II.7 COMBINING ABILITY ESTIMATES FOR GRAIN YIELD AND ITS COMPONENTS OF YELLOW MAIZE INBRED LINES

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Abstract

C ix yellow maize (Zea mays L.) inbred lines were crossed in a half diallel mating scheme at Gemmeiza J Agric. Res. Stn. in 2009. In 2010, the resulting 15 crosses along with three check hybrids; SC 162, SC 164 and SC 166 were evaluated at Gemmeiza and Mallawy, where GCA and SCA effects were estimated. Location and crosses mean squares were significant for all traits except for no. of rows ear⁻¹. Significant cross x location interaction mean squares were recorded for all traits, except for ear diameter and no, of rows ear⁻¹. The mean squares associated with GCA and SCA were significant for all traits at both locations and also in the combined analysis, indicating that both additive and non-additive gene effects were involved in the inheritance of the traits. The ratio of GCA/SCA mean squares exceeded the unity for no. of rows ear⁻¹ and no. of kernels row⁻¹ at the two locations and their combined analysis. However, the same ratio was less than unity for ear diameter, 100-kernel weight and grain yield fed.⁻¹ at the two locations and their combined analysis, indicating that additive (a) and (aa) gene effects play an important role in the inheritance of the traits in the first case and non-additive was predominant in the second one. The ratio of GCA x L/SCA x L mean squares was less than unity for ear diameter, 100-kwt and grain yield fed.¹, indicating that nonadditive genes were more interacted with location than additive ones for the traits in question, while the same ratio exceeded the unity for no. of rows ear⁻¹ and no. of kernels row⁻¹, indicating that additive (a) and (aa) changed with changing the environments. The parental genotype (P2) was a good general combiner for no. of kernels row⁻¹ and 100kwt at Gemmeiza, while P4 was considered as a good general combiner for no. of rows ear⁻¹ and 100-kernel weight at Mallawy and for no. of kernels row⁻¹ at Gemmeiza. The same parental genotype performed as a good general combiner for ear diameter, no. of rows ear¹ and grain yield fed.⁻¹ at Mallawy. The crosses; P1 x P3 and P5 x P6 had significant inter- and intra-allelic interactions for ear diameter at both locations and their combined data, no. of kernels row⁻¹ at Gemmeiza and combined data and grain yield fed.¹ at Mallawy. Moreover, the crosses; P1 x P2, P2 x P4, P3 x P6 and P5 x P6 surpassed the three check hybrids with respect to grain yield.

Keywords: (*Zea mays* L.), GCA, SCA, gene effect, Diallel cross.

INTRODUCTION

Maize *(Zea mays* L.) is one of the major cereal crops in Egypt and the world. The grown area of maize in Egypt is about 1.6 million fedden in 2010 season with an average production of 24 ardab fed.⁻¹ (one feddan = 4200 m² and one ardab=140 kg) according to National Maize Program. It is used mainly for animal feed and domestic consumption. The main goal of the breeders is to develop new maize cultivars, which could be achieved by estimating heterosis and combining ability for maize genotypes under different environments. Sprague and Tatum (1942) were the first scientists defined general and specific combining ability. Hallauer and Miranda (1981) concluded that improving inbred lines increased grain yield and modified maturity.

Yield and yield components are of great importance for dealing with the inheritance of such traits to assist maize breeders and geneticists to plan convenient breeding programs for increasing yield potential. The diallel mating design has been used and abused more extensively than any other designs in maize and other plant species to determine the combining ability of various genotypes. After these steps of evaluation, the breeder can exploit both additive and non-additive gene action available, which helps to plan the suitable breeding program via the proper breeding method. Therefore, the main objectives of the present investigation were to study and determine: a) combining ability and interaction with environment, b) the type of gene action controlling the inheritance of the studied traits and c) identify the superior crosses, which surpass the check cultivars.

MATERIALS AND METHODS

Six yellow (*Zea mays* L.) inbred lines with a wide range of diversity for several traits (Table 1) were crossed in a half diallel mating scheme in 2009 season at Gemmeiza Agric. Res. Station giving a total of 15 crosses as hybrid seeds. In 2010 season, these 15 crosses along with three commercial check hybrids; i.e., (S.C 162, S.C 164 and S.C 166); were evaluated in a randomized complete block design experiment with four replications at two locations i.e. Gemmeiza and Mallawy Agricultural Research Stations, representing Delta and Upper Egypt regions, respectively.

No. of parent	Name	Pedigree
P ₁	Gm. 101	Pool- 22 -622
P ₂	Gm. 102	Pop. 146 -66
. Р ₃	Gm. 104	Pop. 31-69
P ₄	Gm. 207	(Comp # 21)
P ₅	Gm. 215	(Comp # 45)
P ₆	Gm. 230	(Gm.Y.Pop.)

Table 1. Name and pedigree of the six yellow inbred lines.

The experimental plot was one ridge of 6-m length and 0.80 m width. Sowing was done in hills evenly spaced by 25 cm at the rate of two kernels per hill on one side of the ridge. Seedlings were thinned to one plant per hill. Agricultural practices were executed as recommended for maize cultivation. Data were recorded for ear diameter (cm), number of rows ear⁻¹, number of kernels row⁻¹, 100–kernel weight (g) and grain yield (ardab fed.⁻¹) adjusted to 15.5% moisture content. Analysis, of variance for randomized complete block design was performed according to the method outlined by Snedecor and Cochran (1967) and used for each location, and then combined performance across locations.

The L.S.D. test at 0.05 and 0.01 level of probability according to Steel and Torrie (1980) was used for comparisons of the mean performance of different genotypes. General (GCA) and specific (SCA) combining ability effects were estimated according to Griffing (1956) model 1, method 4. Superiority percentage for all characteristics under study was computed for individual crosses as the percentage of increase of each cross relative to the three checks.

Superiority over check $[(F_1 - check) / check | x 100]$

The value of F_1 -check compared with least significant difference (L.S.D) at 0.05 and 0.01 levels of probability to determine the level of significance where:

L.S.D
$$_{0.05} = t_{0.05}$$
 $\sqrt{\frac{2M.S \text{ error}}{r}}$

RESULTS AND DISCUSSION

The analysis of variance for the five studied traits in each location and their combined data are presented in Table 2. Results indicated that location mean squares were significant for all studied traits, except for no. of rows ear⁻¹, indicated overall differences between the two locations.

Significant differences were detected among crosses for all traits in each location as well as the combined data except for Gemmaiza location for no. of rows ear⁻¹, indicating wide diversity between the crosses used in this study. Significant crosses x locations interaction mean squares were obtained for all traits, except for ear diameter and number of rows ear⁻¹. These results indicated that the tested crosses changed its ranking from the first location to the second. These results were in harmony with those reported by Venugopal, *et. al.* (2002), Mosa (2003), Osman *et. al.* (2012), Abd El-Mottalb and Gamea (2014) and Mousa (2014).

Combining ability

Analysis of variance

Analysis of variance for combining ability as outlined by Griffng (1956) model. 1, method 4 in each location and their combined data for studied traits are shown in Table 3. The mean squares associated with (GCA) and (SCA) were significant for all studied traits in both locations as well as the combined analysis. Insignificant mean squares of GCA were detected for ear diameter and grain yield at Gemmeiza, while insignificant mean squares of SCA were detected for no. of rows ear⁻¹ at Gemmeiza and at Mallawy for no. of kernels row⁻¹. The ratio of GCA/SCA mean squares was less than unity for ear diameter, 100-kernel weight and grain yield (ard. fed.⁻¹) at the two locations and their combined data, indicating the importance of non-additive gene action in the inheritance of these traits. These results were in agreement with those reported by Venugopal, et. al. (2002), Mosa (2003), Mosa and Amer (2004), Singh and Roy (2007), Akbar et. al. (2008), Osman et. al. (2012), Abd El-Mottalb and Gamea (2014) and Mousa (2014). On the other hand, the ratio of GCA/SCA mean squares exceeded the unity for no. of rows ear⁻¹ and no. of kernels row⁻¹ at the two locations and their combined analysis. This would indicate that additive and additive x additive gene effects played an important role in the inheritance of the traits in view. Nigussie and Zelleke (2001), Yousif et. al. (2003), Abd El-Hadi et. al. (2005), Soliman et. al. (2005) and Motawei (2005) came up to the same conclusion. The ratio of GCA x location/SCA x location mean squares was less than unity for ear diameter, 100kernel weight and grain yield (ard. fed.⁻¹), indicating that non-additive genes were more interacted with location than additive ones for the traits in question.

						······			
		-	Comb	295.788**	2.190	18.483**	19.670**	2.144	
	No. of	Kernels row ⁻¹	Mal.			4.244**		1.467	
_•			Gm.			33.910**		2.821	
five studied traits under two locations and their combined,2010.			Comb	0.012	1.050	2.514**	0.949	0.712	
and their co	No. of	Rows ear ⁻¹	Mal.			1.684**		0.457	
wo locations			Gm.			1.779		0.966	
aits under t			Comb	13.068**	0.109*	0.190**	0.027	0.037	
/e studied tr	Ear	Diameter	Mal.			0.087**	¥	0.022	
for the fiv			Gm.		-	0.130*		0.052	
w crosses	d.f.		Comb	. 1	9	14	14	84	
re of yello			single			14		42	
Table 2. Mean square of yellow crosses for the		S.O.V.		Loc.	Rep/Loc.	Crosses	Crosses x Loc.	Error	

Table 2. Cont'd

5.0.V		d.f.		100-kernel weight (g)	ht (q)		Grain yield	pic	
-	single	Comb	Gm.	Mal.	Comb.	Gm.	Mal.	Comb	
Loc.		1			506.8**			47.6**	
Rep/Loc.		9			5.0*			7.2	· · · ·
Crosses	14	14	46.6**	17.5**	20.2**	24.2**	68.7**	61.6**	•
Crosses x Loc.		14			43.9**			31.3**	
Error	42	84	2.4	1.1	1.7	8.6	3.9	6.3	
oncient je nindere benidmed – dmed menetien je nindere olonia – olonia vuellede – Matematika – Matematika je ni	- Molicitad	cinalo – cinalo	andrei of un	- dana	Combined anabaic o				

Gm.= Gemmeiza, Mal. = Mallawy, single = single analysis of variance, Comb = Combined analysis of variance.

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On the other hand, the same ratio exceeded the unity for no. of rows ear¹ and no. of kernels row⁻¹, indicating the importance of additive and additive x additive gene effects with changing the environments for these traits. However, Dawood et. al. (1994) found that SCA x location interactions were higher than GCA x locations, indicating that non-additive gene action was more interacted with location than additive one. Mosa (2003) found that additive gene action was more interacted with locations than non-additive due to exceeding the ratio of GCA x location/SCA x location than unity. EL-Shenawy (2005) found that the ratio of SCA x location/GCA x location mean squares was more than unity for ear diameter indicating that nonadditive genes were more interacted with environments than additive one for this trait, Motawei (2006) indicated that mean squares due to GCA x location were higher than those due to SCA x location interaction for all traits, indicating that additive gene effects was more affected by the environmental conditions than non-additive gene action and Mousa (2014) stated that the magnitude of SCA x location interaction was larger than GCA x location for all traits. (The ratio of GCA x loc.1/GCA x loc.2 mean squares was less than unity for grain yield (ard. fed.⁻¹), indicating that additive and additive x additive gene effects more interacted with Mallawy location than do with Gemmeiza location for these traits. The opposite case was observed for ear diameter, no, of rows ear⁻¹, no, of kernels row⁻¹ and 100-kernel weight, where the same ratio was more than one, indicating that additive and additive x additive gene effects more interacted with Gemmeiza location than do with Mallawy one for the traits in consideration. The ratio of SCA x loc.1/SCA x loc.2 mean squares was less than unity for no. of rows ear⁻¹ and grain yield (ard. fed.⁻¹), indicating that non-additive genes were more interacting with Mallawy than with Gemmeiza for the above-mentioned traits, while, ear diameter, no. of kernels row⁻¹ and 100-kernel weight were more affected by non-additive genes at Gemmeiza than at Mallawy (where the same ratio exceeded the unity).

b. General combining ability effects (g_i^{-}) .

Considering ear diameter, desirable significant (g_i) was detected for P₆ at Mallawy only (Table 4). The inbred lines; P₄ and P₆ exhibited desirable significant (g_i) under Mallawy for number of rows ear⁻¹. For number of kernels row⁻¹, the highly significant (g_i) was detected under Gemmeiza for the inbred lines (P₂ and P₄), while the inbred line (P₁) had high significant (g_i) for the trait in view at Mallawy.

Considering 100-kernel weight, desirable significant (g_i) was detected for P_1 and P_2 at Gemmeiza and P_4 at Mallawy. For grain yield, the inbred line P_6 showed desirable and high significant (g_i) under Mallawy and the combined analysis, while the inbred line P_2 was considered as good combiner at Mallawy for the trait in view.

Specific combining ability effects (s[^]_{ii})

Specific combining ability effects (s_{ii}^{*}) of the crosses for all traits at separate locations and their combined are presented in Table 5. For ear diameter, the crosses; $(P_1 \times P_3)$ and $(P_5 \times P_6)$ showed significant positive values of $(\hat{s_{ii}})$ at the two locations and the combined analysis. For no. of rows ear⁻¹, the crosses; $(P_1 \times P_3)$ and $(P_4 \times P_6)$ showed high significant positive values of (\hat{s}_{ii}) at Mallawy. The crosses; $(P_1 \times P_3)$, $(P_1 \times P_3)$ P₆) (P₃ x P₄), (P₄ x P₅) and (P₅x P₆) showed significant positive values of (\hat{s}_{ii}) for no. of kernels row⁻¹ at Gemmeiza and combined analysis. For 100-kernel weight, the cross; ($P_1 \times P_5$) at the two locations and their combined data; the crosses; ($P_1 \times P_6$), $(P_2 \times P_3)$ and $(P_2 \times P_4)$ at Gemmeiza and the combined analysis and the crosses; $(P_1$ x P₂), (P₃ x P₄) and (P₄ x P₆) at Mallawy exhibited significant (s_{ii}^{*}) in positive direction for the trait in question. The cross; $(P_1 \times P_2)$ at the two locations and the crosses; (P₁ x P₄), (P₂ x P₄), (P₃ x P₆) and (P₅ x P₆) at Mallawy showed high significant (s_{ii}) in positive direction for grain yield. These results were in good agreement with those obtained by ZelIeke (2000), Barakat et. al. (2003) and Kabdal et. al. (2003), Osman et. al. (2012), Abd El-Mottalb and Gamea (2014), Mousa (2014) and Osman (2014).

Table 3. Analysis of variance for combining ability of yellow crosses for the five studied traits under two locations and their combined, 2010.	ance for c	Sombining	a bility of	yellow cross	es for the fi	ve studied	traits unde	r two locatio	ins and their o	combined, 2	010.
203	d.f.			Ear diameter		z	No. of rows ear ⁻¹)	(1)	No.	No. of kernels row ⁻¹	-1
	single	Comb	Gm.	Mal.	Comb	ей.	Mal.	Comb	Ш	Mal.	Comb
G.C.A.	5	5	0.030	0.020**	0.023	0.658*	0.543**	0.453**	12.548**	1.666**	2.424**
S.C.A.	6	6	0.034*	0.023**	0.024**	0.326	0.353**	0.237**	6.216**	0.725	2.247**
G.C.A. × Loc.		2		34	0.027**			0.748**			11.79**
S.C.A. x Loc.		6	-		0.032**			0.442**			4.694**
Error term	42	84	0.013	0.006	0.009	0.242	0.114	0.178	0.705	0.367	0.536
G.C.A./ S.C.A			0.882	0.870	0.958	2.018	1.538	1.911	2.019	2.298	1.079
G.C.A x Loc/ S.C.A x Loc					0.844			1.692			2.512
G.C.AxLoc1/G.C.A x Loc2			1	1.5		1.212	12		7.532	32	
S.C.AxLoc1/S.C.A x Loc2		•	1.4	1.478		0.924	24		8.574	74	
Table 3. Cont'd											
S.O.V.		d.f.		10	100-kernel weight (g)	ıt (g)			Grain yield		
	single	Ŭ	Comb	Ш	Mal.	Comb		Gm.	Mal.	8	Comb
G.C.A.	5		5	8.74**	2.82**	1.73**	*	4.32	7.57**	2.8	2.80**
S.C.A.	6		6	13.25**	5.23**	2.96**		7.02**	22.52**	4	4.42
G.C.A. x Loc.			5			9.83 **	*			. 9.0	9.09**
S.C.A. x Loc.			6			15.53**	**			19.	19.11**
Error term	42	-	84	0.58	0.28	0.43		2.15	0.99	1.	1.57
G.C.A./ S.C.A				0.66	0.54	0.58		0.63	0.34	0	0.62
G.C.A × Loc/ S.C.A × Loc						0.63	- ²			0	0.48
G.C.AxLoc1/ G.C.A x Loc2				3.10	0			0.57			
S.C.AxLoc1/ S.C.A x Loc2				2.53	33			0.31			

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Table 4. Estimates of general combining ability effects of six yellow maize inbred lines for the five traits at two locations and their combined

data, 2010.

		Ear diameter	Ļ	No	No. of rows ear ⁻¹	ar-1	No.	No. of kernels row ⁻¹	-ow ⁻¹	100-	100-kernel weight (g)	ht (g)		Grain yield	
Parent	Gm.	Mal.	Comb.	Gm.	Mal.	Comb.	Gm.	Mal.	Comb.	Gm.	Mal.	Comb.	Gm	Mal.	Comb.
P1	-0.08	-0.01	-0.05	-0.23	-0.49**	-0.36	-0.77*	0.93**	0:08	2.09**	-0.04	1.02**	-1.79	-0.49	-1,15*
P2	0.04	0.04	0.04	0.38	0.03	0.21	: 1.60**	-0.78**	0.41	1.55**	-1.17**	0.19	-0.17	1.25**	0.54
P3	-0.13	-0.13**	-0.13	-0.67**	-0.32*	-0.49*	-2.96**	0.40	-1.28**	-1.59**	-0.67**	-0.98**	-0.42	0.49	0.04
P4	0.08	0.02	0.05	0.19	0.42**	0.31	1.79**	0.29	1.04**	-1.09**	1.21**	0.06	0.61	-1.00*	-0.19
P5	0.04	0.02	0.03	0.37	-0.04	0.16	-0.33	-0.38	-0.36	-1.14**	0.46	-0.34	06.0	-1.91**	-0.50
Pe	0.05	0.07*	0.06	-0.05	0.39*	0.17	0.67	-0.46	0.10	-0.13	0.21	0.04	0.88	1.66**	1.27*
LSD5% (gi)	1	0.07	-	0.45	0.31	0.38	0.77	0.56	0.66	0.70	0.49	0.59	-	0.92	1.14
LSD1% (gi)	а 2	0.09	,	0.61	0.42	0.51	1.04	0.75	0.88	0.94	0.65	0.79		1.23	1.50
LSD5% (gi - gj)		0.11	1	020	0.48	0.59	1.20	0.87	1.03	1.09	0.75	0.92		1.42	1.76
LSD1% (ai - ai)	1	0.14	,	0.94	0.65	0.78	1.61	1.16	1.36	1.46	1.01	1.22	1	1.90	2.33

 $\ast,\ \ast\ast$ Significant at 0.05 and 0.01 levels of probability, respectively

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Lat clanneter No. of vermels row* 100-freement weight (gm) Mail Comb. Gm. Mai. Comb. Gm. Gm. <th>rows ear ⁻ Mal. Comb.</th> <th></th> <th></th> <th></th> <th></th> <th>-</th> <th></th> <th></th> <th></th> <th></th>	rows ear ⁻ Mal. Comb.					-				
Mell Comb. Gm Mell Comb. Gm Mell Comb. Gm Mell Comb. Gm	-			- MO	100-k	ernel weigh	it (gm)		Grain yield	
0.00 0.01 0.23 0.08 0.03 0.03 0.03 0.03 0.33 0.34 0.33 0.34 0.33 0.027** 0.037 0.038 1.18** 1.00** 2.16** 0.13 1.16** 0.13 2.16** 0.13 2.16** 0.13 2.16** 0.33 2.15** 0.33 2.15** 0.33 2.14** 0.33 0.014* 0.13 0.04 0.51 0.50 1.54* 1.57* 0.75 2.15** 0.33 2.47** 0.014 0.13 0.04 0.51 0.50 1.54* 1.55* 0.55 2.60** 0.35 2.60** 0.010 0.01 0.13 0.14 1.54* 0.55 1.55* 1.55* 1.55* 1.55* 2.60** 2.60** 0.010 0.01 0.13 0.14 1.55 0.50 1.55* 1.55* 1.55* 1.55* 2.60** 2.60** 0.011 0.11 0.11 0.11 0		Gm.	Mal.	Comb.	Gm.	Mal.	Comb.	Gm.	Mal.	Comb.
0.27** 0.26* 0.83 1.18** 1.00** 2.16** 0.13 1.18** 0.33 3.14** 0.33 0.10 0.11** 0.11* 0.048 0.51 0.50 1.59* 0.75* 2.13** 0.32 2.60** 0.11 0.11* 0.13 0.46 0.53 0.40 2.46* 1.57 2.02* 2.78** 1.10** 0.32 2.60** 0.11 0.04 0.13 0.04 0.24 0.14 0.14 0.15 0.14 0.15 0.14* 0.15 0.14* 0.15 2.04* 1.57* 2.07** 0.15 2.04** 0.11 0.04 0.13 0.14 0.14 0.14 0.15 0.14 0.15 0.14* 0.15 2.04** 2.15** 2.15** 0.15* 2.14** 0.15* 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** 0.15** <t< td=""><td></td><td>0.35</td><td>0.08</td><td>0.21</td><td>-3.82**</td><td>2.98**</td><td>-0.42</td><td>2.88*</td><td>4.31**</td><td>-0.26</td></t<>		0.35	0.08	0.21	-3.82**	2.98**	-0.42	2.88*	4.31**	-0.26
0.16 0.19** 0.17* 0.48 0.51 0.50* 1.59** 0.13** 0.13* 0.13* 0.13* 0.13* 0.13* 0.13* 0.13* 0.14* 0.13* 0.14* 0.13 0.44* 1.55* 1.55* 0.13* 0.13* 0.13* 0.13* 0.14* 0.13 0.04 0.33 0.14* 0.13* 0.14* 0.13* 0.14* 0.13* 0.14* 0.13* 0.14* 0.13* 0.14* 0.13* 0.14* 0.13* 0.14* 0.1			0.14	1.15*	-3.75**	0.73	-1.51**	-3.14**	0.59	0.61
0.14^{4} 0.13 0.46 0.35 0.46^{44} 1.57 2.02^{44} 1.10^{44} 1.94^{44} 0.54 4.03^{44} 0.11 0.04 0.13 0.24 0.13 0.24 0.13 0.24 0.13 0.24 0.13 0.24^{44} 1.57^{44} 1.57^{44} 1.28^{44} 1.08^{44} 2.28^{444} 0.06 0.09 0.01 0.03 0.01 0.03 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.12^{44} 1.69^{44} 1.69^{44} 1.69^{44} 1.83 2.80^{44} 0.101 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.14 0.12^{44} 0.18^{44} 0.26^{44} 1.18^{44} 0.28^{44} 1.18^{44} 0.28^{44} 1.28^{44} 1.04^{44} 1.28^{44} 0.28^{44} 0.101 0.011 0.011 0.011 0.011 0.011 0.12^{44} 0.18^{44} 0.26^{44} 1.28^{44} 0.28^{44} 1.28^{44} 0.28^{44} 0.011		-1.59*	09.0	-0.49	-0.60	-3.65**	-2.13**	-0.32	2.60**	-0.29
0.110.040.040.010.030.0240.130.041.54*0.15*0.032.347**2.15*0.032.347**2.34**0.080.090.010.010.030.150.020.241.04*0.550.261.54**1.64*1.852.86**0.110.12*0.110.510.090.211.71*0.190.053.36**1.54**1.67*1.852.89**0.100.090.090.010.010.010.010.010.140.150.140.151.44*0.260.010.090.010.090.140.150.140.170.291.24*0.281.67*4.14**0.280.010.090.010.090.140.150.140.170.291.24*0.281.67*4.14**0.280.010.090.010.190.160.140.150.190.29*0.281.24*0.281.66**1.67*4.14**0.280.010.010.090.040.160.140.170.170.190.29**0.281.24*1.28*0.661.44**1.28*0.26*1.24*1.24*0.110.11*0.170.190.190.100.190.190.101.24*1.28*0.651.24*1.26*1.24*0.120.140.170.180.181.28*0.181.28*0.	, 	-2.46**	-1.57	-2.02**	2.78**	1.10**	1.94**	0.54	-4.03**	-0.22
0.08 0.00 0.01 0.33 0.01 0.03 0.03 0.02 0.74 1.65** 1.54** 1.66** 1.86 2.80** 0.11 0.12* 0.11 0.51 0.09 0.21 1.71* 0.19 0.59 1.64* 1.85 2.80** 0.11 0.12 0.10 0.57 0.18 0.20 0.09 0.59 0.59 3.56* 1.57* 1.85 2.80** 0.01 0.09 0.01 0.16 0.14 0.15 0.19 0.59 0.59 3.56* 1.57* 1.41* 0.28 0.01 0.01 0.01 0.01 0.14 0.15 0.14 0.15 0.14 0.15 0.14* 1.28* 1.28* 1.44* 0.28 0.01 0.01 0.01 0.01 0.01 0.14 0.15 0.14 1.28* 1.26* 1.44* 0.28 0.11 0.17 0.14 0.15 0.14 0.15 0.14		1.54*	0.75	1.15*	5.39**	-1.15**	2.12**	0.03	-3.47**	0.16
0.11 0.12* 0.11 0.51 -0.09 0.21 -1.71* 0.19 0.95 3.56** 1.28** 1.04* 1.85 2.89** -0.10 -0.09 -0.09 -0.57 0.18 -0.20 -0.09 0.59 0.57 0.18 -0.28 -1.0** -1.4** 0.28 -0.01 -0.09 -0.05 0.16 0.14 0.15 0.19 0.59 0.55 -3.06** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.2** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28 -1.4** 0.28		1.04	-0.65	0.20	4.74**	-1.65**	1.54**	1.88	-2.80**	0.28
-0.10 -0.09 -0.09 -0.57 0.18 -0.20 -0.09 0.04 0.02 $1.67**$ -1.4^{+*} -1.24^{**} -0.28 -0.01 -0.04 -0.02 0.14 0.15 0.14 0.15 0.14 0.15 0.14 0.15 0.14^{**} 0.12 0.16 0.14^{**} 0.12 0.14^{**} 0.12 0.14^{**} 0.12 0.14^{**} 0.12 0.14^{**} 0.12 0.14^{**} 0.12 0.16 0.14^{**} 0.12 0.12 0.22 0.23 0.23 0.23 0.23 0.23 0.23 0.23 0.23 0.23 0.23 0.24 0.12 <		-1.71*	-0.19	-0.95	3.36**	-1.28**	1.04*	1.85	2.89**	-0.01
-0.01 -0.04 -0.02 0.16 0.14 0.15 0.41 0.17 0.12 0.29 $-1.22*$ 0.23 -0.56 $-2.46*$ $-1.22*$ 0.04 0.06 -0.01 -0.09 -0.44 -0.27 $2.10**$ 0.38 $1.24*$ 0.62 -1.26 -1.44 -0.11 -0.07 -0.17 0.03 -0.27 $2.10**$ 0.38 0.12 0.52 0.26 -2.66 -0.11 -0.17 -0.17 0.03 -0.27 $2.07*$ 0.12 $-1.24*$ $1.28*$ 0.48 0.36 $2.80**$ $-0.24*$ -0.11 -0.17 -0.24 -0.24 -0.23 0.03 $-1.25*$ 0.16 0.36 $2.80**$ $-0.24*$ -0.11 -0.17 -0.24 -0.24 -0.23 0.24 0.38 $2.98**$ 0.52 $1.75*$ 0.46 0.36 $2.80**$ $-0.24*$ 0.11 -0.17 0.24 0.12 0.24 0.38 $2.98**$ 0.52 $1.75*$ 0.45 0.16 0.36 0.11 0.09 0.10 0.53 0.24 0.38 $2.98**$ 0.52 $1.54*$ $1.53*$ 2.16 $1.64*$ $0.24*$ $0.14*$ 0.12 0.24 0.26 0.12 $1.78*$ $1.33*$ 0.76 1.63 $5.02*$ 0.12 $0.14*$ 0.19 0.12 0.25 0.26 0.12 $1.24*$ $1.83*$ $2.16*$ $1.24*$ 0.18 0.12 <td< td=""><td><u> </u></td><td>-0.09</td><td>0.59</td><td>0.25</td><td>-3.06**</td><td>-0.28</td><td>-1.67**</td><td>-4.14**</td><td>-0.28</td><td>-0.34</td></td<>	<u> </u>	-0.09	0.59	0.25	-3.06**	-0.28	-1.67**	-4.14**	-0.28	-0.34
0.04 0.06 0.01 0.09 0.04 0.24 0.03 $1.24*$ 0.13 $1.73**$ 0.62 1.26 1.44 0.013 0.01 0.07 0.03 0.07 $2.78*$ 0.10 $1.34*$ $1.28*$ 0.62 1.26 $1.26*$ $2.80**$ 0.13 0.01 0.07 0.03 0.07 $2.78*$ 0.10 $1.134*$ $1.28*$ 0.62 0.16 $2.80**$ 0.11 0.07 0.07 0.03 0.03 0.03 0.03 $2.53**$ 0.03 $1.35*$ 2.16 $1.54*$ 0.11 0.09 0.10 0.53 0.24 0.38 $2.53**$ 0.03 $1.25*$ $1.54*$ $1.28*$ $1.53*$ 2.16 $6.45**$ 0.11 0.09 0.10 0.53 0.24 0.38 $2.98**$ 0.52 $1.76*$ $1.53*$ 2.16 1.35 0.96 0.11 0.09 0.00 0.00 0.00 0.00 0.00 0.00 1.35 0.30 1.35 0.96 $1.64*$ $0.24*$ $0.14*$ $0.19**$ 0.67 0.09 0.23 $1.24*$ $1.33*$ $3.35**$ 0.76 1.63 $5.02**$ 0.12 $0.14*$ $0.19**$ 0.67 0.09 0.23 $1.36*$ $1.33*$ $3.35**$ 0.76 1.64 $0.24*$ $0.14*$ $0.14*$ $0.19**$ 0.67 $1.78*$ $1.33*$ 2.16 $1.64*$ $0.24*$ $0.14*$ $0.14*$ $0.$		0.41	0.17	0.29	-1.22*	0.23	-0.50	-2.46*	-4.12**	0.32
-0.01 -0.07 -0.17 0.03 -0.07 $-2.78**$ 0.10 $-1.34*$ $1.28*$ 0.48 0.36 $2.80**$ -0.11 $-0.17*$ -0.24 $-0.61*$ -0.43 $-2.53**$ 0.03 $-1.25*$ $-1.78**$ $-1.53**$ 2.16 $6.45**$ -0.11 $-0.17*$ -0.24 $-0.61*$ -0.43 $-2.53**$ 0.03 $-1.25*$ $-1.58**$ $-1.53**$ 2.16 $6.45*$ 0.09 0.10 0.53 0.24 0.38 $2.98**$ 0.52 $1.75**$ -0.30 1.35 0.96 0.04 -0.03 -0.03 -0.24 0.03 $1.78*$ -1.31 $1.54**$ $-1.83**$ $2.35**$ 0.76 1.63 $5.02**$ 0.04 -0.03 -0.67 0.17 $-1.78**$ 0.15 -0.15 -0.30 1.35 0.96 $1.64*$ $0.14*$ $0.19**$ 0.67 0.09 0.23 1.32 0.37 $1.54*$ $-1.83*$ $2.35**$ 0.76 1.63 $5.02**$ $0.14*$ $0.19**$ 0.67 0.09 0.23 1.69 0.13 1.19 0.26 1.32 0.76 1.63 $5.02*$ $0.14*$ $0.19**$ 0.67 0.09 0.23 1.67 0.12 1.19 0.26 1.23 2.04 2.04 $0.14*$ $0.19**$ 0.12 0.12 0.12 0.12 1.03 1.19 2.29 1.66 0.12 0.13 0.12 0.12		2.10**	0.38	1.24*	-0.48	1.73**	0.62	-1.26	-1.44	0.04
-0.24** $-0.17*$ -0.24 $-0.61*$ -0.43 $-2.53**$ 0.03 $-1.25*$ $-1.28**$ $-1.53**$ 2.16 $6.45**$ 0.11 0.09 0.10 0.53 0.24 0.38 $2.98**$ 0.52 $1.75**$ -0.45 -0.15 -0.30 1.35 0.96 -0.11 0.09 0.10 0.53 0.24 0.38 $2.98**$ 0.52 $1.75**$ -0.45 -0.30 1.35 0.96 -0.11 0.09 0.09 0.67 0.03 $2.98**$ 0.52 $1.75**$ -0.45 -0.30 1.35 $5.02**$ $-0.14*$ $0.19**$ 0.67 0.09 0.29 $2.35**$ 0.37 $1.36*$ -0.55 -1.163 $5.02*$ $0.24**$ 0.12 $0.19**$ 0.67 0.09 0.29 $2.35**$ 0.37 $1.36*$ -0.55 $-1.15**$ -0.89 $1.6*$ $0.24**$ 0.12 $0.19**$ 0.67 0.09 0.29 $2.35**$ 0.37 $1.36*$ -0.55 $-1.16*$ -1.63 $0.24**$ 0.12 $0.19**$ 0.67 0.09 0.29 1.32 0.76 $1.6*$ -1.63 -1.66 $0.24**$ 0.12 $0.19**$ 0.67 0.69 $1.78*$ $1.36*$ 0.75 1.101 2.29 1.56 $0.24**$ 0.12 $0.19**$ 0.19 0.12 $0.19**$ 0.12 0.12 1.101 1.29 2.04 $0.24**$ 0.12 0.19 </td <td></td> <td>-2.78**</td> <td>0.10</td> <td>-1.34*</td> <td>1.28*</td> <td>0.48</td> <td>0.88</td> <td>0.36</td> <td>-2.80**</td> <td>-0.59</td>		-2.78**	0.10	-1.34*	1.28*	0.48	0.88	0.36	-2.80**	-0.59
0.11 0.09 0.10 0.53 0.24 0.38 $2.98**$ 0.52 $1.75**$ 0.45 0.16 1.35 0.96 0.96 -0.10 0.04 -0.03 -0.46 $0.80**$ 0.17 $1.78**$ 1.31 $1.54**$ $1.83**$ 0.76 1.63 $5.02**$ $0.14*$ $0.19*$ 0.67 0.09 0.29 $2.35**$ 0.13 $1.36*$ 1.63 2.63 1.63 $5.02*$ $0.24**$ $0.19*$ $0.03*$ 0.67 0.09 0.29 $2.35**$ 0.37 $1.36*$ $1.83**$ 0.76 1.63 $5.02*$ $0.24**$ $0.19*$ $0.03*$ 0.67 0.29 $2.35**$ 0.37 $1.36*$ $1.83*$ 0.76 1.63 $5.02*$ $0.24**$ $0.14*$ $0.19*$ 0.67 0.29 0.23 0.2 0.23 $1.36*$ 1.30 1.53 1.63 $5.02*$ $0.24**$ 0.16 0.19 0.23 0.67 1.09 0.23 $1.36*$ 1.63 1.63 $5.02*$ $0.24**$ $0.14*$ 0.19 0.23 1.26 1.29 1.26 1.19 2.29 1.63 2.04 $0.24**$ 0.16 0.19 0.23 0.67 1.03 1.26 1.76 1.12 1.26 1.56 1.26 1.26 $0.24**$ 0.19 0.23 0.23 1.04 1.02 1.29 1.29 1.29 1.29 2.04 2.04 0.24 0.12		-2.53**	0.03	-1.25*	-1.78**	-1.28**	-1.53**	2.16	6.45**	-0.34
-0.10 0.04 -0.03 -0.46 0.80** 0.17 -1.78** -1.31 -1.54** -1.83** 3.35** 0.76 -1.63 5.02** 0.24** 0.14* 0.19** 0.67 -0.09 0.29 2.35** 0.37 1.36* -0.65 -1.63 5.02** 5.02** 0.24** 0.14* 0.19** 0.67 -0.09 0.29 2.35** 0.37 1.36* -0.85 1.189 6.16** 0.24* 0.12 0.19 - 0.53 0.65 1.32 - 1.19 1.39 2.09 5.02** 0.24 0.19 0.19 - 0.51 0.86 1.76 - 1.49 1.33 1.01 2.29 1.56 0.28 0.19 0.19 - 0.51 0.86 1.76 - 1.49 1.33 3.07 2.09 1.56 0.28 0.19 0.29 1.30 1.29 1.59 1.56 3.69 3.69 </td <td></td> <td>2.98**</td> <td>0.52</td> <td>1.75**</td> <td>-0.45</td> <td>-0.15</td> <td>-0.30</td> <td>1.35</td> <td>96.0</td> <td>0.78</td>		2.98**	0.52	1.75**	-0.45	-0.15	-0.30	1.35	96.0	0.78
0.24** 0.14* 0.19** 0.67 -0.09 0.29 2.35** 0.37 1.36* -0.55 -1.15** -0.85 1.89 6.16** 0.18 0.12 0.15 - 0.53 0.65 1.32 - 1.13 1.19 0.82 1.01 2.29 1.56 0.24 0.16 0.19 - 0.53 0.65 1.76 - 1.13 1.19 0.82 1.50 1.56 0.24 0.16 0.19 - 0.71 0.86 1.76 - 1.49 1.59 1.10 2.29 1.56 0.28 0.19 - 0.84 1.03 2.08 - 1.78 1.89 1.33 3.07 2.09 0.28 0.19 - 0.84 1.03 2.08 - 2.36 3.63 2.46 0.28 0.31 - 1.16 2.78 - 2.36 1.76 3.69 3.66 3.79		-1.78**	-1.31	-1.54**	-1.83**	3.35**	0.76	-1.63	-5.02**	-0.52
0.18 0.12 0.15 - 0.53 0.655 1.32 - 1.19 0.82 1.01 2.29 0.24 0.16 0.19 - 0.71 0.86 1.76 - 1.49 1.59 1.01 1.33 3.07 0.28 0.19 0.23 - 0.84 1.03 2.08 - 1.49 1.59 1.10 1.33 3.07 0.28 0.19 0.23 - 0.84 1.03 2.08 - 1.78 1.30 1.59 3.63 0.28 0.31 - 0.84 1.03 2.08 - 2.36 2.17 4.86 0.23 0.19 - 0.13 2.08 1.06 1.30 1.59 3.63 0.23 0.19 - 0.13 2.06 1.76 2.17 2.16 2.16 2.16 2.16 2.16 2.16 2.16 2.16 2.16 2.16 2.16 2.16 2.16 <td></td> <td>2.35**</td> <td>0.37</td> <td>1.36*</td> <td>-0.55</td> <td>-1.15**</td> <td>-0.85</td> <td>1.89</td> <td>6.16**</td> <td>0.38</td>		2.35**	0.37	1.36*	-0.55	-1.15**	-0.85	1.89	6.16**	0.38
0.24 0.16 0.19 - 0.71 0.86 1.76 - 1.49 1.59 1.10 1.33 3.07 0.28 0.19 0.23 - 0.84 1.03 2.08 - 1.78 1.86 1.30 1.59 3.63 0.28 0.19 0.23 - 0.84 1.03 2.08 - 1.78 1.59 3.63 0.38 0.15 0.31 - 1.12 1.36 2.78 - 2.36 2.52 1.74 2.11 4.86 0.23 0.15 0.19 - 0.684 1.69 - 1.46 1.54 1.06 1.30 2.96 0.31 0.20 0.25 - 0.691 1.11 2.27 - 1.46 1.66 1.30 2.96 3.96		1.32	ı	1.13	1.19	0.82	1.01	2.29	1.56	,
0.28 0.19 0.23 - 0.84 1.03 2.08 - 1.78 1.30 1.59 3.63 0.38 0.25 0.31 - 1.12 1.36 2.78 - 2.36 2.11 4.86 0.38 0.25 0.31 - 1.12 1.36 2.78 - 2.36 2.52 1.74 2.11 4.86 0.23 0.19 - 0.68 0.84 1.69 - 1.46 1.54 1.06 1.30 2.96 0.31 0.20 0.25 - 0.91 1.11 2.27 - 1.93 2.06 1.72 3.96		1.76	ı	1.49	1.59	1.10	1.33	3.07	2.09	•
0.38 0.25 0.31 - 1.12 1.36 2.78 - 2.36 2.52 1.74 2.11 4.86 0.23 0.15 0.19 - 0.68 0.84 1.69 - 1.46 1.54 1.30 2.96 0.31 0.20 0.25 - 0.61 1.69 - 1.46 1.54 1.06 1.30 2.96 0.31 0.20 0.25 - 0.91 1.11 2.27 - 1.93 2.06 1.72 3.96		2.08	ı	1.78	1.88	1.30	1.59	3.63	2,46.	I
0.23 0.15 0.19 - 0.68 0.84 1.69 - 1.46 1.54 1.06 1.30 2.96 0.31 0.20 0.25 - 0.91 1.11 2.27 - 1.93 2.06 1.42 1.72 3.96		2.78	•	2.36	2.52	1.74	2.11	4.86	3.29	•
0.31 0.20 0.25 - 0.91 1.11 2.27 - 1.93 2.06 1.42 1.72 3.96		1.69	1	1.46	1.54	1.06	1.30	2.96	2.01	•
		2.27	1	1.93	2.06	1.42	1.72	3.96	2.69	ł
*, ** Significant at 0.05 and 0.01 levels of probability, respectively.			1.03 1.36 0.84 1.11	1.03 2.08 1.36 2.78 0.84 1.69 1.11 2.27	1.03 2.08 - 1.36 2.78 - 0.84 1.69 - 1.11 2.27 -	1.03 2.08 - 1.78 1.36 2.78 - 2.36 0.84 1.69 - 1.46 0.84 1.69 - 1.93 1.11 2.27 - 1.93	1.03 2.08 - 1.78 1.88 1.36 2.78 - 2.36 2.52 0.84 1.69 - 1.46 1.54 1.11 2.27 - 1.93 2.06	1.03 2.08 - 1.78 1.88 1.30 1.36 2.78 - 2.36 2.52 1.74 0.84 1.69 - 1.46 1.54 1.06 1.11 2.27 - 1.93 2.06 1.42	1.032.08-1.781.881.301.591.362.78-2.362.521.742.110.841.69-1.461.541.061.301.112.27-1.932.061.421.72	1.03 2.08 - 1.78 1.88 1.30 1.59 3.63 1.36 2.78 - 2.36 2.52 1.74 2.11 4.86 0.84 1.69 - 1.456 1.54 1.06 1.30 2.96 1.11 2.27 - 1.93 2.06 1.42 1.72 3.96

Table 5. Estimates of specific combining ability effects of yellow maize crosses for five studied traits at two locations and their combined

II.7 COMBINING ABILITY ESTIMATES FOR GRAIN YIELD AND ITS COMPONENTS OF YELLOW MAIZE INBRED LINES

4 – Superiority percentage

The superiority over the three checks (S.C. 162, S.C. 164 and S.C. 166) relative to the average of the two locations is presented in Table 6. For ear diameter, three crosses out of fifteen ones i.e., $(P_2 \times P_4)$, $(P_4 \times P_5)$ and $(P_5 \times P_6)$ exhibited their superiority relative to the check cultivar (S.C.162), where the values of these crosses were significant in positive direction. With regard to no. of rows ear⁻¹, the cross; ($P_4 \times P_4 \times P_4$) P_5) was significant in positive superiority percentage over the three checks, while the crosses; $(P_2 \times P_4)$, $(P_2 \times P_6)$, $(P_4 \times P_6)$ and $(P_5 \times P_6)$ was significantly increased in rows ear⁻¹ than the check cultivar (S.C.162). For no. of kernels row⁻¹, all the significant values of superiority percentage were in negative direction, which means that no. of kernels row⁻¹ of the cross-plant was significantly less than that of the check cultivars. Concerning 100-kernel weight, the crosses; $(P_1 \times P_5)$ and $(P_1 \times P_6)$ exhibited its superiority over the check cultivars (S.C.162 and S.C.166) for the trait in view. For grain yield, the results pointed out that, the crosses; $(P_1 \times P_2)$, $(P_2 \times P_4)$, $(P_3 \times P_6)$ and $(P_5 \times P_6)$ had its superiority percentage over the three checks, where its values were highly significant in positive direction and the crosses; $(P_1 \times P_4)$, $(P_2 \times P_3)$ and $(P_4 \times P_5)$ significantly exceeded grain yield than the two checks i.e., (S.C.164) and (S.C.166). However, all crosses had superior percentage in grain yield over the check cultivar (S.C.164). Results were in good agreement with those reported by EL-Kielany (1999), Rana and Kumar (2001), Hammouda (2002), Singh et. al. (2002), Unay et. al. (2004), EL-Hosary and EL-Badawy (2005), Mousa (2014) and Osman (2014). They compared their crosses with check cultivars and came up to the same conclusions.

	averag	te perfori	nance ac	average performance across locations, 2010.	ions, 201	0.				0.						
	L'OEC		Ear diameter		NG	No. of rows ear ⁻¹	-1	No.	No. of kernels row ⁻¹	W ⁻¹	100-	100-kernel weight (g)	t (g)	Grain	Grain yield (ard. fed. ⁻¹)	d. ⁻¹)
	\$\$0D	S.C 162	S.C 164	S.C 166	S.C 162	S.C 164	S.C 166	S.C 162	S.C 164	S.C 166	S.C 162	S.C 164	S.C 166	S.C 162	S.C 164	S.C 166
	P1 * P2	2.06	-1.98	00.0	3.58	-0.33	0.67	-9.06**	-7.77**	-10.25**	0.68	-6.15**	-0.80	17.60**	38.50**	25.82**
	P1 * P3	3.71	-0.40	1.62	5.16	1.19	2.21	-10.81**	-9.54**	-11.98**	-5.46**	-11.87**	-6.85**	-1.89	15.56**	4.97
	P ₁ * P ₄	-1.44	-5.35*	-3.43	0.34	-3.44	-2.47	-9.22**	-7.93**	-10.41**	-4.30*	-10.79**	-5.70**	6.06	24.91**	13.47**
	P ₁ * P ₅	-1.03	-4.95 **	-3.03	0.00	-3.77	-2.81	-16.06**	-14.87**	-17.17**	5.60**	-1.56	4.05*	-5.55	11.24*	1.05
	P1 * P6	3.09	-0.99	1.01	1.51	-2.32	-1.34	-7.59**	-6.28**	-8.80**	7.11**	-0.15	5.54**	0.98	18.93**	8.04
	P ₂ * P ₃	0.00	-3.96	-2.02	0.48	-3.31	-2.34	-12.26**	-11.01**	-13.41**	0.57	-6.25**	-0.91	7.18	26.24**	14.67**
	P ₂ * P ₄	6.19**	1.98	4.04	9.08**	4.97	6.02	-9.53**	-8.24**	-10.71**	2.03	-4.89**	0.53	16.62**	37.35**	24.77**
	P ₂ * P ₅	1.65	-2.38	-0.40	5.30	1.32	2.34	**66.6-	-8.71**	-11.18**	-6.41**	-12.76**	-7.78**	-1.12	16.45**	5.78
	P ₂ * P ₆	3.71	-0.40	1.62	. 7.71**	3.64	4.68	-8.83**	-7.53**	-10.02**	-2.22	-8.85**	-3.65*	1.38	19.40**	8.46
	P3 * P4	0.00	-3.96	-2.02	1.03	-2.78	-1.81	-8.36**	-7.06**	-9.56**	-2.27	-8,90**	-3,70*	1.31	19.32**	8.39
	P3 * P5	-1.44	-5.35**	-3.43	1.38	-2.45	-1.47	-17.63**	-16,46**	-18.71**	-2.68	-9.28**	-4.10*	0.62	18.50**	7.65
	P3 * P6	-3.09	-6.93**	-5.05**	-1.03**	-4.77	-3.81	-16.34**	-15.16**	-17.44**	-8.17**	-14.39**	-9.51**	27.10**	49.70**	35.99**
	P4 * P5	5.77 **	1.58	3.64	9.98**	5.83*	6.89*	-5.02**	-3.67*	-6.27**	-3.06	-9.63**	-4.48*	8.42	27.69**	15.99**
	P4 * P6	3.71	-0.40	1.62	8.60**	4.50	5.55	-11.63**	-10.37**	-12.79**	0.73	-6.10**	-0.75	-1.42	16.11**	5.47
	P ₅ * P ₆	7.84 **	3.56	5.66 **	8.40**	4.30	5.35	-8.13**	-6.82**	-9.33**	-4.60*	-11.07**	-6.00**	24.13**	46.20**	32.80**
LS	0.05		0.19			0.84			1.46			1.30			2.49	
)	0.01		0.25			1.11			1.93			1.72			3.29	

Table 6. Superiority percentages of yellow maize crosses relative to check hybrids (S.C. 162, 164 and S.C. 166) for studied traits, based on

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II.7 COMBINING ABILITY ESTIMATES FOR GRAIN YIELD AND ITS COMPONENTS OF YELLOW MAIZE INBRED LINES

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

REFERENCES

- Abd El-Hadi, A.H., Kawther S. Kash, A.A. El-Shenawy and I.A. El-Gazzar. 2005. Combining ability and heterosis in maize (Zea mays L.). Egypt. J. Genet. Cytol., 34(2):123-134.
- 2. Abd El-Mottalab, A.A. and H.A.A. Gamea. 2014. Combining ability analysis in new white maize inbred lines ((Zea mays L.), Minufiya J. Agric. Res., 39:143-151.
- Akbar, M., M. Saleem, F. Muhammad, M.K. Ashraf, R.A. Ahmad. 2008. Combining ability analysis in maize under normal and high temperature conditions. J. of Agric. Res. (Lahore). 46(1):27-38.
- Barakat, A.A., M.A.A. El-Moula, A.A. Ahmed. 2003. Combining ability for maize grain yield and its attributes under different environments. Assiut Journal of Agricultural Sciences, 34(3):15-25.
- 5. Dawood, M.I., M.T. Diab, Sh.A. El-Shamarka and A.A. Ali. 1994. Heterosis and combining ability of some new inbred lines and its utilization in maize hybrid breeding program. Minufiya J. Agric. Res., 19(2):1065-1076.
- EL-Hosary, A.A. and M.EI.M. EI-Badawy. 2005. Heterosis and combining ability in yellow corn (Zea mays L.) under two nitrogen levels. The 11th Conf. Agron., Agron. Dep., Fac. Agric., Assiut Univ., 89-99.
- El-Kielany, M.E.M. 1999. Evaluation of some new inbred lines of maize (Zea mays L.). Ph. D. Thesis, Fac. Agric., Moshtohor, Zagazig Univ. Egypt.
- El-Shenawy, A.A. 2005. Combining ability of prolific and non-prolific maize inbred lines in their diallel crosses for yield and other traits. J. Agric. Res. Tanta Univ., 31(1):16-31.
- 9. Griffing, B. 1956. Concept of general and specific combining ability in relation to diallel crossing system. Austrian J. Biol. Sci., 9:463-493.
- 10. Hallauer, A.R. and J.B. Miranda. 1981. Quantitative Genetics in Maize Breeding. Tawastate Univ. Press. USA.
- 11. Hammouda, A.E.H. 2002. Genetic behavior of some quantitative traits in maize (Zea mays L.). M.Sc. Thesis, Fac. Agric. Moshtohor, Zagazig Univ., Egypt.
- Kabdal, M.K., S.S. Verma, A. Kumar, and U.B.S. Panwar. 2003. Combining ability and heterosis analysis for grain yield and its components in maize. Indian J. of Agric. Res., 37(1):39-43.
- Mosa, H.E. 2003. Heterosis and combining ability in maize (Zea mays L.). Minufiya J. Agric. Res., 28(5-1):1375-1386.
- Mosa, H.E. and Amer. 2004. A diallel analysis among maize inbred lines for resistance to pink stem borer and grain yield under artificial infestation and non infestation. Annals of Agric. Sci., Moshtohor, 42(2):449-459.
- 15. Motawei A.A. 2005. Combining ability and heterotic effect of nine maize inbred lines via diallel cross analysis. Minufiya J. Agric. Res., 30 (1):197-214.

- 16. Motawei, A.A. 2006. Gene action and heterosis in diallel crosses among ten inbred lines of yellow maize across various environments. Egypt. J. Plant Bred. 10(1):407-418.
- 17. Mousa, S.Th.M. 2014. Diallel analysis for physiological traits and grain yield of seven white maize inbred lines. Alex. J. Agric. Res., 59 (1):9-17.
- 18. Nigussie, M. and H. Zelleke. 2001. Heterosis and combining ability in a diallel among eight elite maize populations. African Crop Science Journal,9 (3):471-479.
- 19. Osman, M.M.A. 2014. A diallel analysis among seven newly yellow maize inbred lines for grain yield and other agronomic traits. Egypt. J. of Appl. Sci., 29(1):1-12.
- Osman, M.M.A., kh.A.M. Ibrahim and M.A. El-Ghonemy. 2012. Diallel analysis of grain yield and some other traits in yellow maize (Zea mays L.) inbred lines. Assiut J. Agric. Sci., 43 (6):16-26.
- 21. Rana, M.K., V. Kumar. 2001. Heterosis for quantitative characters in maize under hilly conditions of Himachal Pradesh. New Botanist. 28 (1/4):13-19.
- 22. Singh, P.K. and A.K. Roy. 2007. Diallel analysis of inbred lines in maize. Int. J. of Agric. Sci., 3 (1):213-216.
- 23. Singh, P.K., L.B. Chauhdary and S.A. Akhtar. 2002. Heterosis in relation to combining ability in maize. J. Res. Birsa Agric. Univ., 14 (1):37-43.
- 24. Snedecor, G.W. and W.G. Cochran. 1967. Statistical Methods of 6th ed. Iowa State University Press, Ames, Iowa, U.S.A.
- Soliman, M.S.M., Fatma A.E. Nofal and M.E.M. Abd El-Azeem. 2005. Combining ability for yield and other attributes in diallel cross of some yellow maize inbred lines. Minufiya. J. Agric. Res., 30(6):1767-1781.
- 26. Sprague, G.F. and L.A. Tatum. 1942. General versus specific combining ability in single crosses of corn. J. American Soc. Agron., 34:923-932.
- 27. Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. McGraw Hill Book Company, Inc., New York.
- 28. Unay, A., H. Basal, C. Konak. 2004. Inheritance of grain yield in a half-diallel maize population. Turkish J. of Agric. and Forest, 28(4):239-244.
- 29. Venugopal, M., N.A. Ansari, N.V. Rao. 2002. Combining ability studies in maize. An. of Agric. Res., 23(1):92-95.
- 30. Yousif, D.P., H.C. Ali and R.H. Baker. 2003. Estimation of heterosis and combining ability in local maize inbred lines. Dirasat. Agric. Sci., 30(2):246-259.
- 31. Zelleke, H. 2000. Combining ability for grain yield and other agronomic characters in inbred lines of maize. Indian J. of Gen. & Pla. Breed., 60:1, 63-70.

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٢-٧ تقدير القدرة على التآلف لمحصول الحبوب ومكوناته في سلالات
من الذرة الشامية الصفراء المرباة داخليا

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تم التهجين بين ست سلالات من الذرة الشامية الصغراء مرباة داخليا بنظام التهجين النصف دائري في الموسم ٢٠٠٩ بمزرعة محطة البحوث الزراعية بالجميزة حيث تم الحصول على ١٥ هجينًا. و في موسم ٢٠١٠ تم تقييم الهجن الناتجة و معها ثلاثة هجن فرديه صفراء وهي هجين فردي ١٦٢، هجين فردي ١٦٤ وهجين فردي ١٦٦ في موقعين هما محطة البحوث الزراعية بالجميزة بوسط الدلتا ومحطة البحوث الزراعية بملوي بمصر الوسطى باستخدام تصميم القطاعات كاملة العشوائية في أربعة مكررات. وتم تقدير القدرة العامة والخاصة على التآلف طبقا لنموذج جريفيج الموديل الأول الطريقة الرابعة. كان متوسط مجموع مربعات الانحرافات للمواقع والهجن عالى المعنوية لجميع الصفات ماعدا غدد الصفوف بالكوز وكان متوسط مجموع مربعات الانحر افات للتفاعل بين الهجن والمواقع معنويا لجميع الصفات عدا قطر الكوز وعدد الصفوف بالكوز. كان متوسط مربعات الانحرافات لكل من القدرة العامة والخاصة على التآلف معنويا لجميع الصفات في كلا الموقعين والتحليل الضام بينهما بما يشير إلى أن كلا من الجينات المضيفة وغير المضيفة تؤثر فى توريث الصفات المدروسة. كانت النسبة بين متوسط مجموع مربعات الانحرافات للقدرة العامة على التألف إلى القدرة الخاصة على التألف يزيد عن الواحد الصحيح لصفات عدد الصفوف بالكوز وعدد الحبوب بالصف في كلا الموقعين والتحليل الضمام بينهما، بينما كانت نفس النسبة أقل من الواحد الصحيح لصفات قطر الكوز ووزن المائة حبة ومحصول الحبوب للفدان في كلا الموقعين والتحليل الضام بينهما مما يدل على أن الجينات المضيفة والمضيفة × المضيفة كانت تلعب دورا هاما في توريث الصفات في الحالة الأولى بينما الجينات غير المضيفه كانت الأكثر تأثيرًا في توارث صفات الحالة الثانية. كانت السلالة رقم ٢ ذات قدرة ائتلافية عامة عالية لصفات عدد الحبوب بالصف ووزن المائة حبة في الجميزة بينما كانت السلالة رقم ٤ ذات قدرة ائتلافية عامة عالية. لصفات عدد الصفوف بالكوز ووزن المائة حبة في ملوي وعدد الحبوب بالصف في موقع الجميزة. كانت الهجن (١ × ٣) و (٥ × ٦) ذات قدرة ائتلافية خاصة معنوية لصفة قطر الكوز في كلا الموقعين والتحليل المشترك بينهما ولصفة عدد الحبوب بالصف لموقع الجميزة والتحليل المشترك ولصفة محصول الحبوب للفدان في ملوي. أظهر الهجين (١ × ٥) قدرة ائتلافية خاصة معنوية لصفة وزن المائة حبة في كلا الموقعين والتحليل المشترك بينهما والهجين بين السلالتين (١ × ٦) لصفتي عدد الحبوب بالصف ووزن المائة حبة في الجميزة والتحليل المشترك. تفوقت الهجن (١ × ٢) ، (٢ ×٤) ،(٣ × ٦) و (٥ × ٦) معنويا على الهجن الفردية الثلاثة المستخدمة للمقارنة لصفة محصول الحبوب للفدان.

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