Evaluation of Some Barley Landraces

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ABSTRACT

This work was carried out on 18 genotypes of barely (16 out of them are landraces and two are commercial cultivars). These genotypes were cultivated at the farm of Nubaria Agricultural Research Station for the two successive seasons of 2012/2013 and 2013/2014 and evolutional of some characters were significant differ between genotypes with respect of the green yield character.

The data showed that the commercial varieties are higher than that of the landraces. Plant height (cm) showed that genotype 1 and 11 were higher than that of the commercial varieties in both seasons. Also the genotype 12 was found to be higher. No. of days to heading (days) in one season: Genotypes 2, 11 and 13 were proven to be higher compared with the commercial varieties. But in the second season genotypes 11 and 13 were higher compared with that of the commercial varieties. Grain yield (g m^{-2}) in one season: No. 3&16 were found to be higher landraces genotypes compared with the commercial cultivars but its less than commercial cultivars. But in the second season were genotypes 3, 5and 13 higher compared with the remaining landraces but it's lower than the commercial the commercial varieties. Spike length (cm) was genotype 2 hieher compared with landraces genotypes in both seasons. No. plants per m^2 in one season: Genotype 4 and 5 were proven to be higher compared with that of the commercial varieties. But in the second season were 5 and 7 higher compared with that of landraces genotypes. Weight of 1000 grains (g) in one season: No. 1 and 4 proved to be higher compared with that of commercial ones. But in the second season were 1 and 4 hieher compared with landraces genotypes. Correlation between no. of days to heading (days) was significant with spike length (cm) and negative significant with grain yield but 1000 grains (g) during the first season of 2012/2013, but in the second season 2013/2014 it was significant with spike length (cm) and negative high significant with 1000 grains.

Key words: Land races, Barley, Yield and Yield components.

INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the most ancient crops among the cereals and has played a significant role in the development of agriculture (Ullrich, 2011). Today, cultivated barley is grown in much more diverse ecogeographic environmental conditions as compared to other crop species. It can be planted from the tropics to marginal areas in north and high altitudes (Nevo 1992). Before the 20th century barley was mainly used as a human food but presently it is used mainly as animal feed. It is also used for malt production and human consumption. Barley, in comparison with other cereal crops has a better fodder value including both grain and straw. In most of developed countries barley straw is used for animal bedding, whereas, in the developing counties it is also used for animal feed (Akar *et al.,* 2012).

Recently, methods for the estimation of grain yield or quality, based on spectral characteristics of the barley stand in various growth stages have been developed (Wessteiner and Kühbauch 2005, Zhao *et al.* 2005).

The present study was undertaken to:

(a) Evaluation of plant height (cm), spike length(cm), grain yield (g m^{-2}), no. of days to heading (days), no. plants in m^{-2} and weight of 1000 grains (g) and (b) Correlation between characters under studies during the successive seasons of 2012/2013 and 2013/201

MATERIALS AND METHODS

Plant materials:

Barley genoypes (16 landraces) and two commercial cultivars namely (Giza 2000 and Giza131) have been evaluated under normal conditions.

Experiments farm were carried out during two successive seasons of 2012/2013 and 2013/2014 at the Farm of Nubaria, Agric. Res. Center, Ministry of Agric, Egypt. (Table, 1)

Barley (*Hordeum vulgar L.*) sowing dates were December 15th and 17th in the first and second seasons, respectivelly. While, harvesting was in May 15th and 20th at the two successive seasons. The experiment was carried out in a randomized complete block design (RCBD) with 3 replicates. A plot size of 3 x 1.2 m having 6 rows was used with seeding rate of 120 kg ha^{-1}. Basal doses of 108 kg nitrogen, 36 kg phosphorous and 58 kg Potassium ha^{-1} were applied in the time of sowing. Grain yield was obtained for each genptype, which was later converted to yield per square meter.

Measured characters were included; plant height (stem and spike), length of the spike, grain yield (gm m^{-2}), number of the days to heading (50% spikes on plant), number of plants per m^{-2} and weight of 1000 grains (gm).

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Table 1. Barley genotypes included in the study

Genotypes	Type	Chromosome Number	Genotypes	Type	Chromosome Number
7543	6 rows	14	7466	6	14
7436	2 rows	14	7471	2	14
7440	6 rows	14	7476	6	14
7441	2 rows	14	7479	2	14
7442	6 rows	14	7483	2	14
7450	2 rows	14	7458	6	14
7452	2 rows	14	7489	6	14
7454	2 rows	14	Giza 131	6	14
7485	6 rows	14	Giza 2000	6	14

Soil initial state analysis:

Soil analysis of the soil samples (table 2) indicates that the surface soil layer (0-30 cm) has a light texture of sandy loam with a high content of $CaCO_3$ % (22.45 and 25.11 % for the two seasons, respectively). Soils of the both seasons were alkaline and non-saline with low available NPK and low content of O.M. % indicating their deficient fertility status.

Statistical analysis

Data were subjected to the analysis of variance ANOVA using (LSD) Test following the randomized complete block design (RCBD), with three replications for each treatment. The least significant differences (L.S.D) at the 0.05 ≤ level were determined according to computer program (COSTAT software, 1988)

RESULTS AND DISCUSSION

Plant height (cm):

Was calculated and data are given in table (5 and 6). Means ranged from 66 to 94 cm for the genotypes 7485 and 7442 to the genotype 7476, respectively, at the first season, and ranged from 66 to 94 cm for the genotype 7442 to the genotype 7476, respectively, at the second season.

Number of days to heading (days):

The data are given in table (5 and 6). Means ranged from 72.33 to 85 days for the genotype 7440 to the genotype 7471, respectively, at the first season, and ranged from 71.33 to 85.67 days for the genotype 7440 to the genotype 7471, respectively, at the second season.

Grain yield (gm^{-2}):

It was calculated and data are given in table (7 and 8). Means ranged from 214.67 to 432 gm^{-2} for the genotype 7454 to cultivate Giza 2000, respectively, at the first season, and ranged from 244.67 to 443.67 gm^{-2} for the genotype 7454 to cultivate Giza 2000, respectively, at the second season.

Spike length (cm):

The data are given in table (7 and 8). Means ranged from 5.4 to 9.83 cm for the genotype 7440 to cultivate Giza 2000, respectively, at the first season, and ranged from 5.57 to 9.97 cm for the genotype 7440 to cultivate Giza 2000, respectively, at the second season.

Number of plant per m^2:

The data are given in table (7 and 8). Means ranged from 397.67 to 1080 for the genotype 7489 to the genotype 7450, respectively, at the first season, and ranged from 401 to 1099.3 for the genotype 7489 to the genotype 7450, respectively, at the second season.

Table 2. Some initial soil physicochemical characteristics of the surface layer (0 – 30 cm) of the experimental seasons 2012/2013 and 2013/2014

Soil characteristics	Experimental season	
	2012/2013	2013/2014
Soil EC, dS m^{-1}	2.17	2.43
Soil pH (1:2.5)	8.27	8.24
Total $CaCO_3$ %	22.45	25.11
O.M %	0.27	0.31
Soil texture	Sandy Loam	Sandy Loam
Available macronutrients ppm		
N	41.62	39.73
P	3.16	3.28
K	89.74	90.62

Table 3. Mean monthly climatic data for 2012-2013 growing seasons in Nubaria expermintal station

Month	Temperature (°C)		Rainfall (mm)	Relative Humidity (%)
	max	min		
November 2012	26.01	16.62	0.27	59.49
December 2012	19.92	10.90	1.35	59.36
January 2013	18.13	6.72	1.97	61.63
February 2013	20.88	7.64	0.47	51.35
March 2013	25.43	10.65	0.10	43.27
April 2013	27.34	12.16	0.12	47.54
May 2013	32.91	17.19	0.10	41.95

Table 4. Mean of monthly climatic data for 2013-2014 growing seasons in Nubaria expermintal station

Month	Temperature (°C)		Rainfall (mm)	Relative Humidity (%)
	max	min		
November 2013	25.02	14.38	0.26	61.12
December 2013	18.85	9.14	0.63	61.65
January 2014	19.23	8.64	0.64	64.01
February 2014	20.62	8.25	0.47	62.71
March 2014	23.88	10.27	0.36	49.94
April 2014	28.22	12.99	0.23	45.22
May 2014	31.20	16.63	0.19	42.19

Table 5. Means (x^{-} ± S. d) of plant characters under study during the first season of 2012-2013

No.	Genotypes	characters			
				Number of days to heading (days)	
		x^{-}	S. d		S. d
1	7543	90.33AC	3.79	7543	2.00
2	7436	76.33GF	5.51	7436	2.00
3	7440	76.33GF	2.52	7440	0.58
4	7441	78.33DF	3.21	7441	1.15
5	7442	66.00H	2.65	7442	1.00
6	7450	74.33FH	5.86	7450	1.15
7	7452	77.33GF	9.02	7452	3.61
8	7454	79.33GDF	4.51	7454	1.52
9	7485	66.00H	9.54	7485	0.58
10	7466	71.00GH	8.00	7466	0.58
11	7471	92.33AB	4.93	7471	1.00
12	7476	94.00A	4.00	7476	0.58
13	7479	76.00EFG	5.29	7479	0.58
14	7483	76.00EFG	3.61	7483	1.53
15	7458	87.33ABCD	4.04	7458	1.15
16	7489	81.00CDEF	7.21	7489	0.58
17	Giza 131	85.00ABCDE	4.36	Giza 131	1.00
18	Giza 2000	83.67BCDEF	6.03	Giza 2000	1.00

Table 6. Means ($\bar{x} \pm$ S. d) of plant characters under study during the second season of 2013-2014

No.	Genotypes	Characters			
		Plant height (cm)		Number of days to heading (days)	
		$\bar{x}$		$\bar{x}$	S. d
1	7543	93.67A	1	75.00IH	1.00
2	7436	79.67CD	2	80.00BCD	2.00
3	7440	77.67CD	3	71.33K	1.15
4	7441	79.00CD	4	76.67FGH	0.58
5	7442	66.00E	5	72.33JK	1.15
6	7450	75.33D	6	74.33IJ	0.57
7	7452	75.33D	7	78.33DEF	3.79
8	7454	80.67BCD	8	76.00GHI	1.00
9	7485	67.00E	9	72.00K	1.00
10	7466	74.67D	10	80.67BC	1.15
11	7471	88.00AB	11	85.67A	0.58
12	7476	94.00A	12	77.33FG	0.58
13	7479	75.33D	13	82.00B	1.00
14	7483	76.33D	14	79.67CDE	0.58
15	7458	84.00BC	15	77.00FGH	1.00
16	7489	78.67CD	16	76.67FGH	1.15
17	Giza 131	84.00BC	17	77.67EFG	1.53
18	Giza 2000	85.00BC	18	72.00K	1.00

Table 7. Means ($\bar{x} \pm$ S. d) of yield and yield components characters under study during the first season of 2012-2013

No.	Genotypes	characters							
		Grain yield (gm-2)		Spike length (cm)		Number of plant per m2		Weight of 1000 (grams)	
		$\bar{x}$	S. d	$\bar{x}$	S. d	$\bar{x}$	S. d	$\bar{x}$	S. d
1	7543	303.67CDEF	12.58	7.83BCD	0.76	483.33GH	32.14	56.20AB	0.90
2	7436	306.00CDEF	23.58	9.17AB	1.04	560.00GH	70.00	51.33BCDE	0.68
3	7440	357.67BC	63.00	5.40F	0.52	596.67FGH	50.33	51.13BCDEF	3.90
4	7441	222.33GH	10.79	7.17CDE	0.86	831.00BCD	97.08	52.83ABCD	1.40
5	7442	333.00BCDE	91.16	6.47DEF	1.011	870.00B	78.10	50.83CDEF	0.49
6	7450	285.33DEFG	9.07	7.73BCD	1.41	1080.0A	270.74	45.93FGHI	1.76
7	7452	260.00FGH	47.95	8.53ABC	1.07	839.00BC	121.08	45.47GHIJ	2.45
8	7454	214.67H	15.82	6.10EF	0.90	632.00DEFG	72.81	47.63DEFGH	5.12
9	7485	254.33FGH	39.72	5.43F	0.59	648.67CDEFG	60.67	43.23HIJ	1.26
10	7466	323.33CDEF	54.28	6.70DEF	0.52	458.00GH	60.65	42.07IJ	3.10
11	7471	258.00FGH	31.76	8.50ABC	0.87	578.33FGH	109.00	43.03HIJ	3.15
12	7476	358.33BC	50.86	6.10EF	0.90	624.00EFG	115.53	40.57J	2.86
13	7479	270.00EFGH	20.07	6.73DEF	1.10	814.33BCDE	72.28	47.90DEFH	3.91
14	7483	278.00EFGH	14.73	8.87AB	1.27	807.00BCDE	87.13	45.13GHIJ	4.03
15	7458	355.00BCD	46.13	6.53DEF	0.45	776.33BCDEF	123.03	49.40DEFG	3.87
16	7489	362.00BC	44.79	5.60F	0.60	397.67H	86.57	47.40EFGH	2.49
17	Giza 131	401.00AB	9.00	9.10AB	0.90	895.00AB	127.08	55.50ABC	4.81
18	Giza 2000	432.00A	48.59	9.83A	0.64	973.33A	265.01	57.43A	4.70

Table 8. Means ($\bar{x} \pm$ S. d) of yield and yield components characters under study during the second season of 2013-2014

No.	Genotypes	Characters							
		Grain yield (gm-2)		Spike length (cm)		Number of plant per m2		Weight of 1000 (grams)	
		$\bar{x}$	S. d	$\bar{x}$	S. d	$\bar{x}$	S. d	$\bar{x}$	S. d
1	7543	311.00EF	9.54	8.23C	0.32	462.00GH	14.80	55.87AB	2.18
2	7436	318.00DEF	20.22	9.27AB	0.55	577.00EFG	86.75	51.73BCD	0.81
3	7440	353.33BCDE	47.37	5.57G	0.30	615.67EF	20.40	51.77BCD	2.31
4	7441	245.00G	44.98	7.33D	0.45	857.00CD	64.65	52.67BC	3.09
5	7442	353.67BCDE	34.59	6.93DE	0.72	897.00BCD	16.09	51.33BCDE	1.78
6	7450	320.00DEF	55.38	8.27C	1.07	1099.3A	175.54	45.27GH	4.35
7	7452	294.00FG	7.00	8.60BC	0.66	875.33BCD	106.27	47.17DEFG	3.45
8	7454	244.67G	8.08	6.57DEF	0.70	634.00E	35.93	46.10FGH	4.54
9	7485	303.67EF	43.78	5.80FG	0.44	643.67E	54.05	43.90GH	2.35
10	7466	349.67CDE	34.79	6.97D	0.21	497.00FGH	61.65	41.90H	2.86
11	7471	294.33FG	12.58	8.73BC	0.47	659.67E	77.92	43.57GH	2.87
12	7476	365.33BCD	52.79	6.50DEF	0.62	645.67E	74.33	42.67GH	3.45
13	7479	368.00BCD	21.52	7.00D	0.66	832.67D	81.75	46.53EFGH	5.26
14	7483	289.00FG	12.00	8.87BC	0.35	838.67D	63.34	45.87FGH	2.60
15	7458	383.67BC	10.26	6.07EFG	0.15	841.33D	64.03	50.40CDEF	0.92
16	7489	395.00ABC	16.00	6.07EFG	0.15	401.00H	11.14	46.03FGH	3.91
17	Giza 131	407.00AB	14.18	9.23AB	0.61	970.67ABC	114.74	57.70A	4.13
18	Giza 2000	443.67A	41.48	9.97A	0.57	997.67AB	105.5	58.97A	1.70

Weight of 1000 grain (g):

It was calculated and data are given in table (7 and 8). Means ranged from 40.57 to 57.43 g for the genotype 7476 to cultivate Giza 2000, respectively, at the first season, and ranged from 41.9 to 58.97 g for the genotype 7466 to cultivate Giza 2000, respectively, at the second season.

Current study, detecting high genetic variation for the investigated morphological characters and grain yield, indicated that the barley landraces may be useful in selection and breeding programs. According to Marshall and Brown (1975) and Oka (1995), the numbers of genotypes (18) used in this study are sufficient to include all genetic variation under most circumstances.

Some promising genotypes were identified by using the variation within locally adapted barley germplasm.

Akgun *et al.* (2012) found that grain yield, was large for all populations and grain yield was 11.0-427.6 g m-2 among the landraces.

Correlation between characters under study:

In the first season of 2012/2013, the Length of the spike positive significant correlated with number of the days of shooting spikes (50% spikes on plant). The negative significant correlations were between Green yield (gm/m2) and number of the days of shooting spikes (50% spikes on plant). Also, Number of the days of shooting spikes (50% spikes on plant) with Length of the spike was positive significant correlation Length of the spike and negative significant correlation with Green yield (gm/m2). (Table, 9)

In the second season of 2013/2014, Length of the spike positive significant correlation with number of the days of shooting spikes (50% spikes on plant). Also, the positive significant correlations were between numbers of the days of shooting spikes (50% spikes on plant) with Length of the spike. Weight of 1000 grains (gm) was negative high significant correlation with Number of the days of shooting spikes (50% spikes on plant) (Table, 10)

The data obtained from this work revealed that seasons were found to be different, giving strong evidence that environmental factor affecting the tested characters

Table 9. Correlation between characters under study during the first season of 2012/2013

Characters	Plant height (cm)	Spike length (cm)	Grain yield (g m-2)	Number of days to heading (days)	Number of plant per m2	Weight of 1000 grain (grams)
Plant height (cm)	-	0.216	0.202	0.198	-0.196	-0..083
Spike length (cm)		-	0.091	0.277*	0.130	0.166
Grain yield(g m-2)			-	-0.328*	-0.210	0.054
Number of days to heading (days)				-	-0.192	-0.319*
Number of plant per m2					-	0.197
Weight of 1000 grain (grams)						-

*correlation is singnificant at the 0.05 level (2-tailed).

** Correlation is singnificant at the 0.01 level (2-tailed).

Table 10. Correlation between characters under study during the second season of 2013/2014

Characters	Plant height (cm)	Spike length (cm)	Grain yield (g m-2)	Number of days to heading (days)	Number of plant per m2	Weight of 1000 grain (grams)
Plant height (cm)	-	0.239	0.096	0.215	-0.257	0..037
Spike length (cm)		-	0.013	0.269*	0.127	0.185
Grain yield(g m-2)			-	-0.188	-0.262	0.041
Number of days to heading (days)				-	-0.136	-0.382**
Number of plant per m2					-	0.118
Weight of 1000 grain (grams)						-

* Correlation is singnificant at the 0.05 level (2-tailed).

** Correlation is singnificant at the 0.01 level (2-tailed).

REFERENCES

Akar, T., M. Avci and F. Dusunceli 2012. Post-harvest operations. Food and Agriculture Organization of the United Nations.1-64.

http://www.fao.org/3/a-au997e

Akgun, N., A. Topal and M. Akcura 2012. Evaluation of central Anatolian barley landraces. Agric. Res., 29: 87-93.

Akimaliev, D. 2006. Assessment of the modern condition and development of strategies of plant breeding and biotechnology in Central Asia.

Marshal, D. R. and Brown, A. H. D., 1975. Optimum sampling strategies in genetic conservation. In: OH Frankel and JG Hawkes (Eds), Crop Genetic Resources for Today and Tomorrow: 53-80, Cambridge University Press, Cambridge.

Morrell, P. L. and, M. T. Clegg 2007. Genetic evidence for a second domestication of barley (Hordeum vulgare) east of the Fertile Crescent. Proceedings of the National Academy of Sciences 104(9), 3289-3294.

Nevo, E. (1992). Origin, evolution, population genetics and resources for breeding of wild barley, *Hordeum spontaneum* in the fertile crescent. In Barley: Genetics, Biochemistry, Molecular Biology and Biotechnology, Shewry, P. R., Ed., CAB International: Wallingford, UK, pp. 19–43.

Oka, H. I., 1995. Consideration on the population size necessary for conservation of crops germplasms. In: T. Matuso (ed.), Japan International Biological Program-JIBP Synthesis, 5, Tokyo: 57-63.

Ullrich S. E. 2011. Significance, adaptation, production, and trade of barley. In Barley: Production, Improvement, and Uses. Wiley Blackwell, pp.3–13.

Usubaliev, B., A. Brantestam, B. Salomon, L. Garkava-Gustavsson and R. Bothmer 2013. Genetic diversity in farmer grown spring barley material from Kyrgyzstan. Genetic Resources and Crop Evolution, 1-16.

Weissteiner C. J. and W. Kühbauch 2005. Regional yield forecasts of malting barley (*Hordeum vulgare* L.) by NOAA-AVHRR remote sensing data and ancillary data. Journal of Agronomy and Crop Science, 191: 308–320.

Wright, S. 1978. Evolution and the genetics of populations. Variability within and among natural populations. Vol. 4. University of Chicago press, Chicago, IL, USA

Zohary, D. and M. Hopf 1988. Domestication of plants in the Old World. The origin and spread of cultivated plants in West Asia, Europe and the Nile Valley: Clarendon Press. ISBN 0198541988.

Zhao C., L. Liu, J. Wang, W. Huang, X. Song and C. Li 2005. Predicting grain protein content of winter wheat using remote sensing data based on nitrogen status and water stress. International Journal of Applied Earth Observation and Geoinfo, 7: 1-9

الملخص العربي

تقييم بعض الأصول الوراثية للشعير

محمد عبد العزيز محمد عامر وخميس إبراهيم سعد

تم تنفيذ هذا البحث لتقييم ١٨ تركيب وراثى منهم ١٦ أصل وراثى وصنفين تجاريين. أقيمت التجربة بمزرعة محطة البحوث الزراعية بالنوبارية على مدار موسمى ٢٠١٣/٢٠١٢ و٢٠١٤/٢٠١٣. تم تقييم بعض الصفات وتم الحصول على النتائج التى تؤثر على صفات المحصول، ويتضح من النتائج تفوق الأصناف التجارية على الأصول الوراثية وتلاحظ الآتى:

١- صفة ارتفاع النبات(سم): تلاحظ الأصل الوراثى(١) و(١١) أعلى الأصول الوراثية وأيضا أعلى من الأصناف التجارية خلال الموسمين والأصل الوراثى (١٢) أعلى من باقى الأصول الوراثية فى العام الثانى.

٢- صفة عدد الايام اللازمة لطرد السنابل: كانت فى الموسم الاول الاصول الوراثية رقم ٢، ١١ و١٣ تفوقت على الاصناف التجارية وباقى الاصول الوراثية وفى العام الثانى الاصول الوراثية رقم ١١و١٣ كانت هى الاعلى مقارنة بالاصناف التجارية.

٣- صفة محصول الحبوب: فى الموسم الاول الاصول الوراثية ٣ و١٦ كانت اعلى التراكيب الوراثية ولكنها كانت اقل من الاصناف التجارية وفى العام الثانى الاصول الوراثية ٣، ٥ و١٣ كانت اعلى الاصول الوراثية محصولا لكنها اقل من الاصناف التجارية.

٤- طول السنبلة(سم): الاصل الوراثى رقم ٢ اعلى من كل الاصول الوراثية فى كلا الموسمين.

٥- صفة عدد النباتات/م^{٢}: كانت الاصول الوراثية ٤ و٥ اعلى من باقى الاصول الوراثية لكنها اقل من الاصناف التجارية وفى الموسم الثانى الاصول الوراثية ٥ و٧ أعلى من الاصول الوراثية الاخرى.

٦- صفة وزن ١٠٠٠ حبة (جم): الاصول الوراثية ٤ و٥ كانت اعلى من باقى الاصول الوراثية ولكنها اقل من الاصناف التجارية هذا فى الموسم الاول اما الموسم الثانى الاصل الوراثى رقم ١ و٥ كانا اعلى الاصول الوراثية لكنهما اقل من الاصناف التجارية .

٧- فى الموسم الاول الارتباط بين عدد الايام اللازمة لطرد السنابل و طول السنبلة كان ذو معنوية ايجابية وكان سلبى ومعنوى مع صفة المحصول لكن صفة ١٠٠٠ حبة معنوي سلبى مع عدد الايام اللازمة لطرد السنابل. اما فى الموسم الثانى كان هناك ارتباط معنوى سلبى بين عدد الايام اللازمة لطرد السنابل وصفة ١٠٠٠ حبة وكان عالى المعنوية.