40	3689	1065	2623	0.30	12138	2618	9520	0.22	4998	1742	3255	0.35	2142	575	1566	0.29
23	1844	666	1178	0.35	2380	725	1654	0.30	6426	1439	4986	0.23	2300	773	1527	0.36	2082	599	1482	0.29
24	1844	589	1255	0.32	2082	535	1547	0.27	10472	1927	8544	0.19	2181	732	1449	0.34	2826	605	2220	0.23
X	3359	996	2362	0.35	3185	1087	2097	0.37	10970	2471	8498	0.23	3701	1124	2576	0.32	3273	920	2353	0.29
LSD	1014	361	816	0.11	2096	661	1671	0.19	3364	1248	1829	0.10	3061	805	2396	0.10	2531	831	1790	0.13
CV%	33.4	22.1	18.6	20	40.0	36.9	48.4	31.4	18.7	30.7	20.9	25.9	50.3	43.5	56.6	18.6	47.0	45.9	46.2	28.4

Table 6. Mean of biological yield (BY), grain yield (GY), straw yield (SY), and harvest index (HI) of barle, genotypes in the preliminary Screening Nursery grown at five locations in the North Coastal area under rainfed conditions, 1994-1995.

Ent No	Sidi Barani				El-Mathani				El-Kasr				Rafah				El-Gora			
	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi	By	Gy	Sy	Hi
1	2805	701	2104	0.25	2990	804	2186	0.27	1971	563	1408	0.29	1164	298	866	0.23	3678	934	2744	0.26
2	2937	752	2184	0.25	2540	645	1895	0.26	2937	759	2178	0.25	1753	558	1194	0.37	2851	788	2063	0.28
3	2355	645	1709	0.27	1852	644	1208	0.36	1376	526	849	0.38	1124	327	797	0.30	1455	481	973	0.33
4	3176	913	2262	0.28	3242	685	2556	0.19	1217	398	819	0.32	1131	296	835	0.27	3156	884	2271	0.32
5	2434	849	1585	0.34	2818	788	2029	0.29	1945	698	1246	0.36	893	320	572	0.35	2276	790	1485	0.36
6	2302	876	1426	0.38	2606	825	1781	0.33	2130	831	1299	0.38	1025	347	678	0.34	2434	981	1453	0.41
7	2382	582	1799	0.24	2673	816	1856	0.33	1799	444	1355	0.24	483	128	354	0.27	2640	907	1732	0.34
8	1932	381	1550	0.20	2408	733	1675	0.31	1826	574	1251	0.31	1554	492	1062	0.31	2613	821	1792	0.31
X	2540	712	1828	0.28	2641	743	1898	0.29	1900	599	1301	0.32	1141	346	795	0.30	2638	823	1814	0.33
LSD	1134	410	752	0.05	1630	470	1251	0.10	699	295	479	0.09	1126	342	850	0.16	1876	440	1524	0.09
CV%	25.5	32.9	23.5	10.5	35.2	36.1	37.6	19.6	21.0	28.1	21.0	16.4	56.3	56.5	16.1	30.4	40.6	30.5	47.9	15.3

Table 7. Means of plant height (PlHt), spike length (SpLn), biological yield (BY), grain yield (GY), straw yield (SY), and harvest index (HI) of barley genotypes in the LBYT and ABYT experiments combined over locations in the LBYT and ABYT experiments combined over locations in the North Coastal area under rainfed conditions, 1994-95.

Entry								% increase
		Piht	Spln	By	Gy	Sy	Hi	G. 125
Lbyt Experiment								
1	Giza 123	51.8	5.30	5279	1165	4114	0.22	---
2	Giza 124	57.7	5.43	5382	1208	4173	0.26	+3.7
3	Giza 125	60.5	4.56	5291	1420	3870	0.30	+21.9
4	Giza 126	48.3	4.76	4307	1439	2868	0.38	+23.5
5		55.3	4.56	4422	1281	3141	0.31	+9.9
6		57.8	4.33	5616	1298	4318	0.26	+11.4
7		53.7	4.63	4629	1252	3376	0.30	+7.5
8		59.1	4.92	6102	1360	4742	0.24	+16.7
9		56.8	4.43	4809	1309	3500	0.29	+12.4
10		51.8	4.50	5261	1476	3785	0.31	+26.7
11		57.1	3.96	5180	1628	3551	0.35	+39.7*
12		54.7	3.90	3932	1086	2846	0.32	-6.8
13		53.7	3.83	4890	1300	3590	0.30	+11.6
14		56.2	4.60	4988	1445	3542	0.32	+24.0
15		54.8	4.83	4869	1274	3594	0.32	+9.4
16		57.3	4.90	3750	1329	2420	0.40	+14.1
17		56.3	5.13	5113	1602	3510	0.35	+37.5*
18		48.9	4.16	5097	1560	3537	0.35	+33.9*
19		54.6	4.76	5600	1470	4130	0.30	+26.2
20		46.2	3.86	3821	1152	2669	0.35	-1.1
21		54.1	4.20	4818	1495	3322	0.32	+28.3
22		50.9	4.10	5117	1410	3706	0.31	+21.0
23		46.4	4.16	3006	841	2165	0.30	-27.8
24		63.8	5.43	3881	878	3003	0.27	-24.6
X		54.5	4.55	4798	1320	3478	0.27	
LSD		13.2	19.5	51.4	38.4	55.1	25.6	
CV%		5.2	0.65	1835	369	1698	0.06	
Abyt Experiment								
1	G. 125	47.6	4.90	2522	660	1861	0.26	---
2	G. 126	50.0	4.53	2604	701	1903	0.28	+6.2
3		47.8	3.96	1632	525	1107	0.33	-20.5
4		55.9	4.26	2384	635	1749	0.28	-3.8
5		51.1	4.76	2073	689	1383	0.34	+4.4
6		46.5	3.90	2100	772	1327	0.37	+17.0
7		45.6	4.00	1995	575	1419	0.29	-12.9
8		44.9	4.36	2067	600	1466	0.29	-9.1
X		48.7	4.34	2172	645	1527	0.29	
LSD		15.4	16.7	38.9	35.7	35.1	19.7	
CV%		5.4	0.53	565	165	433	0.04	

* Significant at 5% level of probability

Biological yield and SY of G. 125 and G. 126 were high in values compared to the other genotypes and higer than, at least, 18 genotypes out of 22 whereas HI of these two new cultivars were relatively low because of the high BY values of these two cultivars. However, G x E interaction was highly significant for all characters which indicates the necessity of breeding for site-specific cultivars in parallel with wide-adaptability breeding. Some genotypes exhibited high sensitivity to different environments than others. Those were selected to be site-specific to those environments where they perform well under a given condition. As was mentioned earlier, by using stability parameters adopted by Eberhart and Russel (1966). Table 8 shows the means of GY of the high ranking high yielders and their stability parameters including regression line slope (b), mean square of the deveiation from regression (s2d), and coefficient of determination (R2). It is evident from that Table that genotypes Nos 11, 17, and 18 gave the highest GY compared to the other genotypes significantly ($P<0.05$) with two of them Nos 17 and 18 having (b) value of 1.265 and 0.905 that are not significantly different from 1. These genotypes plus G 126 had s2d values not significantly different from zero which is considered perfect stability. In the meantime, the check cultivar G.125 had b and s2d values that are not significantly different from I and zero. The performance of the genotypes in this experiment varied with agroclimatologic zones where some genotypes were consistently high yielders throughout the five environments, while others were fluctuated at different environments in ranking order. At all five environments it was possible to identify genotypes which were superior in GY when compared to the check at a given location (specific adaptability). These genotypes appeared in the top raning but only at one or two of the five locations (data are not shown for being numerous). These are described as site-specific genotypes or having specific adaptability to specific environemt. In other words, they are more susceptible to the environment or the interaction G x E is relatively high. This could be a powerful tool if one attempting to use site-specific recommended cultivars for each site or zone or region in a breeding program.

3. Advanced Barley Yield Trial (ABYT)

This trial included eight most advanced lines which have been tested under drought stress for several years. One of the major findings in this experiment is that, most recent developed high drough tolerant cultivar, G. 126 ranked 2nd, on the average overall environments with % increase of 6.2 over the check G. 125 preceded by entry No 6 which gave the highest GY with % increase of 17.0% over G.125 followed by No 5 with 4.4% increase. The rest of the material gave lower values

compared to the check but insignificantly. It was observed that, in general, the values in ABYT experiment were iower than those in LBYT experiment because of the larger plot size used in ABYT which gave, when data are converted, more reliable figures than the smaller plots. The highest GY was recorded for entry No 6 at Rafah (981 kg/ha) while the lowest value was obtained from No 7 at El-Gora (128 kg/ha), (Table 7).

Beside being high yielding cultivars, those above mentioned three genotypes had high stability with regression slope line and S2d not significantly different from 1 and o, respectively. Giza 126, the new released drought tolerant cultivar, had the highest BY and SY which is considered an ideal cultivar for these conditions in the North Coastal area under drought stress. This confirms the previous results about this cultivar (Noaman, *et al.*, 1994).

Table 8. Means grain yield (GY), regression line slope (b), men square of the deviation from regression (S2d), and coefficient of determination (R2) for LBYT and ABYT top ranking barley genotypes grown at five locations in the North Coast, 1994-95.

var No.	Mean GY kg/ha	(b)	S2d	R2
Lbyt				
11	1628*	1.244*	-82670 NS	0.997
17	1602*	1.265 NS	133497 NS	0.804
18	1560*	0.905 NS	-59656 NS	0.947
2 (G.126)	1208NS	0.409*	-8803 NS	0.975
1 (G.125)	1165	0.881 NS	-79851 NS	0.742
Lbyt				
6	772*	1.265 NS	-10001 NS	0.911
2 (G.126)	700 NS	0.390 NS	-11740 NS	0.751
5	689 NS	1.080 NS	- 9959 NS	0.881
1 (G.125)	660	1.298 NS	-15016 NS	0.973

* Significant different from b = 1 and s2d = 0 at 5% level of probability.

NS Not significantly different from b = 1 and s2d = 0 at 5% level of probability.

CONCLUSION

It was concluded from this study the possibility of having some genotypes that can combine both high yield coupled with high stability under rainfed conditions. In the first experiment (PSN), none of the genotypes in this experiment exceeded the old check, G. 123 or the new check, G. 125 in GY significantly. However, three high yielding genotypes with high stability of production under different environments were identified in each of LBYT and ABYT experiments. Giza 126, the new drought tolerant cultivar proved to be superior in GY, BY, SY, and exhibited wide adaptability across different environments under rainfed conditions. In general, it seems that high grain yielding genotypes, to a large extent, give high biomass or straw which is the most favorable product to farmers (Bedouins) that can be used as forage or as animal feed or grazing especially during severe droughty seasons. These results are encouraging to the breeders, not only to develop high yielding barley cultivars, but also for high adaptability under wide range of environments to maintain stability of production under these very unpredictable conditions.

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أصناف من الشعير تصلح للمناطق المطرية بمصر

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معهد بحوث المحاصيل الحقلية – مركز الزراعة – الجيزة .

أقيمت تجربة حقلية لمقارنة أصناف الشعير المنتخبة من مصادر محلية ومستوردة تشمل ٥٠ صنفا وسلالة فى مناطق متفرقة بالساحل الشمالى. كما أقيمت تجربة أخرى تسمى التجربة المحصولية المحلية أستلمت على ٢٤ صنفا وسلالة منتخبة من مواد التربية السابق اخبارها فى الأعوام السابقة فى ثلاثة مواقع بالساحل الشمالى الغربى وموقعين بشمال سيناء تحت ظروف الزراعة فى موسم ١٩٩٤ / ٩٥ . بالأضافة الى هاتين التجربتين ، تم أيضا اختبار ثمانية تراكيب وراثية متقدمة فى تجربة مقارنة حقلية موسعة وذلك كمرحلة اخيرة قبل تجربتها فى حقول المزارعين كتجارب مشاهدة وقبل تسجيلها كأصناف جديدة.

وقد أتضح من نتائج هذه التجارب تفوق الأصناف جيزة ١٢٣ وجيزة ١٢٥ وجيزة ١٢٦ على باقى المواد المختبرة فى التجربة الأولية . أما فى التجارب المحلية والمستوردة المتقدمة فقد ظهر تفوق ثلاثة تراكيب وراثية على أصناف المقارنة معنويا فى محصول الحبوب والقش كما أظهرت أيضا ثباتا وراثيا تحت مدى واسع من الأختلافات البيئية تحت الظروف المطرية. وقد أتضح أيضا من هذه الدراسة أن الأصناف العالية المحصول فى الحبوب تمتاز أيضا بأرتفاع محصولها من القش وهى من الأهداف الهامة فى برامج التربية لأنتاج أصناف ثنائية الغرض للحبوب والقش معا يمكن أستخدامها كعلف للحيوان.