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Estimation of Combining Ability for Yield and its Components in Barley Under Normal and Stress Drought Condition

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ABSTRACT

This study was carried out at the Experimental Farm in Agronomy Department, Faculty of Agriculture, Mansoura University during the two seasons 2012/2013 and 2013/2014 using six diverse barley genotypes (*Hordeum vulgare* L.). All possible parental combinations without reciprocals were made among the six genotypes, giving 15 crosses. The six parental genotypes and 15 F_1's were evaluated in two experiments. The first experiment, was irrigated with the recommended treatment *i.e* three irrigations after planting irrigation (normal condition), and the second one was irrigated with planting irrigation only (drought condition). Plant height, spike length, number of grains/spike, number of spikes/plant, 100–grain weight and grain yield /plant were studied . Results indicated that water stress treatments decreased the means of all studied traits for parents and their hybrids. Statistical analysis revealed highly significant effects of genotypes, GCA and SCA for all studied traits, providing evidence for presence of large amount of genetic variability. The estimates of GCA effects showed that, P_1 was a good combiner for number of grains/spike and 100-grain weight under both conditions, spikes/plant under Normal and plant height and grain yield/plant under stress; P_2 for grain yield/plant under both conditions, spike length, spikes/plant, number of grains/spike under normal and plant height under stress ; P_3 for plant height, 100 grain weight under both conditions and number of grains/spike under normal; P_4 for grain yield/plant under both conditions, spikes/plant under normal and plant height under stress; P_5 for plant height and number of grains/spike under stress and P_6 for spike length and 100 grain weight under stress. For SCA estimates, it could be summarized that the best hybrids were cross No. 1, 9 and 10 for most studied traits under both conditions. Drought susceptibility index (DSI) used to estimate relative stress injury because it accounted for variation in yield potential and stress intensity. This index could be estimated based on many traits. which included Giza 123, Giza 129, crosses No. 3 and 10 were tolerant for most traits, indicating the importance of these parents in this regard.

INTRODUCTION

Barley (*Hordeum vulgare* L.) has a great adaptation potential in many regions of the world. It has a good tolerance to biotic stresses such as salinity, drought, frost and heat. It is considered one of the most important crops ranking the fourth in the world cereal crops production. Its ecoNomic importance is due to its usage it for animal feeding, brewing malts and human food in some areas.

In Egypt, barley is mainly used as animal feed (grain and straw) and sometimes for bread making by bedouins. Barley is a miNor winter cereal crop grown mainly in rainfed areas where limited water supply is a feature such as in the Northwest Coastal region and North of Sinai, also it is grown over wide range of soil variability and under many diverse climatic conditions compared with many other grain crops. So, it can be grown in irrigated saline lands and poor soil conditions. It has also been grown in the newly reclaimed lands as well as the old land.

This combination of higher yield stability along with higher general yield under drought have been planned because useful selection requirements for characterizing geNotypic performance under various penetration of water stress. Ahmad *et al*. (1999) identified combination of drought susceptibility index (measure of yield stability) compared to. general yield useful within determining geNotypes using yield potential and comparatively dependabl yield performance under various humidity conditions.

Therefore, the main objective of this study included the induction of new promising barley genotypes having high yield potentially and more tolerant to drought stress through the following:- 1) Identification of superior parents and their crosses from a 6 X 6 diallel cross of barley parental genotypes grown under water normal and stress irrigation conditions., 2) Estimation of combining ability effects and the mode of gene action in the inheritance of grain yield and some related agronomic traits and 3) Estimation the susceptibility index (SI) for yield and some related agronomic traits.

MATERIALS AND METHODS

The present study was carried out at the Experimental Farm in Agronomy department, Faculty of Agriculture, Mansoura University during the two successive seasons 2012/2013 and 2013/2014. Six parental genotypes of barley were used, the names and pedigrees of which are presented in Table (1).

Table 1: Names and pedigrees of parental barley genotypes.

No	Genotypes	Pedigree
1	Giza 123	Giza 117/FAO 86
2	Giza 126	BaladiBahteem/SD729-por12762-Bc
3	Giza 129	Deir Alla 106/Cel//As46/Aths*2
4	Giza 130	"Comp.cross"229//Bco.Mr./ DZ0231 /3 /Deir Alla106
5	Giza 131	CM67-B/CENTENO//CAM-B/3/ROW906.73/4/GLORIA-BAR/COMEB/5/FALCON-BAR/6/LINO
6	Giza 132	Rihane-05//As46/Aths*2" Aths/ Lignee686

In 2012/2013 season, the parental genotypes were sown at various planting dates in order to overcome the differences in flowering time. All possible parental combinations excluding reciprocals were made among the six genotypes. In 2013/2014 season, seeds of the parents and their 15 F_1 hybrids were planted in two experiments. The first was irrigated three times after planting irrigation (normal condition).The second experiment was given planting irrigation only (water stress conditions). Each experiment was designated in a randomized complete block design with three replicates. Each parent and F_1 was represented by two rows per replicate. Each row was 1.5 m long, and spaces between rows were 30 cm with 15 cm between plants. All the recommended agroNomic practices for barley production were applied at the proper time.

Ten guarded plants were randomly taken from each entry to collect data on plant height (cm), spike length (cm), number of grains /spike, number of spikes/plant, 100–grain weight (g) and Grain yield /plant (g).

An ordinary analysis of variance for each experiment and the combined analysis across the two experiments (normal and stress irrigation) were performed according to Snedecor and Cochran (1980), whenever homogeneity of error was detected. Combining ability analysis was performed according to Griffing (1956) model 1 (fixed) method 2.

Data of yield and some related traits were used to estimate the drought susceptibility index (DSI) as suggested by Fisher and Maurer (1978) as follows:

$$\mathbf{DSI = (1 - Y_d / Y_p) / D.}$$

Where: Y_d = Performance of a genotype under drought stress, Y_p= Performance of a genotype under Normal irrigation, D = drought stress intensity = 1 - (mean Y_d of all genotypes / mean Y_p of all genotypes).

RESULTS AND DISCUSSION

Analysis of variances:

Mean squares of different barley genotypes for all studied characters in each enviroment are presented in Table 2.

Statistical analysis revealed that, mean squares due to genotypes were highly significant for all traits, providing evidence for presence of large amount of genetic variability, which considered adequate for further biometrical assessment. The results also indicated that mean squares of general combining ability (GCA) and specific combining ability (SCA) were significant or highly significant for all studied traits of barley genotypes under the both environments. Similar results were reported by Eid (2010) and Amer *et al* (2011).

The ratio of GCA/SCA were lesser than unity for all the studied traits under both conditions which mean that Non-additive gene effects played an important role in the inheritance of these traits. In such cases, a bulk method would be fruitful to eliminate the effect of dominance in the advanced generation. These results agreed with those obtained by Amer (2010), Eid (2010) and Amer *et al*. (2011).

Table (2): Mean square of different barley geNotypes for all studied traits under Normal and stress drought conditions.

S.O.V	df	Plant height (cm)		Spike Length (cm)		No. of Spikes plant $^{-1}$	
		Normal	Stress	Normal	Stress	Normal	Stress
Rep	2	23.69	1.45	0.41	0.11	0.45	1.76
Genotype	20	57.91**	62.37**	1.57**	0.530**	9.69**	5.18**
GCA	5	58.47**	38.32**	0.76**	0.55**	11.24**	3.37**
SCA	15	57.72**	70.38**	1.85**	0.52**	9.18**	5.79**
erorr	40	1.21	0.60	0.07	0.06	0.753	1.07
GCA/SCA		0.127	0.068	0.048	0.133	0.141	0.061

*** and ** Significant at 0.05 and 0.01 levels of probability, respectively**

Table (2) continue.

S.O.V	df	Grains spike $^{-1}$		100-grain weight		Grain yield plant $^{-1}$ (g)	
		Normal	Stress	Normal	Stress	Normal	Stress
Rep	2	2.71	20.97	0.04	0.10	111.78	5.05
Genotype	20	83.85**	112.31**	0.530**	0.546**	819.67**	291.79**
GCA	5	100.29**	44.63**	0.84**	0.32**	664.17**	374.17**
SCA	15	78.37**	134.88**	0.43**	0.62**	871.51**	264.33**
erorr	40	2.11	3.41	0.042	0.045	52.01	1.47
GCA/SCA		0.161	0.039	0.257	0.060	0.0933	0.177

*** and ** Significant at 0.05 and 0.01 levels of probability, respectively**

Mean performance

The mean performance of the six parents and their F_1 crosses under normal and stress conditions are presented in Table 3.

The mean performance for all geNotypes were generally decreased under stress conditions and deficiency of soil moisture. Similar results were obtained by Moursi (2003), Bayoumi (2004), Mohamed, Magda (2004), Farhat (2005), El-Shawy (2008) and Amer *et al* (2011).

For plant height, Giza-129 and cross No. 3 under Normal, Giza 130 and cross No.15 under stress were the tallest. Regarding to spike length, the result showed that Giza132 and cross No. 4 under Normal, Giza 131 and cross No. 9 under stress had the tallest spikes. For number of grains/spike, Giza 126 and cross No.5 under Normal, Giza 131 and cross No.6 , under stress, gave the highest number of grains/spike. For number of spikes/plant, Giza 126 under both conditions gave the highest number of spikes/plant among the parents, while crosses No. 13 under Normal and No. 11 under stress gave the highest numbers. Concerning to 100-grain weight, results showed that Giza 129 had the heaviest grains among the parents under both conditions, meanwhile, crosses No. 5 under Normal and No. 6 under stress gave the heaviest grains among the crosses. For grain yield/plant, Giza 131 under Normal Giza 123 under Normal and stress while cross No. 10 under both conditions gave the highest values for grain yield/plant.

Table 3: Means of parents and their F_1 crosses for all the studied traits under Normal and stress drought conditions.

Genotype	Plant height (cm)		Spike length (cm)		No. of grains/spike	
	Normal	Stress	Normal	Stress	Normal	Stress
Giza 123 (P_1)	118.00	91.17	9.70	8.39	61.00	54.67
Giza 126 (P_2)	100.43	97.62	9.67	8.31	71.67	45.33
Giza 129 (P_3)	123.00	101.47	9.10	8.47	58.67	55.33
Giza 130 (P_4)	109.77	107.66	8.73	7.95	56.00	32.00
Giza 131 (P_5)	110.67	95.20	10.00	9.50	71.33	65.67
Giza 132 (P_6)	102.11	100.10	10.77	9.00	62.00	48.33
1 x 2 (1)	123.00	102.00	10.59	9.39	74.67	67.33
1 x 3 (2)	118.17	94.00	10.50	9.71	75.00	54.67
1 x 4 (3)	128.41	101.93	9.27	9.22	63.00	49.00
1 x 5 (4)	118.83	113.77	11.20	8.00	61.67	38.00
1 x 6 (5)	104.50	99.00	9.63	8.20	81.00	44.67
2 x 3 (6)	114.67	108.66	9.13	8.00	69.67	37.00
2 x 4 (7)	117.32	110.57	10.03	9.50	61.00	54.33
2 x 5 (8)	121.67	99.30	9.72	9.27	64.00	32.00
2 x 6 (9)	122.47	106.87	10.22	10.17	65.33	60.67
3 x 4 (10)	105.63	94.77	10.23	9.76	53.67	47.33
3 x 5 (11)	118.57	118.22	9.78	9.50	74.67	63.33
3 x 6 (12)	107.00	95.67	10.06	8.50	67.33	36.33
4 x 5 (13)	107.32	100.23	9.73	8.61	43.33	40.33
4 x 6 (14)	107.55	95.70	9.27	9.11	69.33	31.00
5 x 6 (15)	116.67	115.96	10.17	9.50	62.67	50.67
LSD 5%	1.81	1.28	0.436	0.404	2.40	3.06
1%	2.42	1.71	0.583	0.540	3.21	4.08

Table (3) Continue.

Genotype	No. of spikes/plant		100-grain weight (g)		Grain yield/plant (g)	
	Normal	Stress	Normal	Stress	Normal	Stress
Giza 123 (P_1)	17.33	13.55	6.14	5.10	53.15	50.22
Giza 126 (P_2)	20.89	16.33	5.17	4.16	48.34	41.25
Giza 129 (P_3)	14.33	11.33	6.65	5.89	43.88	39.50
Giza 130 (P_4)	17.00	13.87	5.31	3.16	54.31	48.55
Giza 131 (P_5)	11.23	8.55	6.07	5.36	57.86	33.97
Giza 132 (P_6)	13.45	10.33	5.66	4.67	39.05	23.03
1 x 2 (1)	17.67	15.11	6.71	4.43	77.60	71.57
1 x 3 (2)	14.78	13.57	6.42	4.84	46.67	20.14
1 x 4 (3)	14.89	13.47	5.83	5.61	58.24	56.73
1 x 5 (4)	16.00	14.34	5.50	5.19	48.42	23.32
1 x 6 (5)	16.33	14.66	7.58	5.12	76.11	47.06
2 x 3 (6)	15.23	11.11	6.85	6.46	59.22	43.83
2 x 4 (7)	16.00	15.33	5.27	4.46	55.60	47.28
2 x 5 (8)	12.53	8.00	6.32	4.47	37.86	17.82
2 x 6 (9)	14.33	12.77	6.81	6.06	69.11	65.15
3 x 4 (10)	14.33	12.53	5.09	4.18	85.20	83.29
3 x 5 (11)	18.00	16.10	5.95	5.40	63.17	30.55
3 x 6 (12)	18.37	12.44	5.85	4.45	43.32	41.36
4 x 5 (13)	18.57	11.56	5.30	4.30	71.91	58.31
4 x 6 (14)	15.57	12.78	5.29	3.72	71.73	43.34
5 x 6 (15)	13.47	13.22	5.58	5.03	60.47	29.39
LSD 5%	1.43	1.21	0.338	0.350	11.89	1.10
1%	1.91	1.61	0.451	0.467	15.90	2.67

General combing ability effects:

Estimates of general combining ability effects for parents under Normal and water stress conditions are presented in Table 4. Data indicated that P_1 was a good combiner for number of grains/spike and 100-grain weight under both conditions; P_2 for grain yield/plant under both conditions, spike length, spikes/plant, number of grains/spike under stress and plant height under Normal ; P_3 for plant height and grain yield/plant under both conditions and number of grains/spike under stress; P_4 for 100-grain weight under both conditions, spikes/plant under stress and plant height under Normal; P_5 for plant height and number of grains/spike under Normal and P_6 for spike length and grain yield/plant under Normal. Similar results were obtained by Ahmed (1990), Singh *et al*. (2002), Sharma *et al*. (2003), Mahmoud, Badeaa (2006), Amer (2010), Amer *et al*. (2011) and Ismaeil (2015).

Table 4 : Estimates of general combining ability effects for barley parents for all studied traits under Normal and stress drought conditions.

Parents	Plant height (cm)		Spike length (cm)		No. of grains/spike	
	Normal	Stress	Normal	Stress	Normal	Stress
Giza 123	-3.90**	2.64**	0.05	-0.56**	1.72**	2.96**
Giza 126	1.25**	0.41	0.07	0.30**	-0.07	3.25**
Giza 129	0.90**	1.53**	0.13	0.14	-0.03	1.04*
Giza 130	1.17**	0.31	-0.45**	0.14	-4.40**	-6.12**
Giza 131	1.84**	0.28	-0.12	0.12	2.31**	-2**
Giza 132	-1.27**	-5.18**	0.33**	-0.14	0.47	0.88
LSD 0.05	0.507	0.715	0.166	0.168	1.21	0.947
LSD 0.01	0.678	0.956	0.221	0.224	1.61	1.27

*** and ** indicate significance at 0.05 and 0.01 levels of probability, respectively**

Table 4: continued

Parents	No. of spikes/plant		100-grain weight		Grain yield/plant	
	Normal	Stress	Normal	Stress	Normal	Stress
Giza 123	1.01**	0.42	4.51**	6.54**	0.04	0.31**
Giza 126	0.32	1.26**	1.56**	8.47**	0.04	0.08
Giza 129	0.10	-0.35	-1.28**	-7**	0.21**	0.24**
Giza 130	-0.06	1.02**	9.30**	8.67**	-0.36**	-0.57**
Giza 131	-0.56	-1.99**	-10.49**	-12.65**	-0.06	-0.17*
Giza 132	-0.81*	-0.35	-3.60**	-4.03*	0.14*	0.12
LSD 0.05	0.673	0.566	0.790	4.71	0.133	0.137
(gi) 0.01	0.899	0.756	1.06	6.29	0.178	0.184

- **and ** indicate significance at 0.05 and 0.01 levels of probability, respectively**

Specific combining ability effects:

The estimated specific combining ability (SCA) effects of all barley parental combinations computed for all traits under Normal and water stress are presented in Table 5. for plant height, the best crosses were crosses No. 9, 11 and 15 where they showed highly significant and positive SCA effects under both conditions, indicating spike length the importance of dominance effect in these crosses for tallness. Regarding, spike length the best crosses were crosses No. 7 and 12 where they showed highly significant positive SCA effects under both conditions. These crosses are considered to be promising for improving this trait. For number of grains/spike, significant or highly significant and positive SCA effects were obtained from crosses No. 1, 2, 11 and 14 under both conditions, indicating that these crosses could be considered promising in this respect. With respect to number of spikes/plant crosses No. 4 and 11 under Normal and 12 and 13 under stress showed highly significant and positive SCA effects. For 100-grain weight, significant or highly significant positive SCA effects were estimated for crosses No. 3, 6 and 9 under both conditions. These results indicated that, these crosses were superior to the others. As for grain yield/ plant, estimates of SCA effects were highly significant and positive for the crosses No. 1, 9 and 10 under both conditions. These results indicate the superiority of these crosses in this trait. These results are in general agreement with those reported by Ahmed (1990), Bhatnagar and Sharma (1997), Sharma *et al* (2003), Mahmoud, Badeaa (2006), Amer (2010), Eid (2010), Amer *et al* (2011), Amer *et al* (2012) and Ismaeil (2015).

Table 5 : Estimates of Specific combining ability effects for F_1 crosses for all studied traits under Normal and stress drought conditions..

Cross		plant height		Spike length		No. of grains/spike	
		Normal	Stress	Normal	Stress	Normal	Stress
1 x 2	1	4.55**	1.18	0.25	0.51*	4.27**	15.74**
1 x 3	2	-1.40	-6.47**	0.74**	0.38	6.81**	3.04*
1 x 4	3	10.06**	1.20	0.25	-0.27	1.98	1.74
1 x 5	4	0.51	12.37**	-0.96**	1.33**	-7.82**	-15.63**
1 x 6	5	-8.35**	0.71	-0.50*	-0.68**	12.98**	-7.46**
2 x 3	6	1.21	9.05**	-0.71**	0.63**	1.18	-12.84**
2 x 4	7	1.20	4.68**	1.77**	0.47*	-0.98	8.54**
2 x 5	8	5.57**	-7.25**	0.46*	-0.63**	-1.44	-20.17**
2 x 6	9	11.84**	3.42**	1.60**	-0.17	-2.98*	10.33**
3 x 4	10	-7.27**	0.10	0.38	0.61**	-5.44**	1.83
3 x 5	11	3.12**	12.36**	1.34**	-0.46*	11.43**	11.12**
3 x 6	12	-4.74**	-7.43**	0.66**	1.04**	1.23	-14.05**
4 x 5	13	-8.67**	-6.24**	-1.05**	0.36	-12.73**	-7.51**
4 x 6	14	-2.97**	-7.67**	2.10**	-0.55	9.06**	6.33**
5 x 6	15	10.06*	12.63**	-1.50**	0.02	-12.40**	9.95**
LSD 0.05		1.97	1.39	0.463	0.452	2.61	3.31
(Sij) 0.01		2.63	1.86	0.618	0.605	3.48	4.43

*** and ** indicate significance at 0.05 and 0.01 levels of probability, respectively**

Table 5 : Continued.

Cross		No. of spikes/plant		100-grain weight		Grain yield/plant	
		Normal	Stress	Normal	Stress	Normal	Stress
1 x 2	1	-0.62	1.53	0.31	-0.45*	45.19**	19.51**
1 x 3	2	1.47	-2.35*	-0.14	-0.22	-22.89**	-29.08**
1 x 4	3	-0.60	-2.29*	0.74**	1.35**	-25.68**	-6.54**
1 x 5	4	1.86*	0.75	-1.03**	-1.25**	-15.49*	-16.69**
1 x 6	5	0.54	1.33	1.14**	0.14	3.59	0.17
2 x 3	6	-3.85**	0.01	0.52**	1.40**	-12.27	-2.43*
2 x 4	7	0.52	0.26	-0.26	-0.03	27.28**	-9.56**
2 x 5	8	-5.32**	-2.03*	0.40**	-0.33	-28.49**	-12.99**
2 x 6	9	0.64	-1.55	0.83**	1.05**	45.54**	21.21**
3 x 4	10	0.39	-2.32*	-0.39*	-0.55**	50.85**	29.28**
3 x 5	11	6.92**	1.76	0.18	0.21	4.69	-0.44
3 x 6	12	-0.91	4.27**	-0.52**	-0.71**	-7.54	2.22*
4 x 5	13	-1.52	4.38**	0.03	-0.09	5.87	14.71**
4 x 6	14	-1.95*	1.63	0.10	0.22	-2.92	-6.93**
5 x 6	15	1.51	0.03	-0.38*	0.14	7.14	-2.51*
LSD 0.05		1.55	1.85	0.38	0.37	12.91	2.16
LSD 0.01		2.07	2.47	0.51	0.49	17.25	2.89

*** and ** indicate significance at 0.05 and 0.01 levels of probability, respectively**

Drought susceptibility index (SI):

A drought susceptibility index (SI), which provides a measure of stress resistance based on minimization of yield loss under stress as compared to optimum conditions, rather than on yield level under stress, has been used to characterize the relative drought tolerance of wheat genotypes (Fisher and Maurer, 1978). This index was used to estimate the relative stress loss because it accounted for variation in yield potential and stress intensity. This index could be estimated based on many traits. Lower stress susceptibility index than unity (SI<1) is synonymous to high stress tolerance, while high stress susceptibility index (SI >1) mean higher stress sensitivity.

\Means performance of drought susceptibility index (SI) of all barley genotypes calculated for all studied traits are presented in Table 6.

Data indicated that for plant height three parents and 7 crosses possessed DSI less than one the best of them was Giza 130 and Giza 132 for parents and cross No. 11 for crosses. For spike length three parent and 9 cross possessed DSI less than one the best of them was Giza 131 for parent and cross No. 9 for crosses. As for number of grains/spike four parents and 8 crosses possessed DSI less than one the best of them was Giza 129 for parents and cross No. 13 for crosses. Regarding 100 grain weight four parents and 8 crosses possessed DSI less than one, the best of them was Giza 129 for parents and cross No. 3 for crosses. Concerning grain yield/plant four parent and 7 cross possessed DSI less than one, the best of them was Giza 123 for parents and cross No. 10 for crosses. The previous data revealing that these parents and crosses were more resistance to water stress. These results agreed with those obtained by Eid (2010), Amer *et al* (2011), Abdel-Moneam *el al*. (2014) and El-Shouny *et al*. (2015).

Table 6: Susceptibility index for barley parents and their F_1 crosses based on all studied traits.

Genotype	Plant height	Spike length	No. of grains/spike	No. of spikes/plant	100-grain weight	Grain yield/plant
Giza 123 (P_1)	2.22	1.44	0.40	1.21	0.91	0.22
Giza 126 (P_2)	0.27	1.50	1.40	1.21	1.05	0.59
Giza 129 (P_3)	1.71	0.74	0.22	1.17	0.62	0.40
Giza 130 (P_4)	0.19	0.95	1.63	1.02	2.18	0.42
Giza 131 (P_5)	1.36	0.53	0.30	1.33	0.63	1.65
Giza 132 (P_6)	0.19	1.75	0.84	1.29	0.94	1.64
1 x 2 (1)	1.66	1.21	0.37	0.81	1.83	0.31
1 x 3 (2)	1.99	0.80	1.03	0.46	1.32	2.27
1 x 4 (3)	2.01	0.06	0.85	0.53	0.20	0.10
1 x 5 (4)	0.41	3.05	1.46	0.58	0.30	2.07
1 x 6 (5)	0.51	1.59	1.71	0.57	1.75	1.53
2 x 3 (6)	0.51	1.32	1.79	1.51	0.31	1.04
2 x 4 (7)	0.56	0.56	0.42	0.23	0.83	0.60
2 x 5 (8)	1.79	0.49	1.90	2.01	1.58	2.12
2 x 6 (9)	1.24	0.05	0.27	0.61	0.59	0.23
3 x 4 (10)	1.00	0.49	0.45	0.70	0.96	0.09
3 x 5 (11)	0.03	0.31	0.58	0.59	0.50	2.06
3 x 6 (12)	1.03	1.66	1.75	1.80	1.29	0.18
4 x 5 (13)	0.64	1.23	0.26	2.10	1.02	0.76
4 x 6 (14)	1.07	0.18	2.11	1.00	1.60	1.58
5 x 6 (15)	0.06	0.70	0.73	0.10	0.53	2.05

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تقدير القدرة على التألف للمحصول ومكوناته فى الشعير تحت الظروف العادية وظروف الجفاف

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أجريت هذه الدراسة بالمزرعة البجثية بقسم المحاصيل كلية الزراعة جامعة المنصورة خلال موسمي ٢٠١٣/٢٠١٢ و ٢٠١٤/٢٠١٣، باستخدام ستة تراكيب وراثية من الشعير المتباعدة وراثيا. وقد أجريت كل التهجينات الممكنة بين الآباء مع استبعاد الهجن العكسية للحصول على ١٥ هجين فردى . وزرعت الآباء والجيل الأول في تجربتين منفصلتين، أعطيت الأولى ثلاث ريات بعد رية الزراعة (ظروف عادية) ، بينما أعطيت الثانية رية الزراعة فقط (إجهاد مائى). تم دراسة مجموعة الصفات التالية : طول النبات، طول السنبلة، عدد الحبوب فى السنبلة، عدد السنابل/نبات، وزن المائة حبة ومحصول الحبوب للنبات. أوضحت النتائج أن الإجهاد الرطوبى أدى إلى خفض في متوسطات التراكيب الوراثية المختلفة بالنسبة لكل الصفات تحت الدراسة لكل من الآباء والهجن. من تحليل التباين نجد أن الاختلافات بين التراكيب الوراثية كانت عالية المعنوية لكل الصفات مما يشير إلى وجود قدر كافى من التباين الوراثي بين تلك التراكيب الوراثية. أظهرت التقديرات الخاصة بالقدرة العامة على الائتلاف أن الصنف جيزة ١٢٣ أب ذو قدرة عامة جيدة لصفات عدد حبوب السنبلة ووزن المائة حبة تحت الظروف العادية وظروف الاجهاد ؛ طول النبات ؛ محصول الحبوب تحت ظروف الإجهاد وعدد السنابل فى النبات تحت الظروف الطبيعية. الصنف جيزة ١٢٦ أب مشارك جيد لصفات محصول الحبوب للنبات تحت الظروف العادية وظروف الاجهاد، طول السنبلة، عدد السنابل للنبات، عدد حبوب السنبلة تحت الظروف الطبيعية وطول النبات تحت ظروف الاجهاد. الصنف جيزة ١٢٩ أب ذو قدرة عامة على الائتلاف لصفة طول النبات، وزن المائة حبة تحت الظروف العادية وظروف الاجهاد وعدد حبوب السنبلة تحت الظروف الطبيعية. يعتبر الصنف جيزة ١٣٠ أب مشارك جيد لصفات محصول الحبوب للنبات تحت الظروف العادية وظروف الاجهاد ووزن المائة حبة تحت الظروف الطبيعية، عدد السنابل للنبات تحت الظروف الطبيعية وطول النبات تحت ظروف الاجهاد .وأظهر الصنف جيزة ١٣١ قدرة عالية على الائتلاف لصفات طول النبات و عدد حبوب السنبلة تحت ظروف الاجهاد. الصنف جيزة ١٣٢ يعتبر أب مشارك جيد لصفات طول السنبلة و وزن المائة حبة تحت ظروف الاجهاد. أظهرت نتائج القدرة الخاصة على التآلف أن أفضل الهجن كانت: الهجن رقم ١، ٩، ١٠ بالنسبة لمعظم الصفات تحت كل من المعاملتين. أظهر التحليل الخاص بدليل الحساسية للجفاف أن الاصناف جيزة ١٢٣ و جيزة ١٢٩ والهجن أرقام: ٣ و ١٠ كانت متحملة للإجهاد المائى بالنسبة لمعظم الصفات تحت الدراسة