The Response of Barley Genotypes (*Hordeum vulgare*, L.) to Variable Environments in Egypt

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ABSTRACT

The objective of this investigation aims to evaluate nine barley genotypes under different locations of heat stress for testing their performance. Where development of any crop genotypes with adaptation to climatic changes especially heat stress is one of the most important goal of a breeding program. These genotypes were examined over different four locations; Sakha, Sids, El-Menia and New-valley during two seasons (2016/2017 and 2017/2018). The combined analysis of variance for locations, years and genotypes were highly significant for all studied traits. Results revealed that the genotypes Line 1, Line 4, and Line 3 gave the highest values for grain yield compared with the other genotypes. In contrast, the least values of grain yield were recorded by Line 6, Line 7, and Giza 124 genotypes. From the previous results, the promising barley genotypes could be used as new cultivars or as a source in a breeding program for high yielding.

Key words: Barley, grain yield, heat stress.

INTRODUCTION

Barley (*Hordeum vulgare L.*), is the fourth most important cereal crop after wheat, rice, and maize. Barley became widely used about 10000 years ago in the Middle East. From that time, it has been used for feeding animals, making beer, and smaller quantities for making food. Total harvested areas in Egypt from 2016/2017 season amounted to 175,270 faddan with an annual production of approximately 239,666.7 ton Like other grown plants, it is continuously exposed to biotic and abiotic stresses, which can significantly influence its development, growth and productivity (FAO, 2013).

Abiotic stresses such as extreme temperatures and low water availability, frequently limit the growth and productivity of major crop species including cereals. High temperature is often accompanied by high water need, so cereal breeding programs oriented to develop tolerant cultivars to stresses (Tester and Bacic 2005).

Severe grain losses are caused by higher or lower temperatures, drought and excess salts (Cattivelli *et al*., 2013). Heat stress is a severe threat to crop production worldwide (Hall, 2001). High temperature limits the accumulation of carbohydrate for grain growth. Also, heat stress before flowering cause sterility and yield decline.

The main objective of this study was to identify promising barley genotypes that can produce high yield and are more tolerant to heat stress conditions.

MATERIALS AND METHODS

Description of Experimental Site:-

Four field experiments were performed in four locations i.e; Sakha, Sids, ELmenia and New valley research stations, Agriculture research center, Egypt, during winter sowing seasons of 2016-2017 and 2017-2018. Trials were sown on the 1st December on Sids, ELmenia, and New valley and on 15th December at Sakha in both seasons.

Plant Material and Experimental Design:-

Nine barley genotypes were evaluated. The names and pedigree of the tested genotypes were presented in Table (1). Monthly range of air temperature (C$^{\circ}$) and Relative humidity (RH%) were recorded by a meteorological station situated in each experimental site (Table 2).

Grains were hand drilled at the recommended sowing rate of barley in the irrigated land of Egypt (50 kg fad^{-1}). Each genotype was sown in six rows of 3.5 m long, and 20 cm among rows (plot area 4.2 m^2). These experiments were laid out in an RCBD with three replications in each location, then were combined analyzed, over locations (Steel *et al,* 1997). collected Data were, days to heading, days to maturity, plant height (cm), spike length (cm), No. of spikes m^{-2}, No. of grains spike^{-1}, 1000-grain weight (g) biological yield (arddab. fad^{-1}) and grain yield (ton. fad^{-1}).

RESULTS AND DISCUSSION

Interactions effect:

The differences among years, locations and genotypes were highly significant for all studied traits. Also, the mean square of interaction between the years x locations were highly significant for plant height, spike length, number of spikes m^{-2} and number of grains spike^{-1}, genotypes x locations were highly significant for all studied traits except for, number of spikes m^{-2}, grain yield, and biological yield. While genotypes x years x locations were highly significant for the number of days to maturity (Table 3).

Table 1: Names and pedigree of the nine barley genotypes used in the study.

Genotype	Pedigree
Line-1	PETUNIA2 / 3GLORIA-BAR / COME // ESPERANZA /4/CBSS99M00349T-F-3M-1Y-IM-IY-IM-0M
Line-2	CHENG DU 105 /4/ EGYPT4 / TERAN78 // P.STOO /3/CBSS00Y00236T-E-0Y-0M-2Y-0M
Line-3	TOCTE /3/ CHAMICO / TOCTE // CONGONA /4/ LIGNEE527 /CBSS99M00468T-H-1M-1Y-1M-1Y-0M
Line-4	GLORIA-BAR / COME // LIGNEE640 /3/ S.P-B/4/SLLO /5/CBSS99M00429T-L-1M-1Y-1M-1Y-0M
Line-5	BBSC / CONGONA // BLLU /3/ CIRU CBSS00Y00225T-C-0Y-0M-2Y-1M-0M
Line-6	PETUNIA2 /6/ ALPHA-BAR / DURRA // CORACLE /3/CBSS00Y00446D-F-0Y-0M-1Y-0M
Line-7	PETUNIA2 /3/ TOCTE / TOOCTE / TOCTE // BERROS /4/ PENCOO / CBSS00Y00475T-O-0Y-0M-2Y-0M
GIZA 126	Local variety
GIZA124	Local variety

Table 2: Monthly mean of air temperature (C°) and relative humidity (RH%) in winter seasons of 2016/2017 and 2017/2018 at Sakha, sids, elmenia and new-valley sites.

At C° 2016/2017												
Month	**Sakha**			**Sids**			**Elmenia**			**New valley**		
	Max	**Min**	**RH%**	**Max**	**Min**	**RH%**	**Max**	**Min**	**RH%**	**Max**	**Min**	**RH%**
December	19.03	9.42	67.54	20.4	7.4	64.3	18.42	5.96	64.05	19.67	6.62	5345
January	17.99	6.87	67.43	19	5.2	61.3	18.17	4.95	57.03	20.48	6.11	40.09
February	19.03	9.42	67.54	24.6	8.4	52.3	20.3	5.26	49.73	21.31	5.95	37.68
March	24.43	10.8	56.39	28.1	9.1	42.3	25.63	9.91	35.9	26.51	10.42	27.76
April	28.16	12.39	51.39	34.9	17.5	33.7	31.24	14.21	27.69	32.65	16.32	19.05
At C° 2017/2018												
Month	**Sakha**			**Sids**			**Elmenia**			**New valley**		
	Max	**Min**	**%RH2M**	**Max**	**Min**	**%RH2M**	**Max**	**Min**	**%RH2M**	**Max**	**Min**	**%RH2M**
December	21.81	11.69	67.82	19.8	7.1	61.7	21.79	9.45	55.21	23.71	9.93	47.84
January	19.44	9.12	67.57	19.2	5.4	57.3	19.38	5.41	56.01	20.04	5.28	47.49
February	22.34	10.02	62.85	20.9	7	55.7	24.58	10	41.45	26.02	10.84	31.9
March	28.3	11.92	47.07	25.2	11	42.7	30.18	12.79	26.86	31.94	14.94	19.08
April	30.92	14.24	44.16	31.3	15.4	38	32.11	15.23	26.93	33.59	16.56	19.21

Table 3: The combined analyses of variance over years (Y) and locations (L) and genotypes (G) for all studied traits.

S.o.v	d.f.	days to heading	days to maturity	plant height (cm)	spike length (cm)	number of spikes m-2	no. of grains spike^{-1}	1000 -grain Weight (g)	grain yield (arddab fad^{-1})	biological yield (ton fad^{-1})
Years (Y)	1	87.86**	221.04**	897.96**	5.64**	3504.73**	120.80**	138.62**	29.01**	46.50**
Location(L)	3	2434.98**	3522.76**	904.96**	1.16**	144327.8**	330.64**	650.19**	32.65**	405.75**
Y x L	3	6.78	21.90	45.81**	0.82**	190.25**	23.77*	2.00	0.35	0.44
Error	12	2.11	11.19	3.38	0.10	14.00	6.64	1.01	0.51	1.36
Genotypes (G)	8	117.40**	204.59**	824.72**	14.04**	5022.02**	283.76**	503.22**	20.97**	133.60**
G x Y	8	2.16	4.88	16.02	0.02	4.83	2.45	0.17	0.23	0.16
G x L	24	34.78**	47.48**	89.19**	0.54*	43.15	23.07**	13.63**	0.08	0.76
G x Y x L	24	1.60	5.37**	14.57	0.03	3.40	1.84	0.11	0.04	0.02
Errors	132	1.74	2.71	12.73	0.34	114.82	8.83	3.86	0.32	0.99

* and ** indicate significant mean square at 0.05 and 0.01 levels, respectively.

Genotypes respond similarly to year fluctuation and the interaction of year x location. That was reflected in most studied traits especially; grain, biological yields, and yield components.

Mean effects

The effect of years, locations and genotypes on the studied characteristics for the two seasons were presented in Table (4).

Effect of years:

The first season had higher mean values of all studied characters compared to the second season, which might be due to the reduction of the mean of air temperature in the first year compared with the second year. These results were in agreement with those obtained by Talukder *et. al*. (2014)

Effect of location

The first location (Sakha) showed the highest values for all characters, followed by the second location (Sids), while the fourth location showed the lowest values.

Effect of genotypes

Regarding the genotypes means across seasons and locations, line5 was the earliest in the heading, while Giza 126 and Line 4 were the latest. Line6 was the earliest in maturity, while Line4 showed the reverse trend for the same characters and possessed the highest mean values for plant height, spike length, no. of grains .spikes^{-1}**,** 1000-grain weight and biological yield. Also, Line1 recorded the highest mean values for the number of spikes .m^{-2} grain yield. On the other hand, Giza126 was the shortest in plant height and the least in1000-grain weight. Line7 was the least in spike length, number of spikes. m^{-2} and grain yield. Moreover, Giza124 had the least mean values for no. of grains .spikes^{-1} and biological yield.

Mean Performance of genotypes:

Mean performances of the nine genotypes in days to heading were presented in Table (5). The most desirable mean values towards the earliness were exhibited by Line 5 and Line 6 over years and locations. On the other hand, Giza 126, Line 4 and Giza 124 were the latest genotypes (Table 5). Line 6 was the earliest genotype over years and locations; on the other hand, Line 4 had the latest genotype (Table 6). It was valuable to notice that genotypes varied about six days over the studied environments which indicate similarity in heading pattern. Also, only line 4 showed a tendency to delayed maturity.

The maturity of line 4 required (136.3) days in sakha location during the second year, while, line 6 matured after (103.7) days in the new valley at the first season.

The mean values for plant height showed that Giza 126 was the shortest genotype, while Line 4 had the tallest genotype (Table 7). Line 4, Giza 124, Line 3 and Line 1 gave the highest values for plant height. These results are in harmony with those of Farhat (2005), Bagheri and Abad (2007), Samarah *et al*., (2009) and Vaezi *et al*., (2010).

Table 4: **Means of the nine genotypes over years and locations.**

Item	days to heading	days to maturity	plant height (cm)	spike length (cm)	number of spikes m-2	no. of grains spike^{-1}	1000 -grain Weight (g)	grain yield (arddab fad^{-1})	biological yield (ton fad^{-1})
First season	85.7	120.1	95.5	7.0	320.6	62.1	42.2	17.7	6.8
Second season	78.5	110.3	90.3	6.7	297.7	57.7	39.8	16.9	6.9
L.S.D $_{0.05}$	0.36	0.81	0.4	0.1	0.91	0.6	0.2	0.27	0.15
Location									
Sakha	91.0	127.7	101.0	7.3	361.7	65.8	45.5	20.5	7.8
Sids	89.7	125.1	99.0	7.1	353.4	63.6	44.7	20.2	7.7
Elmenia	88.2	122.2	98.6	7.2	334.6	62.1	44.0	17.3	7.0
New valley	76.4	109.5	91.6	7.0	249.0	59.9	37.9	14.7	6.2
L.S.D $_{0.05}$	0.51	1.15	0.6	0.1	1.28	0.9	0.3	0.38	0.22
Genotypes									
Line 1	87.1	123.1	99.5	6.7	347.7	65.0	45.2	21.3	8.1
Line 2	85.6	119.3	93.3	7.3	339.9	63.6	45.0	18.6	7.4
Line 3	86.0	120.7	100.3	7.2	323.7	60.1	47.5	20.2	7.8
Line 4	88.5	127.1	106.1	8.6	304.5	68.5	51.5	20.6	8.6
Line 5	82.4	119.2	93.3	7.2	322.6	63.1	41.5	19.2	7.4
Line 6	83.8	118.0	95.8	7.9	322.4	62.9	40.1	17.2	7.4
Line 7	86.1	118.3	93.1	6.0	307.7	62.0	38.7	16.1	6.1
Giza 126	88.9	123.2	90.4	6.7	316.7	64.5	37.6	18.1	6.4
Giza 124	88.4	121.4	103.9	6.7	336.7	56.1	40.2	16.6	5.8
L.S.D $_{0.05}$	0.8	0.9	2.1	0.3	6.2	1.7	1.1	0.6	0.3

Table 5: Means of days to heading for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	90.0	88.7	88.3	78.3	91.7	90.0	89.3	80.7
Line 2	89.0	87.7	87.3	74.7	90.0	90.3	89.0	76.9
Line 3	89.6	85.0	85.7	80.0	90.7	86.0	88.7	82.4
Line 4	93.3	91.3	90.7	76.3	93.3	93.7	90.3	78.6
Line 5	87.3	84.3	83.7	71.3	89.5	85.0	84.3	73.5
Line 6	86.2	86.7	84.3	76.0	86.8	86.9	85.0	78.3
Line 7	89.3	89.7	86.7	75.0	90.9	90.7	89.4	77.3
Giza 126	94.8	94.5	92.7	72.7	95.3	95.7	90.7	74.8
Giza 124	94.8	93.7	91.7	73.0	96.0	94.0	89.3	75.2
$LSD_{0.05}$				2.1				

Table 6: Means of days to maturity for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	127.5	126.4	123.7	113.0	129.3	125.3	122.7	117.0
Line 2	125.7	123.7	120.7	103.3	129.0	124.3	122.0	106.0
Line 3	123.6	121.0	119.0	114.7	127.3	123.3	119.3	117.7
Line 4	130.2	129.0	127.3	118.0	136.3	132.0	126.5	117.0
Line 5	123.7	121.3	118.3	108.7	126.3	124.7	120.3	110.3
Line 6	123.0	119.7	117.7	103.7	126.7	123.3	119.3	110.8
Line 7	125.5	121.7	120.0	102.7	124.7	124.0	122.0	106.0
Giza 126	129.8	128.3	126.0	105.0	131.7	128.0	126.3	110.7
Giza 124	129.1	128.0	125.0	101.3	130.0	128.7	123.3	105.7
$LSD_{0.05}$				2.7				

Table 7: Means of plant height (cm) for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	102.1	100.1	97.7	91.0	105.2	103.1	102.6	94.6
Line 2	95.5	93.6	91.3	86.0	98.4	96.4	95.9	89.4
Line 3	103.7	101.6	99.2	89.3	106.8	104.7	104.1	92.9
Line 4	109.1	106.9	104.3	96.3	112.4	110.1	109.6	100.2
Line 5	94.1	92.3	90.0	90.0	96.9	95.0	94.5	93.6
Line 6	99.3	97.4	95.0	84.3	102.3	100.3	99.8	87.7
Line 7	92.7	90.9	88.7	93.3	95.5	93.6	93.1	97.1
Giza 126	90.6	88.8	86.7	88.7	93.3	91.5	91.0	92.2
Giza 124	108.7	106.6	104.0	89.7	112.0	109.8	107.6	93.3
$LSD_{0.05}$				5.8				

As for spike length, line 4 and line 6 showed similar tall spikes. The other genotypes were significantly similar in spike length (Table 8).

Concerning the number of spikes.m^{-2}, two genotypes gave high values over environments namely; Line1 and Line2. On the other hand, genotypes Line 4 and Line 7 possessed the least mean values (Table 9).

Regarding grains number.spike^{-1}, the differences among genotypes were highly significant, indicating overall differences in growth potentiality. Over environments, only line and Giza 124 gave significantly lower grains spike^{-1} (Table 10). In Table 11, Line 4 scored the heaviest grains (1000 grains weight) over years and locations. The second rank was occupied by Line 1, 2 and 3 with significantly lower grain weight. These results match true with those reported by EL- Shawy (2008), EL- Seidy *et al*, 2012 EL- Seidy *et al* , 2013, Mansour *et al* , 2016 and EL- Shawky (2018).

The scored data in Table (12) showed that the genotypes exhibited highly significant differences in biological yield. fad^{-1}. Line 4 and Line 1 gave the highest mean values, respectively. Whereas, Giza 124 and Line 7 were the lowest genotypes.

Regarding grain yield .fad^{-1}, mean of the genotypes showed that Line 1and Line 4, respectively gave the highest mean values (Table 13).

Table 8: Means of spike length (cm) for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	6.7	6.5	6.3	6.6	6.8	6.6	6.8	7.0
Line 2	7.5	7.2	7.0	7.0	7.6	7.4	7.6	7.4
Line 3	7.4	7.1	6.9	6.7	7.5	7.2	7.5	7.1
Line 4	8.9	8.6	8.4	7.9	9.0	8.7	9.0	8.4
Line 5	7.4	7.1	7.0	6.7	7.5	7.3	7.5	7.1
Line 6	8.1	7.8	7.6	7.5	8.2	8.0	8.2	8.0
Line 7	5.9	5.7	5.5	6.5	6.0	5.8	6.0	6.9
Giza 126	6.8	6.6	6.4	6.4	6.9	6.7	6.9	6.8
Giza 124	7.0	6.8	6.6	5.6	7.1	6.9	7.9	6.0
LSD $_{0.05}$				1.0				

Table 9: Means of number of spikes .m^{-2} for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	384.8	374.6	354.1	259.0	391.4	382.7	362.4	272.7
Line 2	376.2	367.2	346.8	252.1	381.4	374.0	353.5	268.0
Line 3	356.9	349.2	330.9	241.5	362.6	355.6	337.3	255.8
Line 4	336.6	328.1	309.7	231.2	341.2	334.6	316.7	238.3
Line 5	356.6	347.9	329.1	240.2	362.0	354.9	335.6	254.6
Line 6	356.5	347.5	329.1	239.9	361.8	354.6	335.4	254.2
Line 7	340.2	331.9	313.9	229.1	345.3	338.5	320.2	242.8
Giza 126	350.8	342.2	323.6	236.2	356.0	344.3	330.1	250.4
Giza 124	372.2	363.2	343.5	250.7	377.8	370.4	350.4	265.7
LSD $_{0.05}$				17.5				

Table 10: Means of the number of grains .spike^{-1} for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	67.2	65.0	64.2	60.0	67.7	66.7	65.9	63.6
Line 2	66.5	63.0	60.0	62.5	65.3	64.0	61.4	66.3
Line 3	63.0	59.0	58.0	56.1	62.9	60.4	59.6	61.5
Line 4	69.7	69.3	66.5	65.3	71.0	70.0	68.0	68.0
Line 5	64.6	62.0	63.3	59.3	65.7	62.3	65.1	62.8
Line 6	66.6	63.0	61.0	58.0	67.3	63.3	62.8	61.4
Line 7	63.6	62.7	61.3	58.5	63.7	62.9	61.4	62.0
Giza 126	69.7	66.7	62.7	54.5	70.3	69.0	65.7	57.6
Giza 124	59.7	57.0	57.4	49.8	60.2	58.7	54.1	51.6
LSD $_{0.05}$					4.8			

Table 11: Means of 1000-grain weight (g) for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	46.8	45.9	44.7	40.3	48.2	47.2	47.0	41.5
Line 2	47.7	46.7	45.6	36.9	49.1	48.1	47.9	38.1
Line 3	48.8	47.8	46.7	42.7	50.3	49.3	49.0	45.3
Line 4	54.3	53.2	51.9	43.0	55.9	54.8	54.5	44.4
Line 5	44.0	43.2	42.1	33.6	45.3	44.4	44.2	34.9
Line 6	41.3	40.5	39.5	36.2	42.6	41.7	41.5	37.4
Line 7	40.4	39.6	38.6	33.5	41.6	40.8	40.5	35.1
Giza 126	38.1	37.4	36.5	35.1	39.3	38.5	38.3	37.2
Giza 124	42.5	41.7	40.7	32.7	43.8	42.9	42.7	34.4
$LSD_{0.05}$				3.2				

Table 12: Means of biological yield (ton/feddan) for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Seds	Elmenia	New valley	Sakha	Seds	Elmenia	New valley
Line 1	8.3	8.3	7.4	6.6	9.2	9.0	8.4	7.3
Line 2	7.4	7.4	6.8	6.1	8.4	8.3	7.7	6.7
Line 3	8.2	8.3	7.1	6.4	8.9	8.7	8.1	7.1
Line 4	8.9	8.9	7.7	7.0	9.8	9.6	9.1	7.8
Line 5	7.5	7.6	6.6	6.0	8.9	8.7	7.6	6.6
Line 6	7.2	7.2	6.3	5.7	8.0	7.9	7.2	6.2
Line 7	6.5	6.5	5.5	4.9	6.8	6.7	6.2	5.4
Giza 126	6.9	6.8	5.8	5.2	7.2	7.1	6.6	5.8
Giza 124	6.0	5.9	5.3	4.8	6.6	6.5	6.1	5.3
$LSD_{0.05}$					0.9			

Table 13: Means of grain yield (ardab/faddan) for the nine studied genotypes in four locations during 2016/2017 and 2017/2018 seasons.

Genotypes	First season				Second season			
	Sakha	Sids	Elmenia	New valley	Sakha	Sids	Elmenia	New valley
Line 1	23.5	23.1	19.8	16.8	24.6	24.2	20.8	17.7
Line 2	20.5	20.1	17.3	14.7	21.5	21.1	18.2	15.4
Line 3	22.2	21.8	18.8	15.9	23.3	22.9	19.7	16.7
Line 4	22.6	22.2	19.1	16.2	23.9	23.5	20.1	17.0
Line 5	21.0	20.6	17.7	15.1	22.6	22.2	18.6	15.8
Line 6	18.7	18.4	17.1	13.4	19.7	19.4	16.6	14.1
Line 7	17.9	17.0	17.3	12.4	18.2	17.8	15.3	13.0
Giza 126	19.9	17.3	19.5	15.4	18.4	20.1	18.6	16.0
Giza 124	18.7	16.1	18.5	13.1	17.2	18.2	17.9	13.3
$LSD_{0.05}$				1.6				

CONCLUSION

The genotypes Line 1, Line 4, and Line 3 gave the highest values for grain yield compared with the other genotypes, which would be used as new cultivars or as a source in a breeding program for high yielding.

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الملخص العربى

إستجابة تراكيب وراثية من الشعير لبيئات مختلفة فى مصر

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يهدف هذا البحث إلى تقييم تسعة تراكيب وراثية من الشعير في مواقع مختلفة لتقييم أداءها نحو الاجهاد الحرارى. حيث يعتبر إنتاج تراكيب وراثية جديدة متأقلمة تحت الاجهاد الحرارى هو واحد من أهم أهداف برامج التربية. تم اختبار هذة التراكيب الوراثية فى اربعة مواقع مختلفة متباينة فى درجات الحرارة، وهى: سخا، سدس، المنيا والوادى الجديد. وقد أجريت التجارب الحقلية فى المحطات البحثية لهذة المواقع خلال موسمى(٢٠١٦-٢٠١٧ و٢٠١٧-٢٠١٨).

اظهر تحليل التباين معنوية عالية لكل من المواقع والتراكيب الوراثية والسنوات لمعظم الصفات المدروسة. وقد أظهرت النتائج ان أفضل التراكيب الوراثية هى السلالة ١، السلالة٤ والسلالة٣ حيث اعطت القيم الاعلى بالنسبة لصفة محصول الحبوب بالمقارنة بالتراكيب الوراثية الاخرى. بينما السلالات ٦ و٧ والصنف جيزة١٢٤ كانت الاقل. وبناء على النتائج السابقة فإنه يمكن استخدام السلالات المتفوقة كنواه لاصناف جديدة تحت هذه الظروف او استخدامها فى برنامج التربية كمصدر جيد للمحصول العالى تحت ظروف الاجهاد الحرارى.