Annals of Agric. Sci., Moshtohor ISSN 1110-0419
Vol. 60(1) (2022), 25 – 37 https://assjm.journals.ekb.eg

Estimation of Combining Ability In 10x10 Diallel Crosses Of Bread Wheat Grown Under Normal Irrigation and Salinity Stress Treatment for Some Morphological Physiological Traits

Wafaa M. Ali, M.EL.M. EL-Badawy, A.M. Morsy and A.A.A. El Hosary
Agronomy.Dep, Fac. of Agric, Moshtohor, Egypt

Abstract

A10x10 half diallel cross were made in 2018/2019 season. Each of parents and their 45 F_1 crosses were evaluated under two locations (Ras Sudr and Moshtohor) during 2019/2020 season for some physiological traits. Highly significant genotypes, for genotype and its partitioning (parent, crosses and Parent *vs* crosses) and both types of combining ability mean squares (MS) were obtained for all studied traits under salinity stress , normal and across locations. Meanwhile, significant G x L, parent x L and cross x L were significant for all studied trails except peduncle leaf. Interaction between GCA or SCA and location MS were significant for all studied traits. the ratio between GCA/ SCA were more than unity for all traits except, flag leaf angle in salinity stress, normal condition and combined analysis, as well as relative water content in normal condition and combined analysis. P_2 (Shandwel 1) exhibited significant positive ĝi effects for flag leaf area ,peduncle leaf and relative water content in both and cross location and total chlorophyll in Ras-sudr location ,indicating that (Shandwel 1)could be considered as a good combiner for this trails. The most desirable inter and intra allelic interactions were presented by P_3 x P_4 for flag leaf angle, P_3 x P_{10} for flag leaf area; P_7 x P_8 for peduncle leaf; P_1 x P_{10} for relative water content and P_2 x P_5 for total chlorophyll exhibited significant positive $\hat{S}_{ij}$ effects.

Key words*: combining ability, drought stress, GCA, heterosis, ,SCA and Wheat*

Introduction

Salinity stress is one of the major factors responsible for less yield and restricting economic utilization of land resources both in arid and semi-arid regions of the World (El Ameen *et al*. 2020). Also, Salinity stress is a major environmental challenge that limits the productivity of crop production worldwide (Oyiga *et al*.2016). More than 800 Mha of land are affected by salinity, which is equivalent to more than 6% often world’s total land (Mickelbart *et al.*2005). Hence, efforts to improve the salt tolerance of plants are of immense importance for sustainable agriculture and may also significantly improve crop yield (Goyal *et al.*2016)

The diallel cross designs are frequently used in plant breeding research to obtain information about genetic properties of parental lines or estimates of general (GCA), specific (SCA) combining ability and heritability **(Baker, 1978; EL- Maghraby *et al*., 2005; Iqbal *et al.*, 2007, Afiah *et al*. 2019 and El-Fahdawy *et al.* 2019)**. In addition, the diallel cross technique was reported to provide early information on the genetic behavior of these attributes in the first generation **(Chowdhry *et al.*, 1992; Topal *et al*., 2004 and El-Hosary *et al*. 2019 a).** Diallel analysis technique is the choice of providing such detailed genetic information for selecting breeding materials that show great promise for success **(Lonnquit and Gardner, 1961)**.

Combining ability describes the breeding value of parental lines to produce hybrids. GCA refers to the average performance of a parent in hybrid combinations and SCA is the performance of a parent relatively better or worse than expected on the basis of the average performance of the other parents involved **(Sprague and Tatum, 1942; and Griffing, 1956)**. Combining ability analysis helps in the identification of parents with high GCA and parental combinations with high SCA. Based on combining ability analysis of different characters, higher SCA values refer to dominance gene effects and higher GCA effects indicate a greater role of additive gene effects controlling the characters. If both the GCA and SCA values are not significant, epistatic gene effects may play an important role in the genetic of characters **Sprague and Tatum, (1942), Hussain *et al*. (2020) and El-Safy et al. (2020).**

The estimation of additive and non-additive gene action through this technique could be useful in determining the possibility of commercial exploitation of heterosis and isolation of pure lines among the progenies of the desirable hybrids **(Stuber, 1994)**. The diallel genetic design and its various modifications have been used by breeders to estimate the potential of populations for intrapopulational improvement and the usefulness of parents in interpopulational breeding programs, and to select inbred lines in hybrid development programs. The best-known methods for diallelic analysis are those developed by **(Hayman, 1954)**, both exclusively for homozygous parents, that by **(Griffing, 1956)**, for circulate diallel cross, that by **(Gardner and Eberhart, 1966)**, of these, the Griffing and Gardner and Eberhart methods are doubtless the most frequently applied.

The main objectives of the present investigation were to: induce genetic variability by hybridization, evaluation and selection for the best genotypes of wheat compared with the parents under Moshtohor (Normal water irrigation) and Ras Suder (Saline water irrigation) for important morphological characters.

Materials and Methods

This investigation was carried out at two locations the first one was Ras-suder .Desert Research Center (DRC) and the second location was Moshtohor, Faculty of Agriculture, Banha University during the two successive seasons 2017/2018 and 2018/2019. The mechanical and chemical analysis of the two studied experimental soils at Ras Suder .Agricultural Experiment Farm and Moshtohor Research station are in tables (1 and 2). Ten genotypes of bread wheat were used in this study. These parent were selected on bases of yield ability and of desirable plant aspects. The plant materials were selected with wide range of diversity for several trails. The names, source and pedigree of these materials are presented in table 3.

In 2017/2018 growing season, grain from each of the parental varieties or lines were sown at two various planting dates in order to overcome the differences in time of flowering. During this season, all parental combinations without reciprocal were made among the ten parents giving a total of forty-five F_1 crosses.

Field experiments

In 2018/2019 the ten parents and their forty-five possible F_1 crosses were sown on 24th Nov.2019 at the first location (Ras Sudr) and 25th Nov .2019 at the second location (Moshtohor Faculty of Agriculture) .The first experiment represented saline soil using saline irrigation water Table 1 and 2, and the second one was under-normal condition .

Each experiment was designed in a randomized complete block design with three replications .Each plot consisted of one row ,three meters long with 20 cm between rows and plants within row 15 cm apart allowing a total of 20 plant per plot.

Each of Flag leaf angle, Flag leaf area (cm^2), Peduncle leaf,

(Relative water content (R.W.C) and total chlorophyll content measured by)(chlorophyll meter SPAD520), **(Barrs and Weatherly 1962)**were recorded as mean of five individual guarded plants/plot chosen at random from each genotype in each experiment.

Table 1. Mechanical properties of the soil in the experimental farm of Ras Sudr and moshtohor Agricultural Research Stations analysis.

Depth (cm)	Coarse Sand%	Fine sand %	Silt %	Clay %	Texture
Ras Sudr Agricultural Research Station					
O_15	22.6	45.49	16.48	15.33	Sandy loam
15_30	35.20	28.40	18.96	17.10	Sandy loam
Moshtohor Agricultural Research Station					
O_15	7.26	26.91	13.85	51.98	Clay
15_30	6.59	27.64	12.60	53.17	Clay

Table 2. Soil chemical analysis of the soil in the experimental farm of Ras Sudr and moshtohor Agricultural Research Stations analysis and water analysis of Ras Sudr station**.**

Depth (cm)	pH	E.Ce.ds/m	Caco3	Soluble castion(mg/100g)				Soluble anions(mg/100g)			
				Na+	Ca++	Mg+	K+	co3-	Hco3	Cl-	SO4--
Ras Sudr Agricultural Research Station											
0-15	7.39	8.54	45.62	48.04	21.21	10.86	5.62	…….	10.85	43.8	25.2
15-30	7.71	7.84	48.34	43.24	15.19	10.80	6.23	……	11.6	44.95	19.8
Moshtohor Agricultural Research Station											
0-15	7.8	0.18	2.3	0.81	0.9	0.23	0.16	……	1.25	0.57	2.58
15-30	7.6	2.00	3.30	0.77	0.9	0.28	0.21	…….	1.25	0.61	3.6
Water analysis in Ras Sudr Agricultural Research Station											
Ras - sudr	7.3	4.01	---	22.1	9.1	7.3	0.5		11.1	19.7	8.2

Table 3. The name pedigree and source of the parental varieties and lines.

NO	Entry name	Source	Pedigree
1	Gemiza 11	Egypt	BOW"S"/KVZ"S"//7C/SER182/3/GIZA 168/SAKHA61. GM7892-2GM-1GM-2GM-1GM-0GM
2	Shandwel 1	Egypt	Site / Mo /4/ Nac / Th.Ac // 3* Pvn /3/ Mirlo / Buc CMSS93B00567S-72Y-010M-010Y-010M-3Y-0M-0THY-0SH
3	G 168	Egypt	MIL/BUC//Seri CM93046-8M-0Y-0M-2Y-0B
4	Sakha 93	Egypt	S 92/TR 810328 S8871-1S-2S-1S-0S
5	Gemiza 12	Egypt	OTUS/3/SARA/THB//VEE (CMSS97YOO227 S-5Y-010M-010Y-010M-2Y – 1M-0Y- OGM)
6	Misr 1	Egypt	OASIS / SKAUZ // 4*BCN /3/ 2*PASTOR CMSS00Y01881T-050M-030Y-030M-030WGY-33M-0Y-0S
7	L 125	CIMMYT	MILAN \ S87125 \\ BABAX
8	L 137	CIMMYT	MILAN \ S7137\\ Hall //(Ne700011)
9	Bulk37_8	Egypt	
10	Bread43	Egypt	

Statistical analysis:

The data of the two experiments were subjected to proper statistical analysis of variance according to **Snedecor and Cochran (1967)**. The effects of genotypes were assumed to be fixed; a one tail was used to test the significance of difference sources of variation. When the differences between genotypes reached the significant level, further appropriate analysis was carried out. Combined analysis of the two experiments was carried out whenever homogeneity of variance was detected. The combined analysis was conducted for the data of the two experiments according to **Cochran and Cox (1957).** Heterosis relative to mid and better parents were also determined for individual crosses according to **Paschal and Wilcox (1975)**

General and specific combining ability estimates (GCA and SCA) were obtained by employing Griffing's diallel cross analysis **(1956)** designated as method 2 model I.

Results And Discussion

The analysis of variance for all studied traits under salinity (location 1) and normal irrigation (location 2) and, across locations is presented in Table 4. Mean squares for location were significant for mention traits revealing that, there was difference between the studied locations.

Highly significant genotypes mean squares were obtained for all morphological and physiological studied traits under both and cross locations. These results indicate that genetic diversity among parents were found. Meanwhile, genotypes x location mean squares were significant for mention traits except, peduncle leaf revealing that the behavior of genotypes response defiantly from one location to another. However, genotypes x location mean squares were in-significant for peduncle leaf indicating that this genotype responds similarly the two types of water supplies (salinity and normal irrigation).

Results in Table 4 indicate that mean squares due to parents were significant for all studied traits under both and across locations. These results indicate wide diversity among studied parents.

Crosses mean squares were significant for physiological traits, its indicating wide diversity among crosses. Meanwhile, significant
genotype x L, parents x L and crosses x L were significant for all studied trails except, peduncle leaf, indicating that, these genotypes behaved somewhat differently from location to another. For the other traits, insignificant interactions were obtained, reflecting that these genotypes responded similarly to locations changes.

Table (4): Mean squares for flag leaf angle, flag leaf area and peduncle leaf R. W.C, total chlorophyll and peduncle leaf at both and cross location

S.O.V.	**d.f.**	**Flag leaf angle (°)**	**Flag leaf area (cm^2)**	**Peduncle leaf(cm^2)**	**Relative Water Content**	**Total chlorophyll (spad)**
L1 (Ras sidr)						
Rep/L	2	2.78	2.84	15.21**	1.13	5.56
Genotypes (G)	54	44.62**	89.46**	13.24**	229.60**	14.04**
Parent (Par.)	9	49.54**	29.94**	16.56**	395.43**	27.39**
Cross (Cr.)	44	44.62**	103.44**	12.86**	195.88**	11.40**
Par.vs.cr.	1	0.11	10.31	0.02	220.54**	10.17
Error	108	4.05	2.88	2.6	5.63	4.68
GCA	9	14.67**	69.61**	8.54**	82.35**	10.77**
SCA	45	14.91**	21.86**	3.59**	75.37**	3.46**
Error	108	1.35	0.96	0.87	1.88	1.56
GCA/SCA		0.98	3.18	2.38	1.09	3.11
L2 (moshtohor)						
Rep/L	2	5.83	7.24	0.85	1.29	0.79
Genotypes (G)	54	36.94**	98.27**	15.81**	208.29**	24.25**
Parent (Par.)	9	13.36**	23.67**	18.30**	108.08**	20.25**
Cross (Cr.)	44	42.44**	115.02**	15.65**	233.18**	25.23**
Par.vs.cr.	1	7.3	32.54**	0.25	15.17	17.05
Error	108	3.12	3.99	3.77	3.92	6.27
GCA	9	11.93**	70.22**	11.94**	44.81**	9.09**
SCA	45	12.39**	25.26**	3.93**	74.36**	7.88**
Error	108	1.04	1.33	1.26	1.31	2.09
GCA/SCA		0.96	2.78	3.04	0.6	1.15
Comb and cross location						
Location (L)	1	670.02*	1237.95*	174.87*	51.06*	5580.97*
Rep/L	4	4.31	5.04	8.03*	1.21	3.18
Genotypes (G)	54	59.25**	181.64**	25.61**	221.41**	19.33**
Parent (Par.)	9	28.49**	49.63**	33.50**	204.78**	21.51**
Cross (Cr.)	44	66.83**	211.87**	24.57**	225.85**	18.72**
Par.vs.cr.	1	2.82	39.74*	0.22	175.69*	26.77*
G x L	54	22.31**	6.09**	3.44	216.48**	18.96**
par. x L	9	34.41**	3.98	1.36	298.74**	26.14**
Cr. x L	44	20.24**	6.58**	3.94	203.21**	17.91**
Par.vs.cr. x L	1	4.59	3.11	0.06	60.02*	0.44
Error	216	3.58	3.43	3.19	4.78	5.48
GCA	9	16.30**	138.48**	18.95**	61.95**	11.53**
SCA	45	20.44**	44.96**	6.45**	76.17**	5.43**
GCA x L	9	10.30**	1.35	1.53	65.20**	8.33**
SCA x L	45	6.86**	2.17**	1.07	73.55**	5.92**
Error	216	1.19	1.14	1.06	1.59	1.83
GCA/SCA		0.8	3.08	2.94	0.81	2.12
GCA x L/GCA		0.63	0.01	0.08	1.05	0.72
SCA x L/SCA		0.34	0.05	0.17	0.97	1.09

*,** L1 and L2 refer to, significant at 0.5 , 0.01 levels of probability,Rassidr location and Moshtohor, respectively

The mean performances of the ten parental varieties or lines and parental combinations are presented in Table 5.

It is clear that crosses p_7 x p_{10} , p_1 x p_7 ,p_3 x p_4 and p_4 x p_5 behave as the Eric leaf of plant , when it had the lowest mean values for flag leaf area .These crosses may be used to increase the density of plants per unit area .

For leaf area, the crosses p_2 x p_6 , p_2 x p_4 ,p_2 x p_5, p_2 x p_8 and p_3 xp_{10} gave the highest values for this trait .

For peduncle leaf , the three parental No p_{10} (Bread 43) ,p_3 (G168) and p_4(Saka 93) and the nine crosses p_2 x p_5 , p_2 x p_6 ,p_4 x p_8, p_4x p_9 , p_4 x p_{10} p_6 x p_9 , p_6 x p_{10} ,p_7 x $p_8$and p_7 x p_{10} had the highest mean values in the combined analysis. The crosses p_1 x p_9 , p_1 x p_4 and p_1 x p_6 showed the lowest mean values for this trait .

Concerning to R.W.C the three crosses p_1 x p_3 , p_1 x p_{10} and p_2 x p_3
had the highest mean values .These hybrids were the highest tolerance to stress condition .However, the parent p_{10} (Bread 34)gave the lowest one.

For total chlorophyll content, the three crosses p_1 x p_6 , p_1x p_7 and p_8 x p_{10} gave the highest values . Also the parents p_6 , p_7, p_8 ,and p_{10} and the crosses p_1 x p_5 , p_1 x p_8 ,p_1 x p_4, p_1 x p_{10} , p_2 x p_4 , p_3 x p_6 , p_4x p_6 ,p_4 x p_8, p_4x p_{10} ,p_5 x p_6 , p_5 x p_7 , p_5 x p_{10} ,p_6 x p_7, p_6x p_8 and p_9 x p_{10} gave the highest values without significant than the highest mean value of cross p_8 x p_{10} (52.87).The cross p_1 x p_4 gave the lowest one.

Combining ability:

Analysis of variance for combining ability at each location and combined data for all studied traits are shown in Table 4. Mean squares of both GCA and SCA were significant for all studied traits in salinity stress (Rassidr location) and normal (Moshotohor location) as well as combined across locations. However, the ratio between GCA/ SCA were more than unity for all traits except flag leaf angle in both and cross locations, relative water content in normal condition and combined cross locations.

Mean squares due to the interaction between GCA or SCA and locations were significant for all traits, indicating that the magnitude of additive and additive by additive and non-additive types of gene action varied from one location to another. On the contrary, insignificant mean squares due to the interaction between GCA and locations were detected for leaf area and peduncle leaf indicating that additive and additive x additive types of gene action was more stable for both traits. **El-Shal (2011) , Zare-kohan and Heidari (2012), Farshadfar *et al.* (2013)and Gomaa *et al.* (2014)**.

The interaction between SCA and locations were significant for flag leaf angle, flag leaf area, relative water content, and total chlorophyll indicating that (non-additive types of) gene action varied from location to another**.** Insignificant mean squares due to the interaction between SCA and location were detected for peduncle leaf indicating that non additive type of gene action for this trait was more stable in different location.

The ratio between GCA x location /GCA was much higher than that of SCA x location /SCA for flag leaf angle and relative water content, indicating that additive effects were much more influenced by location than non-additive genetic one. For the exceptional cases, the ratio between

SCA x L /SCA was much higher than of GCA x L/GCA indicating that non additive type of gene action were more influenced than additive effects. Such results are in harmony with those obtained by **Gilbert (1958).**

Table 5. Mean performance for flag leaf angle, flag leaf area and peduncle leaf R. W.C, total chlorophyll and peduncle leaf at both and cross locations

	Flag leaf angle(°)			**Flag leaf area(cm^2)**			**Peduncle leaf(cm^2)**		
Genotype	**L1**	**L2**	**Comb.**	**L1**	**L2**	**Comb.**	**L1**	**L2**	**Comb.**
P1 (Gemiza 11)	33.43	31.57	32.50	54.18	58.71	56.45	9.83	11.73	10.78
P2 (Shandwel1)	32.17	33.33	32.75	59.11	62.38	60.75	13.17	13.53	13.35
P3 (G 168)	35.00	37.43	36.22	52.66	56.90	54.78	13.17	16.63	14.90
P4 (Sakha 93)	35.33	35.53	35.43	51.88	55.17	53.52	12.83	13.33	13.08
P5 (Gemiza 12)	30.17	32.87	31.52	60.20	60.83	60.51	11.33	13.73	12.53
P69(Misr 1)	25.00	36.73	30.87	52.31	58.44	55.37	9.80	11.40	10.60
P7 (L 125)	24.00	36.37	30.18	53.50	56.62	55.06	10.67	11.40	11.03
P8 (L 137)	34.87	37.43	36.15	51.57	56.25	53.91	10.23	11.63	10.93
P9 (Bulk37_8)	32.67	33.07	32.87	56.64	60.18	58.41	16.17	17.10	16.63
P10 (Bread43)	33.67	35.47	34.57	51.89	53.07	52.48	15.87	17.70	16.78
1x2	32.67	37.73	35.20	52.81	54.53	53.67	12.33	10.77	11.55
1x3	34.83	35.37	35.10	52.55	55.18	53.86	11.73	12.49	12.11
1x4	36.56	33.90	35.23	51.81	54.88	53.34	10.00	9.63	9.82
1x5	35.83	26.97	31.40	53.60	56.67	55.13	10.00	10.37	10.18
1x6	33.66	37.76	35.71	41.71	48.19	44.95	9.55	10.30	9.93
1x7	24.17	25.63	24.90	44.20	46.29	45.25	9.50	11.20	10.35
1x8	34.33	38.20	36.27	43.13	44.62	43.88	9.83	11.30	10.57

Genotype	Flag leaf angle(°) L1	L2	Comb.	Flag leaf area(cm^2) L1	L2	Comb.	Peduncle leaf(cm^2) L1	L2	Comb.
1x9	25.47	28.27	26.87	55.21	58.87	57.04	8.47	10.60	9.53
1x10	32.33	32.67	32.50	56.61	59.72	58.17	10.10	16.30	13.20
2x3	36.00	37.77	36.88	61.78	63.81	62.80	13.00	13.60	13.30
2x4	34.83	36.77	35.80	63.39	69.44	66.42	13.00	14.80	13.90
2x5	34.00	37.33	35.67	63.65	67.16	65.40	16.33	17.30	16.82
2x6	36.10	34.63	35.37	64.16	70.35	67.25	15.53	16.57	16.05
2x7	31.67	36.77	34.22	65.55	65.52	65.53	12.17	12.53	12.35
2x8	30.50	31.17	30.83	62.17	69.49	65.83	12.43	12.93	12.68
2x9	32.00	29.10	30.55	61.76	64.81	63.29	14.50	16.20	15.35
2x10	30.50	37.43	33.97	53.03	56.12	54.57	13.00	16.87	14.93
3x4	24.00	28.20	26.10	51.88	57.12	54.50	12.67	11.30	11.98
3x5	35.83	37.77	36.80	55.12	60.81	57.96	11.83	14.40	13.12
3x6	24.33	32.23	28.28	52.50	53.77	53.14	11.23	12.30	11.77
3x7	36.00	36.20	36.10	51.57	59.58	55.58	15.50	12.83	14.17
3x8	33.50	37.43	35.47	55.33	60.81	58.07	10.83	13.20	12.02
3x9	29.67	34.63	32.15	58.37	64.30	61.33	12.67	13.43	13.05
3x10	35.67	36.73	36.20	62.58	69.13	65.86	10.63	11.20	10.92
4x5	24.83	35.53	30.18	54.50	55.56	55.03	14.17	16.20	15.18
4x6	34.30	34.53	34.42	53.31	58.71	56.01	12.37	13.60	12.98
4x7	31.67	34.97	33.32	46.57	51.82	49.19	10.83	13.43	12.13
4x8	32.17	32.00	32.08	61.63	63.03	62.33	16.33	17.30	16.82
4x9	35.83	36.93	36.38	56.75	64.78	60.77	15.00	17.10	16.05
4x10	29.83	31.60	30.72	55.49	59.03	57.26	13.50	16.87	15.18
5x6	31.00	38.30	34.65	61.76	62.78	62.27	13.17	13.63	13.40
5x7	31.87	39.00	35.43	51.86	53.85	52.86	12.70	13.10	12.90
5x8	31.67	35.60	33.63	57.87	63.00	60.43	11.60	15.47	13.53
5x9	26.67	26.37	26.52	56.89	59.44	58.16	12.17	16.07	14.12
5x10	30.50	36.97	33.73	53.08	60.41	56.75	11.70	15.73	13.72
6x7	34.50	34.43	34.47	53.29	58.23	55.76	11.23	11.70	11.47
6x8	34.17	36.53	35.35	51.56	52.56	52.06	12.17	12.63	12.40
6x9	25.03	36.07	30.55	59.40	62.78	61.09	13.47	14.87	14.17
6x10	26.67	34.50	30.58	42.29	46.73	44.51	15.17	15.30	15.23
7x8	35.83	35.70	35.77	57.60	62.83	60.21	16.13	16.63	16.38
7x9	33.33	32.87	33.10	51.87	58.33	55.10	9.50	12.30	10.90
7x10	24.00	24.87	24.43	60.88	63.19	62.04	14.00	17.20	15.60
8x9	32.67	36.60	34.63	53.88	57.93	55.90	8.50	11.87	10.18
8x10	32.17	37.93	35.05	50.76	53.73	52.24	10.83	11.60	11.22
9x10	33.17	37.60	35.38	51.15	55.42	53.28	11.00	12.30	11.65
LSD 5%	3.22	2.83	3.03	2.71	3.20	2.96	2.58	3.11	2.86
LSD 1%	4.22	3.70	3.97	3.56	4.19	3.89	3.39	4.07	3.75

Table (5): Cont.

Genotype	Relative water content L1	L2	Comb.	Total chlorophyll L1	L2	Comb.
P1 (Gemiza 11)	82.59	61.78	72.19	56.33	39.87	48.10
P2 (Shandwel1)	77.39	72.13	74.76	55.23	41.50	48.37
P3 (G 168)	73.12	65.27	69.20	51.30	45.30	48.30
P4 (Sakha 93)	80.18	64.02	72.10	49.27	42.50	45.88
P5 (Gemiza 12)	62.76	74.49	68.63	47.87	42.70	45.28
P6 (Misr 1)	62.18	77.08	69.63	55.70	44.57	50.13
P7 (L125)	72.79	75.48	74.14	54.83	48.07	51.45
P8 (L 137)	72.94	78.95	75.94	54.63	45.53	50.08
P9 (Bulk37_8)	66.56	66.71	66.63	49.97	46.23	48.10
P10 (Bread43)	43.13	67.95	55.54	51.87	46.93	49.40
1x2	73.06	62.84	67.95	55.73	41.53	48.63
1x3	80.72	82.78	81.75	50.37	45.80	48.08
1x4	72.28	82.75	77.52	45.80	41.93	43.87

Genotype	Relative water content L1	L2	Comb.	Total chlorophyll L1	L2	Comb.
1x5	85.82	55.85	70.83	52.40	48.40	50.40
1x6	67.87	65.86	66.86	55.87	48.27	52.07
1x7	58.18	65.14	61.66	57.47	47.53	52.50
1x8	75.99	70.95	73.47	51.23	52.73	51.98
1x9	64.41	82.18	73.30	54.10	46.53	50.32
1x10	84.36	80.77	82.57	53.77	47.33	50.55
2x3	83.88	85.93	84.90	54.50	45.60	50.05
2x4	83.86	71.86	77.86	52.80	40.87	46.83
2x5	76.96	62.02	69.49	53.57	49.53	51.55
2x6	74.03	67.33	70.68	55.33	42.23	48.78
2x7	66.20	67.55	66.87	53.33	41.73	47.53
2x8	77.86	74.20	76.03	53.97	45.30	49.63
2x9	76.27	81.97	79.12	54.63	40.83	47.73
2x10	77.25	75.20	76.23	54.37	43.57	48.97
3x4	72.96	62.01	67.49	51.57	46.60	49.08
3x5	66.99	66.71	66.85	53.63	44.13	48.88
3x6	64.95	83.68	74.31	53.57	48.57	51.07
3x7	66.65	47.95	57.30	52.23	42.77	47.50
3x8	62.11	86.85	74.48	53.33	44.50	48.92
3x9	83.16	66.31	74.73	52.10	42.47	47.28
3x10	75.53	73.05	74.29	53.00	43.73	48.37
4x5	64.76	70.63	67.69	53.50	41.60	47.55
4x6	64.14	63.27	63.70	54.73	47.33	51.03
4x7	61.36	64.70	63.03	51.70	44.37	48.03
4x8	74.51	52.46	63.49	52.73	46.67	49.70
4x9	74.55	72.28	73.41	51.93	45.53	48.73
4x10	75.80	61.82	68.81	51.43	47.57	49.50
5x6	61.48	73.32	67.40	54.40	47.40	50.90
5x7	63.79	68.33	66.06	53.17	45.07	49.12
5x8	67.02	67.26	67.14	50.10	44.20	47.15
5x9	56.74	71.50	64.12	53.73	39.47	46.60
5x10	79.40	77.15	78.27	54.23	48.13	51.18
6x7	86.22	71.46	78.84	52.57	49.10	50.83
6x8	79.09	63.17	71.13	54.27	46.23	50.25
6x9	81.87	71.38	76.63	54.03	41.13	47.58
6x10	78.03	70.98	74.51	55.43	42.63	49.03
7x8	72.60	83.82	78.21	51.37	45.03	48.20
7x9	71.14	84.10	77.62	54.10	44.97	49.53
7x10	72.70	73.09	72.89	55.77	41.93	48.85
8x9	76.39	75.36	75.88	53.53	44.13	48.83
8x10	66.53	73.28	69.91	56.60	49.13	52.87
9x10	56.81	71.70	64.26	52.47	47.77	50.12
LSD 5%	3.80	3.17	3.50	3.46	4.01	3.75
LSD 1%	4.98	4.15	4.59	4.54	5.26	4.91

L1 and L2 refer to Rassidr location and Moshtohor location respectivel

General combining ability effects (ĝi):

Estimates of ĝi effects for individual parental genotypes for each treat in both and cross locations are presented in Table 6.General combining ability effects estimated herein were found to differ significantly from zero. The obtained high positive values for all traits in question except leaf angle would be useful from the breeder's point of view.

The parental P1(Gemiza 11)had significant positive ĝi effect for flag leaf area in both locations as well as combined analysis while R.W.C in first location (R.S)and the cross location for R.W.C and significant negative ĝi effect for relative water content and significant negative ĝi effect for leaf angle ,However ,it gave undesirable ĝi effects for other cases.

The parental P_2(Shandwel 1) exhibited significant positive ĝi effects for flag leaf area ,peduncle leaf and relative water content in both and cross locations and total chlorophyll in the first location ,indicating that (Shandwel 1)could be considered as a good combiner for this trails. However, it gave undesirable ĝi effect for other cases.

The parental P_3(G 168) showed significant positive ĝi effects for flag leaf area in the second location (Moshtoher) and the combined analysis and it poor combiner for other traits.

The parental P_4(Sakha 93) show significant positive ĝi effects for peduncle leaf of the first location (R.S) and the combined analysis and RWC in first location. While ,it gave undesirable (ĝi) effect for other cases.

The parental P_5(Gemiza 12) considered best combiner for flag leaf area in both and cross locations and peduncle leaf at the second location .However, it gave undesirable(ĝi) effect for other location.

The parental P_6 (Misr 1) and p_7 (L 125) were considered the best combiner for flag leaf angle in both and cross locations.Therefore , this parent could be considered a good combiner for flag leaf angle of wheat .

The parental P_8 (L 137) exhibited significant positive (ĝi) effect for RWC and total chlorophyll in the second location .Meanwhile, it gave undesirable (ĝi) effect for other cases.

The parental P_9 (Bulk37_8) showed significant desirable (ĝi) effect for flag leaf area and flag leaf angle in both and cross locations RWC and total chlorophyll in the second location .Meanwhile, it gave insignificant (ĝi) effect for other cases.

The Parental variety P_{10} (Bread43) expressed significant positive (ĝi) for peduncle leaf in both and cross locations RWC and total chlorophyll in the second location .This parent was consider a good combiner for this case . Such results are in harmony with those obtained by **Yildirim and Bahar (2010)**

Table 6. General combining effects for flag leaf angle and flag leaf area and peduncle leaf RWC and Total chlorophyll at both and cross locations.

parent	Flag leaf angle(°)			Flag leaf area (cm²)			Peduncle leaf (cm²)			Relative water content			Total chlorophyll		
	L1	L2	Comb	L1	L2	Comb	L1	L2	Comb	L1	L2	Comb	L1	L2	Comb
g1 (Gemiza 11)	0.68*	-1.69**	-0.50	-3.68**	-4.20**	-3.94**	-1.99**	-2.06**	-2.02**	3.16**	-0.72*	1.22**	0.33	0.40	0.36
g2 (Shandwel1)	1.17**	0.46	0.82**	5.20**	4.94**	5.07**	1.13**	0.63*	0.88**	4.51**	0.98**	2.75**	1.10**	-1.74**	-0.32
g3(G 168)	0.94**	0.94**	0.94**	0.24	0.96**	0.60*	0.11	-0.26	-0.07	1.10**	0.37	0.74*	-0.72*	-0.02	-0.37
g4 (Sakha 93)	0.51	-0.36	0.07	-0.42	-0.17	-0.30	0.70**	0.48	0.59*	1.22**	-4.29**	-1.54**	-1.73**	-0.63	-1.18**
g5 (Gemiza 12)	-0.50	-0.03	-0.26	2.05**	1.21**	1.63**	0.10	0.72*	0.41	-3.46**	1.63**	-2.55**	-0.92**	-0.14	-0.53
g6 (Misr 1)	-1.56**	1.05**	-0.26	-1.63**	-1.32**	-1.47**	-0.13	-0.62*	-0.38	-0.66	0.27	-0.19	1.34**	0.58	0.96**
g7 (L125)	-1.46**	-0.56*	-1.01**	-1.15**	-1.16**	-1.15**	-0.18	-0.61*	-0.40	-2.13**	-0.35	-1.24**	0.49	0.30	0.40
g8 (L137)	1.52**	1.35**	1.43**	-0.59*	-0.52	-0.56	-0.50	-0.41	-0.45	0.67	1.99**	1.33**	0.08	1.16**	0.62
g9 (Bulk37_8)	-0.78*	-1.28**	-1.03**	1.20**	1.69**	1.44**	0.21	0.65*	0.43	-1.29**	2.41**	0.56	-0.41	-0.81*	-0.61
g10 (Bread43)	-0.53	0.11	-0.21	-1.21**	-1.43**	-1.32**	0.55*	1.47**	1.01**	-3.11**	0.97**	-1.07**	0.44	0.89*	0.66
L.S.D gi 0.05	0.63	0.55	0.59	0.53	0.62	0.57	0.50	0.60	0.55	0.74	0.62	0.68	0.67	0.78	0.73

L.S.D gi 0.0	0.82	0.72	0.77	0.69	0.82	0.75	0.66	0.80	0.73	0.97	0.81	0.89	0.89	1.03	0.95
L.S.D gi-gj 0.05	0.93	0.82	0.87	0.79	0.93	0.86	0.75	0.90	0.82	1.10	0.92	1.01	1.00	1.16	1.08
L.S.D gi-gj 0.01	1.23	1.08	1.15	1.04	1.22	1.12	0.98	1.19	1.08	1.45	1.21	1.32	1.32	1.53	1.42

*,** L1 and L2 refer to, significant at 0.5 , 0.01 levels of probability, Rassidr location and Moshtohor, respectively

Specific combining ability effects (ŝij):

Specific combining ability analysis of the parental combination were combated for all trail at both locations and combined , and are presented in Table (7)

For flag leaf angle, elven, elven and elven crosses exhibited significant negative ŝij effects at first location (Rassidr), second location (Moshtohor) and the combined analysis, respectively. The rest of crosses gave significant positive or insignificant ŝij effects. Eric of leaf ,if found in wheat is favorable and intensive production .The highest value was obtained by crosses P_3 x P_4.

Conceiting flag leaf area; fourteen, sixteen and sixteen crosses exhibited significant positive ŝij effects leaf area at first location (Rassidr), second location (Moshtohor) and the combined analysis, respectively. However, the most desirable ŝij for leaf area were detected for the cross P_3 x P_{10} in both locations and combined analysis .

For peduncle leaf eight; six and six crosses expressed significant and positive ŝij effects in at first location (Rassidr), second location (Moshtohor) and the combined analaysis, respectively.. However, the best ŝij effects for peduncle leaf were detected for the crosses P_7 x P_8 at both and cross locations .

Regarding relative water content, nineteen, seventeen and eighteen crosses exhibited significant and positive ŝij in the first location (Rassidr), second location (Moshtohor) and the combined analysis, respectively. However, the cross P_6 x P_7 gave the best ŝij effects for this trait in the first location . Whereas, the cross P_1 x P_4 gave the best ŝij effects for this trait at the second location and the cross P_1 x P_{10} in combined analysis .

For total chlorophyll three, six, and three crosses expressed significant and positive ŝij effects at first location (Rassidr), second location (Moshtohor) and the combined analysis, respectively. However, the best ŝij effects for this trail were detected for the crosses P_1 x P_7 in the first location while, the cross P_2 x P_5 in the second location and combined analysis. Such results are in harmony with those obtained by **El-Hosary *et al.*(2012)**

Table 7. Specific combining ability effects of, flag leaf angle and flag leaf area peduncle leaf Relative Water Content, total chlorophyll and at both and cross at both and cross

Crosses	**Flag leaf area angle(°)**			**Flag leaf area (cm^2)**		**Peduncle leaf (cm^2)**		
	L1	**L2**	**Comb.**	**L1**	**L2**	**L1**	**L2**	**Comb.**
P1xP2	-0.87	4.43**	1.78	-3.63**	-5.00**	0.92	-1.54	-0.31
P1xP3	1.52	1.58	1.55	1.07	-0.38	1.33	1.07	1.20
P1xP4	3.68**	1.42	2.55*	0.99	0.46	-0.99	-2.53*	-1.76
P1xP5	3.97**	-5.85**	-0.94	0.31	0.86	-0.39	-2.03	-1.21
P1xP6	2.86**	3.86**	3.36**	-7.91**	-5.09**	-0.60	-0.76	-0.68
P1xP7	-6.74**	-6.65**	-6.70**	-5.89**	-7.15**	-0.61	0.13	-0.24
P1xP8	0.45	4.01**	2.23*	-7.52**	-9.46**	0.04	0.03	0.03
P1xP9	-6.12**	-3.30**	-4.71**	2.77**	2.58*	-2.03*	-1.73	-1.88*
P1xP10	0.50	-0.29	0.10	6.58**	6.55**	-0.74	3.15**	1.21
P2xP3	2.20*	1.83	2.02*	1.43	-0.88	-0.52	-0.51	-0.51
P2xP4	1.46	2.14*	1.80	3.70**	5.88**	-1.11	-0.05	-0.58
P2xP5	1.64	2.37*	2.00*	1.48	2.21*	2.82**	2.22*	2.52**
P2xP6	4.81**	-1.41	1.70	5.67**	7.93**	2.26**	2.82**	2.54**
P2xP7	0.27	2.33*	1.30	6.58**	2.94**	-1.06	-1.22	-1.14
P2xP8	-3.87**	-5.17**	-4.52**	2.64**	6.28**	-0.48	-1.02	-0.75
P2xP9	-0.08	-4.62**	-2.35*	0.45	-0.61	0.88	1.18	1.03
P2xP10	-1.83	2.33*	0.25	-5.88**	-6.19**	-0.96	1.03	0.04
P3xP4	-9.14**	-6.91**	-8.03**	-2.85**	-2.47*	-0.43	-2.66*	-1.55
P3xP5	3.71**	2.31*	3.01**	-2.09*	-0.16	-0.66	0.20	-0.23
P3xP6	-6.73**	-4.29**	-5.51**	-1.03	-4.68**	-1.03	-0.56	-0.79
P3xP7	4.83**	1.28	3.06**	-2.45**	0.98	3.29**	-0.03	1.63
P3xP8	-0.64	0.61	-0.02	0.76	1.57	-1.06	0.13	-0.47

Crosses	Flag leaf area angle(°)			Flag leaf area (cm^2)		Peduncle leaf (cm^2)		
	L1	L2	Comb.	L1	L2	L1	L2	Comb.
P3xP9	-2.18*	0.43	-0.87	2.01*	2.85**	0.06	-0.70	-0.32
P3xP10	3.57**	1.14	2.36*	8.63**	10.80**	-2.31**	-3.75**	-3.03**
P4xP5	-6.87**	1.39	-2.74**	-2.05*	-4.28**	1.08	1.26	1.17
P4xP6	3.67**	-0.69	1.49	0.44	1.40	-0.48	0.00	-0.24
P4xP7	0.93	1.36	1.14	-6.79**	-5.65**	-1.97*	-0.17	-1.07
P4xP8	-1.55	-3.52**	-2.53*	7.72**	4.93**	3.85**	3.49**	3.67**
P4xP9	4.42**	4.04**	4.23**	1.05	4.47**	1.81*	2.23*	2.02*
P4xP10	-1.84	-2.68**	-2.26*	2.20*	1.84	-0.03	1.18	0.57
P5xP6	1.38	2.74**	2.06*	6.42**	4.09**	0.92	-0.21	0.36
P5xP7	2.14*	5.05**	3.59**	-3.96**	-5.00**	0.50	-0.74	-0.12
P5xP8	-1.04	-0.26	-0.65	1.49	3.51**	-0.29	1.42	0.57
P5xP9	-3.74**	-6.87**	-5.30**	-1.29	-2.26*	-0.43	0.96	0.27
P5xP10	-0.16	2.34*	1.09	-2.68**	1.83	-1.23	-0.19	-0.71
P6xP7	5.84**	-0.59	2.62**	1.14	1.90	-0.73	-0.81	-0.77
P6xP8	2.53*	-0.40	1.07	-1.14	-4.40**	0.52	-0.08	0.22
P6xP9	-4.31**	1.76	-1.27	4.91**	3.61**	1.11	1.09	1.10
P6xP10	-2.92**	-1.20	-2.06*	-9.79**	-9.32**	2.47**	0.71	1.59
P7xP8	4.09**	0.38	2.23*	4.42**	5.71**	4.53**	3.92**	4.23**
P7xP9	3.89**	0.17	2.03*	-3.10**	-0.99	-2.81**	-1.47	-2.14*
P7xP10	-5.70**	-9.22**	-7.46**	8.31**	6.98**	1.35	2.61*	1.98*
P8xP9	0.24	1.99*	1.12	-1.65	-2.03	-3.49**	-2.11*	-2.80**
P8xP10	-0.51	1.94*	0.72	-2.36**	-3.12**	-1.50	-3.20**	-2.35*
P9xP10	2.79**	4.23**	3.51**	-3.76**	-3.64**	-2.04*	-3.56**	-2.80**
LSD5%(sij)	2.11	1.85	1.96	1.78	2.09	1.69	2.03	1.85
LSD1%(sij)	2.77	2.43	2.59	2.34	2.75	2.22	2.67	2.44
LSD5%(sij-sikl)	3.10	2.72	2.89	2.61	3.07	2.48	2.99	2.72
LSD1%(sij-sikl)	4.07	3.57	3.80	3.43	4.04	3.27	3.93	3.59
LSD5%(sij-skil)	2.95	2.59	2.75	2.49	2.93	2.37	2.85	2.59
LSD1%(sij-skil)	3.88	3.41	3.63	3.27	3.85	3.11	3.75	3.42

*,** L1 and L2 refer to, significant at 0.5 , 0.01 levels of probability, Rassidr location and Moshtohor, respectively

Table (7): Cont.

Crosses	Relative water content			Total chlorophyll		
	L1	L2	Comb.	L1	L2	Comb.
P1xP2	-6.42**	-8.45**	-7.44**	1.08	-2.13	-0.53
P1xP3	4.65**	12.10**	8.37**	-2.47*	0.42	-1.02
P1xP4	-3.91**	16.74**	6.41**	-6.02**	-2.84*	-4.43**
P1xP5	14.30**	-12.83**	0.73	-0.23	3.14*	1.45
P1xP6	-6.45**	-4.72**	-5.58**	0.97	2.28	1.63
P1xP7	-14.66**	-4.81**	-9.74**	3.42**	1.83	2.63*
P1xP8	0.35	-1.35	-0.50	-2.39*	6.17**	1.89
P1xP9	-9.27**	9.46**	0.10	0.96	1.94	1.45
P1xP10	12.50**	9.49**	11.00**	-0.23	1.05	0.41
P2xP3	6.45**	13.54**	9.99**	0.89	2.35	1.62
P2xP4	6.31**	4.14**	5.22**	0.20	-1.77	-0.78
P2xP5	4.09**	-8.37**	-2.14	0.16	6.41**	3.28**
P2xP6	-1.64	-4.95**	-3.30**	-0.34	-1.62	-0.98
P2xP7	-8.00**	-4.12**	-6.06**	-1.48	-1.83	-1.66
P2xP8	0.86	0.19	0.52	-0.44	0.87	0.22
P2xP9	1.23	7.55**	4.39**	0.72	-1.62	-0.45
P2xP10	4.03**	2.22*	3.13**	-0.40	-0.59	-0.50
P3xP4	-1.17	-5.10**	-3.14**	0.79	2.25	1.52
P3xP5	-2.47	-3.06**	-2.76*	2.04	-0.71	0.67
P3xP6	-7.31**	12.00**	2.35*	-0.29	3.00*	1.36
P3xP7	-4.14**	-23.10**	-13.62**	-0.77	-2.52	-1.64
P3xP8	-11.47**	13.45**	0.99	0.75	-1.65	-0.45

Crosses	Relative water content			Total chlorophyll		
	L1	L2	Comb.	L1	L2	Comb.
P3xP9	11.53**	-7.50**	2.02	0.00	-1.70	-0.85
P3xP10	5.72**	0.68	3.20**	0.05	-2.13	-1.04
P4xP5	-4.82**	5.52**	0.35	2.92*	-2.63*	0.15
P4xP6	-8.23**	-3.74**	-5.99**	1.89	2.38	2.14
P4xP7	-9.54**	-1.69	-5.61**	-0.29	-0.31	-0.30
P4xP8	0.81	-16.27**	-7.73**	1.16	1.13	1.15
P4xP9	2.81*	3.14**	2.97*	0.85	1.97	1.41
P4xP10	5.87**	-5.88**	-0.01	-0.51	2.31	0.90
P5xP6	-6.21**	3.65**	-1.28	0.75	1.95	1.35
P5xP7	-2.43	-0.71	-1.57	0.37	-0.10	0.14
P5xP8	-2.00	-4.13**	-3.07**	-2.28*	-1.83	-2.05
P5xP9	-10.33**	-0.30	-5.32**	1.84	-4.58**	-1.37
P5xP10	14.15**	6.78**	10.47**	1.48	2.38	1.93
P6xP7	17.20**	0.51	8.85**	-2.49*	3.21*	0.36
P6xP8	7.27**	-10.13**	-1.43	-0.38	-0.52	-0.45
P6xP9	12.01**	-2.33*	4.84**	-0.13	-3.64**	-1.88
P6xP10	9.99**	-1.29	4.35**	0.42	-3.84**	-1.71
P7xP8	2.24	11.15**	6.70**	-2.43*	-1.43	-1.93
P7xP9	2.75*	11.02**	6.88**	0.79	0.47	0.63
P7xP10	6.12**	1.44	3.78**	1.61	-4.26**	-1.32
P8xP9	5.20**	-0.07	2.57*	0.64	-1.22	-0.29
P8xP10	-2.84*	-0.71	-1.78	2.86*	2.08	2.47*
P9xP10	-10.60**	-2.70*	-6.65**	-0.79	2.69*	0.95
LSD5%(sij)	2.49	2.07	2.27	2.27	2.62	2.43
LSD1%(sij)	3.27	2.73	2.99	2.98	3.45	3.20
LSD5%(sij-sikl)	3.66	3.05	3.33	3.33	3.86	3.57
LSD1%(sij-sikl)	4.81	4.01	4.39	4.38	5.07	4.70
LSD5%(sij-skil)	3.49	2.91	3.18	3.18	3.68	3.40
LSD1%(sij-skil)	4.58	3.82	4.19	4.18	4.83	4.48

*, ** L1 and L2 refer to, significant at 0.5, 0.01 levels of probability, Rassidr location and Moshtohor, respectively

References

Afiah S.A.; A.A. Elgammaal and A.A.A. EL-Hosary (2019) Selecting diverse bread wheat genotypes under saline stress conditions using ISSR marker and tolerance indices. Egypt. J. Plant Breed. 23 (1):77 –92

Baker, R.J. (1978). Issues in diallel analysis. Crop Sci. 18: 533-536.

Barrs, H.D. and Weatherley, P.E. (1962): A re-examination of the relative turgidity technique for estimating water deficits in leaves. *Australian J.Biol. Sci.,* 15: 413–428

Chowdhry, M. A.; M. Rafiq and K. Alam (1992). Genetic architecture of grain yield and certain other traits in bread wheat. Pakistan J Agric Res 13: 216-220.

Cochran, W.G. and G.M. Cox (1957). Experimental Design, 2nd ed. John Wiley, N.Y. USA.611p.

El Ameen MT, Abdels abour G.A. Khaled and Ibrahim F.O. Elshazly (2020) Genetic analysis of eight parents and their 28 hybrids under salinity tolerance in bread wheat. Asian Journal of Research in Biosciences ,2(1): 37-48

El-Fahdawy, A.; A.A El-Hosary.; M.El.M. El-Badawy, S.A.S Mehasen, A.A.A. El-Hosary (2019). utilization of diallel crosses to determine combining ability and heterosis in wheat grown under drought and normal irrigation treatments. Egypt. J. Plant Breed., 23(3):219 -229 .

EL-Hosary, A.A.; M.E.M. EL-Badawy; A.K. Mustafa and EL-Shal, M.H. (2012). Breeding bread wheat for tolerance to drought stress**.** Minufiya J. Agric. Res. 37(2)**.**

El-Hosary A.A.; M.El.M. El-Badawy; S.A.S Mehasen, A.A.A.; El-Hosary, T.A. ElAkkad and A. El-Fahdawy (2019 a). Genetic diversity among wheat genotypes using RAPD markers and its implication on genetic variability of diallel crosses .bioscience research , 2019 16(2): 1258-1266.https://www.isisn.org/BR_16_2_2019.htm.

EL-Shal M. H. A. (2011). Characterization and evaluation of some wheat genotypes under drought stress. Ph. D. Thesis. Fac. of Agric., Benha Univ., Egypt.

EL-Maghraby, M.A.; M. E. Moussa; N.S. Hana and H. A. Agrama (2005). Combining ability under drought stress relative to SSR diversity in common wheat. Euphytica. 141: 301-308.

El-Safy H. R., M.EL.M. EL-Badawy, S. A. H. Allam and A.A.A. El Hosary (2020) Genetic Analysis of Diallel Crosses in Wheat under Drought and Normal Irrigation Treatments. Annals of Agric. Sci., Moshtohor 58 (4): 915-922

Farshadfar, E.; F. Rafiee and H. Hasheminasab (2013). Evaluation of genetic parameters of agronomic and morpho-physiological indicators of drought tolerance in bread wheat (*Triticum aestivum L.*) using diallel mating design. Australian J. of Crop Sci., 7(2):268-275 .

Gardner C.P. and S.A. Eberhart (1966). Analysis and interpretation of the variety cross diallel and related population. Biometrics 22:439- 452.

Gilbert, N. E.G.(1958). Diallel cross in plant breeding. heredity. 12:477–492.

Gomaa, M.A.; M. N. M. El-Banna; A. M.Gadalla; E.E. Kandil and A.R.H. Ibrahim(2014). Heterosis, combining ability and drought susceptibility index in some crosses of bread wheat (*Triticum aestivum* L.) under water stress conditions . Middle East J. of Agric. Res., 3(2): 338-345.

Goyal E, S.K. Amit and R.S. Singh (2016) Transcriptome profiling of thesalt-stress response inTriticum aestivumcv. Kharchia Local. SciRep 6:27752

Griffing, B. (1956). Concept of general and specific combining ability in relation to diallel crossing system. Aust. J. Biol. Sci.9**:** 463-493.

Hayman, B.I. (1954). The analysis of variance of diallel crosses. Biometrics 10: 235-244.

Hussain N. S. , M. El. M. El-Badawy,A.A.A. El Hosary, S.A.S Mehasen (2020) Estimation of Combining Ability and Gene Action by Using Line X Tester Procedure in Bread Wheat (*Triticum astivum*., L) Annals of Agric. Sci., Moshtohor 58 (4): 923-930.

Iqbal, M.; A. Navabi; D. F. Salmon; R. C. Yang; B. M. Murdoch; S. S. Moore and D. Spaner (2007). Genetic analysis of flowering and maturity time in high latitude spring wheat . Euphytica 154: 207-218.

Lonnquit, J.H. and C.D. Gardner (1961). Heterosis in intervarietal crosses in maize and its implications in breeding procedures. Crop Sci. 1: 179-183.

Mickelbart MV, PM Hasegawa, Bailey- J Serres. (2005) Genetic mechanisms of abiotic stress tolerance that translate to crop yield stability. Nat Rev Genet 16:237–251

Oyiga BC, Sharma RC, Shen J, Baum M (2016) Identification and characterization of salt tolerance of wheat germplasm using multivariable screening. J Agron Crop Sci 202:472–485

Paschal, H. E. H. and J. R. Wilcox (1975) Heterosis and combining ability in exotic soy bean germplasm. Crop Sci., 13:344-349.

Snedecor, G.W. and W.G. Cochran (1967). Statistical methods. 6th Ed., The State University Press, Ames Lowa, USA, 593p**.**

Sprague. T. L. and A. Tatum (1942) General versus specific combining ability in single crosses of corn. J. AM Soc Agron. 43:923-932

Stuber, C.W. (1994). Heterosis in plant breeding. Plant Breed Rev 12: 227-251.

Topal, A.; C. Aydin; N. Akgiin and M. Babaoglu (2004). Diallel cross analysis in durum wheat (Triticum durum Desf.): identification of best parents for some kernel physical features. Field Crop Res 87(1): 1-12.

Yildirim, M. and B. Bahar (2010) Responses of some wheat genotypes and their F2 progenies to salinity and heat stress scientific Research and Essays 5(13):1734-1741

Zare-kohan, M. and B. Heidari(2012). Estimation of genetic parameters for maturity and grain yield in diallel crosses of five wheat cultivars using two different models. J. Agri. Sci., 4(8):74-85**.**

تحليل القدرة على التالف في التهجين التبادلي (10x10) للقمح النامي تحت الظروف الطبيعية والاجهاد المحلى لبعض صفات النمو المور فولوجيه و الفسيولوجية

وفاء على محمد , محمود الزعبلاوى البدوى, و عدلى محمد مرسي و احمد على الحصرى
قسم المحاصيل – كلية الزراعة – جامعة بنها – مصر.

تم التهجين بنظام النصف دياليل 10x10 في موسم 2019/2018 ، تم تقييم كل من الاباء و 45هجين (نواتج التهجين) تحت موقعين (رأس سدر ومشتهر) خلال موسم 2020/2019 لبعض الصفات الفسيولوجية. كان متوسط التباين للتراكيب الوراثية وتقسيمها (الهجن ،الاباء, والاباء مقابل الهجن) وايضا كلا من القدرة على الجمع بين عالية المعنوية لجميع الصفات المدروسة تحت ظروف الإجهاد الملحي و البيئة العادية وعبر الموقع. بينما ، كانت التفاعل بين كل من التراكيب الوراثية و الهجن و الاباءمع المواقع معنوية لجميع الصفات باستثناء المسافه بين ورقه العلم و السنبلة. كان التفاعل بين كل من القدرة العامة و الخاصة و المواقع معنويا لجميع الصفات المدروسة. كانت النسبة بين القدرة العامه / القدرة الخاصه أكثر من واحد لجميع الصفات باستثناء زاوية ورقة العلم تحت ظروف الإجهاد الملحي والظروف الطبيعية والتحليل التجميعى ومحتوى الماء النسبي تحت ظروف مشتهر و التحليل التجميعى. أظهر الاب الثانى شندويل 1اعلى تأثير إيجابي للقدرة العامه على التالف لمنطقة بين ورقة العلم و السنبلة والمحتوى المائي النسبي في كل من الموقعين بالإضافة إلى التحليل التجميعي وإجمالي الكلوروفيل في الموقع الأول ، مما يشير إلى أنه يمكن اعتبار الصنف شندويل 1 له قدرة عامه عالية لهذه الصفات كانت أكثر التفاعلات المرغوبة بين الأليلات وداخلها بواسطة P3 x P4الزاوية ورقة العلم ، P3 x P10للمنطقه بين ورقة العلم و السنبلة؛ P7 x P8 لمساحه ورقه العلم ؛ P1 x P10 للمحتوى الماء النسبي ؛ P2 x P5لإجمالي الكلوروفيل واعطت تللك الهجن تأثيرات إيجابية كبيره للقدرة الخاصة على التالف.