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COMBINING ABILITY FOR SOME YELLOW MAIZE INBRED LINES BY DIALLEL CROSSES

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ABSTRACT

Eight yellow maize inbred lines (L 730, L 731, L 739, L 743, L 744, L 745, L 746 and L 749) were planted at Gemmeiza Research Station, and were crossed in a diallel cross system during the growing season 2009. The 28 crosses and two check hybrids (SC 162 and SC 166) were evaluated at Gemmeiza and Sids Agricultural Research Stations during 2010 growing season. Data were collected on number of days to 50% silking (day), plant and ear heights (cm), resistance to late wilt disease and grain yield (ton/ha) and analyzed according to Griffing (1956) method-4 model-1fixed model for each location and their combined performance. Locations mean squares were significant for all studied traits, except for number of days to 50% silking. Variations of genotypes (G) and their partitions; crosses (Cr), checks (Ch) and Cr vs Ch were significant for most traits, except some partitions for all the studied traits under the two locations and their combined performance, as well as their interactions with locations were significant for mean squares of most partitions. These results indicated that the genotypes and their different partitions differed in their performances from location to another for all the studied traits. GCA and SCA mean squares for each location and their combined were significant for all the studied traits, except for plant height and SCA for ear height under Gemmeiza and resistance to late wilt disease under the two locations and their combined performance. Moreover, interactions GCA and SCA with locations were significant for all the studied traits, except for resistance to late wilt disease under the combined performance only, indicating that additive and non-additive effects were important in the inheritance of the studied traits. On the other hand, the ratio of $\boldsymbol{\delta}^2$ GCA / $\boldsymbol{\delta}^2$ SCA was greater than unity for most studied traits, indicating an importance of additive gene effects in the inheritance of studied traits. While, the ratio $\boldsymbol{\delta}^2$GCA x loc/$\boldsymbol{\delta}^2$SCA x loc indicated an important both additive and non-additive effects in the expression of these studied traits, Moreover, the additive and non-additive effects were more interacted by environmental conditions (locations) under this study . The inbred line L 743 seemed to be a good combiner for earliness, inbred line L 749 was the best combiner for shorter plants and lower ear placement, inbred line L 730 exhibited desirable GCA effects for resistance to late wilt and grain yield, also the inbred line L739 gave positive and desirable GCA effects for grain yield (ton/ha). Three crosses i.e. 1x8, 1x4 and 3x5 (10.21, 10.11 and 9.91 ton/ha) significantly out-yielded the check hybrid SC162 9.12 ton/ha by (11.95, 10.90 and 8.70 %, respectively). These crosses are considered promising comparing with the check hybrid SC162 under this study.

Keywords: Combining ability, Superiority, Diallel , GCA , SCA, Maize.

INTRODUCTION

Maize (*Zea mays* L.) is one of the major cereal crops in the world and the production area of maize is gradually increased. New maize hybrids need to be higher yielding to meet the demand of maize producers. The concept of general (GCA) and specific (SCA) combining ability was introduced by Sprague and Tatum (1942) and its mathematical modeling was set by Griffing (1956) in his classical paper in conjunction was the diallel crosses. Diallel cross analysis have been widely used to investigate the inheritance of important traits for a set of genotypes. It was devised to investigate the combining ability of the parental lines for the purpose of identifying superior parents for use in hybrid development programs. El- Zeir *et al.*(1999) and Ibrahim (2001) found that SCA effects were higher than GCA effects for grain yield, while, Mahmoud (1996), Soliman and sadek (1999) found that the additive effects played important role in the inheritance most studied traits comparing with non-additive effects. El-Shouny *et al.* (2003) reported that GCA and SCA mean squares were highly significant for grain yield trait.

Economic Superiority of new and promising hybrids relative to the commercial check for grain yield trait (ton/ha) was reported by Venugopal *et al.* (2002) , Yang *et al.* (2003) and Motawie and Mosa (2009) The objectives of this study were to estimate general combining ability of inbred lines herein yellow and specific combining ability for new crosses, their interaction with locations and to identify superior parental lines, promising crosses for grain yield and resistance to late wilt in an 8x8 half-diallel of maize.

MATERIALS AND METHODS

Eight (S_6) yellow maize inbred lines were used for the purpose of current research. Their names and it's sources are presented in Table (1).

Table 1: Names and sources of the inbred lines used in this study

No.	Name	Sources
1	L 730 -P1	Comp- # 45-Egypt
2	L 731 -P2	Comp- # 45-Egypt
3	L 739 -P3	Gm. Y. -Egypt
4	L 743 -P4	Gm. Y.- Egypt
5	L 744 -P5	Comp. # 21-Egypt
6	L 745 -P6	Comp. # 21-Egypt
7	L 746 -P7	CIMMYT-POP. 31
8	L 749 -P8	CIMMYT- POP. 41

All possible combinations, without reciprocals, were made between the eight inbred lines at Gemmeiza Agricultural Research Station in 2009 season. The 28 single crosses and two check hybrids (SC 162 and SC 166) were evaluated in 2010 growing season at two locations, Gemmeiza and Sids Agricultural Research Stations.

A randomized complete block design with four replications was used at each location. Plot size was one row, 6 m long and 80 cm width. Sowing was made in hills spaced at 25cm along the row. All agricultural practices were applied as recommended for maize cultivation. Data were recorded for grain yield (ton/ha) and adjusted to 15.5% moisture content, number of days to 50% silking, plant height (cm), ear height (cm) and resistance to late wilt disease (%) caused by Cephalosporium maydis. The analysis of variance was done for every location and for combined data across locations according to Snedecor and Cochran (1967) .

The genetic analysis for the diallel crosses was computed according to Method - 4 model -1 (fixed model) of Griffing (1956) for all studied traits.The hybrid effects was assumed to be fixed while; the locations effect was considered random. Superiority of promising hybrids over the commercial check.

(Sup %) for grain yield was computed according to Meredith and Bridge (1972)

as follows :- **Sup. =** $(\bar{F}_1 - \bar{Mch} / \bar{Mch}) \times 100$

Where : $\bar{F}_1$ is the mean value of promising hybrid and $\bar{Mch}$ is the mean value of the check.

RESULTS AND DISCUSSION

Analysis of variance of the studied traits for both locations and their combined performance are peresented in Table (2). Locations mean squares were significant for all the studied traits, except for number of days to 50% silking, these results agreed with that obtained by Soliman *et al.* (1995) and El-Zeir *et al.* (1999). Variations of genotypes (G) and their partitions; crosses (Cr), checks (Ch) and Cr vs Ch were significant for all the studied traits under both locations and their combined, except for their partitions such as crosses for ear height under Gemmeiza and resistance to late wilt under the two locations and their combined performance, checks mean squares were not significant for days to 50% silking under Sids location, resistance to late wilt and grain yield (ton/ha) under the two locations and their combined , where they were not significant. While the interaction of genotypes and their partitions with locations were significant, except Ch x loc for the all studied traits under the combined performance. These results indicated that the genotypes and their partitions differed in their performances from location to another for most the studied traits. These results are in agreement with Morshed *et al.* (1990), Amer (2002 and 2003). On the other hand, mean squares both GCA and SCA were significant for all the studied traits, except for plant height and SCA only for ear height under Gemmeiza location, also resistance to late wilt disease was not significant under the two locations and their combined performance across locations, indicating that the additive and non-additive effects are important for the inheritance of the studied traits as reported by El-Ghonemy and Ibrahim (2010), while the interaction between GCA and SCA with locations was significant to express an importance both additive and non-additive effects for all the studied traits, except resistance to late wilt disease under combined data. On the other side, the ratio of δ^2 GCA /δ^2 SCA was greater than unity for 50% silking date, plant height and ear height under both locations and their combined performance, while, the ratio of resistance to late wilt trait under their combined and grain yield (ton/ha) under Gemmeiza location and the combined performance were greater than unity, indicating an importance of additive gene effects in the inheritance of these studied traits under this study. These results are in agreement with El-Hosary (1989), El-Hosary *et al.* (1990), El-Shamarka *et al.* (1994) and Amer (2002). While, the ratio δ^2 GCA /δ^2 SCA was less than unity for resistance to late wilt under the two locations and grain yield under Sids location only, indicating that the non-additive gene effects were important in the inheritance of these traits as reported by Amer *et al.* (1998) and Motawei and Mosa (2009) .

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Table 2. Cont :

Source of variance	df	Resistance to late wilt %			Grain yield (ton /ha)		
		Gm	Sd	Com	Gm	Sd	Com
Location (Loc)	1	-	-	5655.11**	-	-	164.244**
Rep/Loc	6	-	-	72.225	-	-	3.566
Genotypes	(29)	163.91**	81.15*	127.071**	7.45**	3.99**	6.818**
Crosses	27	83.27ns	50.163ns	63.553ns	7.93**	3.83**	6.919**
Checks	1	9.68ns	5.45ns	4.840ns	0.594ns	0.466ns	1.055ns
Cr vs Ch	1	2487.32**	993.49**	1964.27**	1.348**	11.834**	9.854**
GCA	7	72.664ns	44.69ns	77.752ns	9.124**	1.856**	8.928**
SCA	20	86.992ns	52.08ns	58.584ns	7.512**	4.520**	6.216**
G X Loc	(29)	-	-	117.725*	-	-	4.622**
Cr X Loc	27			69.896ns	-	-	4.841**
Ch X Loc	1	-	-	10.290ns	--	--	0.005ns
Cr vs Ch X Loc	1	-	-	916.539**	-	-	3.328**
GCA x Loc	7	-	-	39.60ns	-	-	2.052**
SCA x Loc	20	-	-	80.50ns	-	-	5.816**
Error	174	44.440	38.800	41.621	0.317	0.807	0.566
δ^2GCA/δ^2SCA	-	0.940	0.860	1.585	1.220	0.410	1.619
δ^2GCA x Loc δ^2SCA x Loc	-	-	-	0.535	-	-	0.356
CV%	-	8.58	7.13	7.94	5.98	11.68	8.85

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

The interaction between GCA and SCA with locations was significant to express the importance of both additive and non-additive effects for all the studied traits, except resistance to late wilt under combined data, while on the other hand, the ratio δ^2GCA x loc/δ^2SCA x loc was less than unity for number of days to 50% silking, resistance to late wilt disease and grain yield (ton/ha) to indicate an important the non-additive effects in the inheritance of these traits, while, on the other side, the same ratio exceeded than unity for plant height and ear height, indicating an importance the additive effects in the inheritance of the two traits.These results showed that additive and non-additive effects were more interacted with environmental conditions (locations) as reported by Matzinger *et al.* (1959), Katta (1971), Amer (2003) and Ibrahim and El-Ghonemy (2010) .

Mean performance of crosses at Gemmiza , Sids and their combined across locations for grain yield trait is shown in Table (3). Mean performance of crosses at Gemmeiza location ranged from 6.33 ton/ha (2x7) cross to 11.96 ton/ha (1x4) cross, mean performance of crosses at Sids location ranged from 5.58 ton/ha (4x7) cross to 9.19 ton/ha (3 x 6) cross, with mean performance values for Gemmeiza location being higher than those for Sids location for grain yield (ton/ha), while means of performance across two locations ranged from 6.27 ton/ha (4x7) cross to 10.21 ton/ha (1x8) cross. Moreover, three crosses i.e.1x8, 1x4 and 3x5 (10.21, 10.11 and 9.91 ton/ha, respectively) gave higher values comparing with the check hybrid (SC162 9.12 ton/ha). Consequently, it could be concluded that these new crosses are favorite for improving grain yield comparing with the check hybrid SC162.

Table 3. Mean performance of maize single crosses at the two locations Gemmeiza and Sids and their combined data across locations in 2010 season.

Crosses	50% to silking (day)			Plant height (cm)			Ear height (cm)		
	Gm	Sd	Comb	Gm	Sd	Comb	Gm	Sd	Comb
1 X 2	62.5	63.3	62.9	232.0	217.5	224.8	133.8	115.0	124.4
X 3	65.0	60.3	62.6	227.3	232.5	229.9	134.3	127.5	130.9
X 4	61.3	61.0	61.1	238.5	240.0	239.3	137.8	137.5	137.6
X 5	61.8	60.5	61.1	240.0	261.3	250.6	139.0	153.8	146.4
X 6	62.8	61.3	62.0	227.0	247.5	237.3	132.8	137.5	135.1
X 7	63.8	64.5	64.1	230.0	232.5	231.3	138.0	128.8	133.4
X 8	63.3	65.3	64.3	230.3	201.3	215.8	131.5	102.5	117.0
2 X 3	64.0	66.3	65.1	235.8	216.3	226.0	134.5	110.0	122.3
X 4	63.3	62.5	62.9	241.0	233.8	237.4	139.3	128.8	134.0
X 5	63.8	62.0	62.9	235.3	232.5	233.9	137.5	125.0	131.3
X 6	61.8	61.8	61.8	235.5	227.5	231.5	139.3	121.3	130.3
X 7	63.0	62.0	62.5	234.5	240.0	237.3	135.5	132.5	134.0
X 8	62.8	65.0	63.9	225.5	220.0	222.8	139.8	117.5	128.6
3 X 4	62.8	65.3	64.0	235.5	225.0	230.3	135.3	113.8	124.5
X 5	63.5	63.3	63.4	237.3	230.0	233.6	132.8	128.8	130.8
X 6	63.8	64.0	63.9	234.8	226.3	230.5	135.0	121.3	128.1
X 7	64.3	61.8	63.0	238.0	242.5	240.3	141.0	133.8	137.4
X 8	63.3	62.3	62.8	238.5	230.0	234.3	143.5	127.5	135.5
4 X 5	61.3	60.5	60.9	230.8	243.8	237.3	131.8	133.8	132.8
X 6	62.5	61.8	62.1	231.5	233.8	232.6	135.0	130.0	132.5
X 7	63.3	65.8	64.5	230.5	225.0	227.8	138.0	121.3	129.6
X 8	62.5	62.0	62.4	229.5	220.0	224.8	139.0	117.5	128.6
5 X 6	63.3	63.5	63.4	232.8	216.3	224.5	129.8	112.5	121.1
X 7	63.5	63.5	63.5	242.0	221.3	231.6	137.8	117.5	127.6
X 8	63.5	63.0	63.3	229.8	207.5	218.6	137.0	108.8	122.9
6 X 7	61.3	62.3	61.8	237.5	220.0	228.8	138.5	117.5	128.0
X 8	62.5	63.0	62.8	232.8	220.0	226.4	137.3	116.3	126.8
7 X 8	62.5	66.3	64.4	229.0	210.0	219.5	139.3	107.5	123.4
Check									
SC162	66.5	66.3	66.4	259.3	231.3	245.3	139.5	121.3	130.4
SC166	65.0	66.5	65.8	231.0	210.0	220.5	132.8	111.3	122.0
LSD									
0.05	1.47	2.93	1.63	6.74	5.12	5.99	4.07	6.43	4.67
0.01	1.94	3.86	2.15	8.87	6.14	7.88	5.36	8.46	6.15

Table 3. Cont :

Crosses	Resistance to late wilt %			Grain yield (ton/ha)		
	Gm	Sd	Comb	Gm	Sd	Comb
1 X 2	83.0	86.8	85.0	7.66	6.24	6.95
X 3	80.6	90.0	85.4	9.06	7.32	8.19
X 4	76.5	85.9	81.4	11.96	8.25	10.11
X 5	77.7	90.0	84.0	11.21	7.19	9.20
X 6	78.0	90.0	84.1	7.61	9.00	8.31
X 7	80.2	83.0	81.9	9.39	8.18	8.79
X 8	78.6	90.0	84.5	11.52	8.90	10.21
2 X 3	80.6	90.0	85.4	11.48	6.76	9.12
X 4	87.1	85.9	86.6	8.01	7.50	7.76
X 5	68.8	90.0	79.5	8.20	8.86	8.53
X 6	76.5	90.0	83.4	10.73	8.09	9.41
X 7	80.8	90.0	85.5	6.33	8.25	7.29
X 8	79.8	80.3	80.3	9.59	8.16	8.88
3 X 4	80.6	90.0	85.4	8.63	8.79	8.71
X 5	77.5	90.0	83.9	11.02	8.81	9.91
X 6	70.7	84.9	78.0	10.29	9.19	9.74
X 7	74.3	90.0	82.4	9.22	9.07	9.15
X 8	78.7	84.5	81.8	9.42	6.74	8.10
4 X 5	78.7	84.9	82.0	9.57	7.57	8.57
X 6	75.1	84.7	80.0	7.74	7.19	7.47
X 7	77.0	90.0	83.8	6.99	5.58	6.27
X 8	68.9	87.1	78.1	9.56	7.10	8.33
5 X 6	74.7	90.0	82.5	10.46	7.82	9.14
X 7	84.5	79.4	82.0	9.47	6.58	8.03
X 8	69.6	79.3	74.6	9.50	7.10	8.30
6 X 7	72.6	90.0	81.5	9.43	6.27	7.85
X 8	81.5	90.0	85.9	9.77	7.19	8.58
7 X 8	74.5	84.7	79.8	9.52	7.78	8.65
Check						
SC162	87.1	90.0	88.6	9.54	8.71	9.12
SC166	84.9	90.0	87.5	10.09	9.19	9.64
LSD						
0.05	9.24	8.63	6.32	0.78	1.25	0.74
0.01	12.16	11.36	8.32	1.03	1.65	0.97

The relative increasing (superiority) of single crosses relative to the two check hybrid (SC162 and SC166) for grain yield as an average of the two locations are presented in Table(4) . Three crosses i.e. (1x8), (1x4) and (3x5) significantly out-yielded the check hybrid (SC162 9.12 ton/ha) by relative increasing (11.95, 10.86 and 8.70 %, respectively) for grain yield as an average the two locations. While under Gemmieza conditions, five crosses i.e. 1x4, 1x8, 2x3, 1x5 and 3x5 (11.96, 11.52, 11.48, 11.21 and 11.02 ton/ha, respectively) significantly out-yielded the single cross 166 (10.09 ton/ha). Under Sids location, the cross 3x6 (9.19 ton/ha) did not differ significantly than the check SC166 (9.19 ton/ha), six single crosses i.e. 3x7, 1x6, 1x8, 2x5, 3x5 and 3x4 (9.07, 9.00, 8.90, 8.86, 8.81 and 8.79 ton/ha, respectively) did not differ significantly than the check SC162 (9.54 ton/ha) ,indicating the importance of these crosses under this study, similar results were reported by El-Shamarka (1995), Mosa (2003) and Ibrahim (2005) .

Table 4. The relative increasing (superiority) of single crosses over the two checks (SC162 and SC166) for grain yield as an average of the two locations.

Single crosses	Grain yield (ton/ha)	Superiority relative to Checks	
		SC162 (9.12 ton/ha)	SC166 (9.64 ton/ha)
1 X 2	6.95	-23.80**	-27.90**
X 3	8.19	-10.20*	-15.04**
X 4	10.11	10.86**	4.88
X 5	9.20	0.88	-4.60
X 6	8.31	-8.90*	-13.80**
X 7	8.79	-3.60*	-8.80*
X 8	10.21	11.95**	5.91
2 X 3	9.12	0.00	-5.39
X 4	7.76	-14.90*	-19.50**
X 5	8.53	-6.50*	-11.50**
X 6	9.41	0.22	-2.39
X 7	7.29	-20.00**	-18.05**
X 8	8.88	-2.60*	-7.90
3 X 4	8.71	-4.50*	-9.60*
X 5	9.91	8.70*	2.80
X 6	9.75	6.90	1.14
X 7	9.15	0.33	-5.08
X 8	8.10	-11.20**	-15.90**
4 X 5	8.57	-6.03	-11.10**
X 6	7.47	-18.10**	-22.50**
X 7	6.27	-31.20**	-34.90**
X 8	8.33	-8.70*	-13.60**
5 X 6	9.14	0.22	-5.20
X 7	8.03	-11.95**	-16.80**
X 8	8.30	-9.00*	-13.90**
6 X 7	7.85	-13.90**	-18.60**
X 8	8.58	-5.90	-11.00*
7 X 8	8.65	-5.20	-10.30*

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

Estimates of general combining ability effects for eight inbred lines at (Gemmeiza and Sids) locations and their combined in 2010 season are presented in Table (5). High positive values of some inbreds for some traits would be of interest, while other traits like 50% silking, plant height and ear height, were negative ones which could be useful from breeders point of view. Consequently, the inbred line L743 seemed to be good combiner for number of days to 50% silking towards earliness under the two locations and their combined, respectively. The inbred line L 749 is considered the best combiner for plant and ear heights towards shorter plants and lower ear placement, inbred line L 730 exhibited desirable GCA effects for resistance to late wilt disease and grain yield. Moreover, the inbred line L739 gave positive and desirable GCA effects for grain yield.

Table 5. Estimates of general combining ability effects for eight inbred lines at Gemmeiza and Sids locations and their combined data across locations in 2010 season.

Inbred lines	50% to silking (day)			Plant height (cm)			Ear height (cm)		
	Gm	Sd	Com	Gm	Sd	Com	Gm	Sd	Com
L 730	-0.063	-0.813	-0.438	-1.771	6.510	2.370	-1.510	6.875**	2.682
L 731	0.153	0.313	0.288	0.646	-0.990	-0.172	0.573	-1.875	-0.651
L 739	0.979	0.854	0.667	1.896	1.510	1.703	0.031	0.208	0.120
L 743	-0.694*	-0.854*	-0.579*	3.271	4.635	2.453	0.115	3.542	1.828
L 744	-0.021	-0.771	-0.396	2.021	3.177	2.600	-1.760	3.125	0.682
L 745	-0.479	-0.563	-0.521	-0.646	-0.365	-0.505	2.427	-0.833	-1.130
L 746	0.146	0.854	0 .500	0.979	-0.365	0.307	1.990	-0.417	0.787
L 749	-0.021	0.979	0.479	-6.396**	-14.115**	-8.755**	-2.990*	-10.625**	-4.318**
LSD 0.05	0.612	0.817	0.534	4.661	6.125	3.971	2.720	5.096	3.099
gi 0.01	0.805	10.75	0.702	6.135	8.063	5.227	3.581	6.708	4.079
LSD 0.05	0.925	1.235	0.808	7.046	9.261	3.344	4.112	7.707	4.684
gi-gj 0.01	1.218	1.625	1.063	9.275	12.191	4.401	5.413	10.144	6.166

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

Table 5 . Count :

Inbred lines		Resistance to late wilt %			Grain yield (ton/ha)		
		Gm	Sd	Com	Gm	Sd	Com
L 730		3.131*	2.884*	2.526*	0.429**	0.364*	0.313*
L 731		2.485	0.434	1.421	-0.638**	0.01	-0.333*
L 739		0.181	1.506	0.839	0.548**	0.470**	0.500**
L 743		0.331	-0.303	0.026	-0.562**	-0.319	-0.458**
L 744		-1.697	-1.124	-1.432	0.598**	0.101	0.313*
L 745		-2.115	1.543	-1.287	0.031	0.149	0.188
L 746		0.369	-0.537	-0.057	-0.914**	-0.464**	-0.690
L 749		-1.685	-4.403	-2.036	0.508**	-0.312*	0.167
LSD gi	0.05	3.2	2.5	2.0	0.215	0.337	0.304
	0.01	4.2	3.3	2.7	0.283	0.443	0.400
LSD gi-gj	0.05	4.8	3.8	3.7	0.325	0.510	0.459
	0.01	6.4	5.0	4.1	0.428	0.671	0.605

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

Estimates of specific combining ability effects of 28 single crosses at the two Locations (Gemmeiza, Sids) and their combined performance are shown in Table (6). Three crosses i.e. 1x4, 1x8 and 3X5 exhibited positive and desirable SCA effects for grain yield under both locations and their combined across locations, three crosses i.e. 3x7, 3x8 and 6x7 gave negative and desirable SCA effects for number of days to 50% silking trait, towards earliness. While, the crosses 1x2, 1x8 and 5x6 showed negative and desirable SCA effects for ear height, towards lower ear placement, while the cross 5 x 6 seemed to be favorite and desirable cross for plant and ear heights towards, shorter plants and lower ear placement. Moreover, the cross 6 x 8 exhibited positive and desirable SCA effects for resistance to late wilt disease under the two locations and their combined across locations. Its known that developing hybrids for earliness, shorter plants together with highly yield and resistance to late wilt disease is the one of objectives of maize breeding program, consequently the cross 1 x 8 is the best desirable for this purpose under this study.

Table 6. Estimates of specific combining ability effects for 28 single crosses at the two locations Gemmeiza and Sids and their Combined data across locations in 2010 season.

Crosses	Days to 50% silking (day)			Plant height (cm)			Ear height (cm)		
	Gm	Sd	Comb	Gm	Sd	Comb	Gm	Sd	Comb
1 X 2	-0.446	0.768	0.161	-0.536	-15.7*	-8.095	-6.89*	-13.10*	-7.46*
X 3	1.137	-2.274*	-0.568	-6.536	-3.15	-4.845	-0.85	-2.62	-1.74
X 4	-1.030	-0.815	-0.923	6.339	1.22	3.780	2.57	4.05	3.31
X 5	-1.113	-0.899	-1.006	6.089	23.9**	15.01**	5.69	20.70**	13.20**
X 6	0.345	-0.357	-0.006	-4.244	13.7	4.738	-0.89	8.42	3.76
X 7	0.720	1.476	1.098	-2.869	-1.28	-2.074	0.94	-0.74	0.10
X 8	0.387	2.101*	1.244*	1.756	-18.8	-8.512	-6.56*	-16.80**	-11.17**
2 X 3	2.012	2.601**	1.307*	-0.452	-11.9	-6.179	-2.69	-11.40*	-7.03*
X 4	0.845	-0.440	0.202	6.423	2.47	4.446	2.98	4.05	3.01
X 5	0.762	-0.524	0.119	-1.077	2.68	0.801	2.11	0.71	1.41
X 6	-0.780	-0.982	-0.881	1.839	1.22	1.530	3.52	0.92	2.22
X 7	-0.155	-2.149*	-1.152	-0.786	13.7	6.467	-3.64	11.80	4.06
X 8	-0.238	0.726	0.244	-5.411	7.47	1.030	5.61	6.96	3.79
3 X 4	-0.571	2.268*	0.848	-0.327	-8.78	-4.554	-1.48	-13.1	-7.26*
X 5	-0.405	0.685	0.140	-0.327	-2.32	-1.324	-2.10	2.38	0.14
X 6	0.304	1.226	0.765	-0.161	-2.53	-1.345	-0.19	-1.16	-0.67
X 7	-1.379*	-2.440**	-1.231*	11.464*	13.7*	7.592	7.40*	10.90	6.66
X 8	-1.655**	-2.065*	-1.360*	6.339	15.0*	10.655*	4.90	14.90**	9.89**
4 X 5	-1.071	-1.357	-1.214*	-5.202	8.30	1.551	-3.19	4.05	0.43
X 6	0.637	-0.315	0.161	-1.786	1.85	0.630	-0.27	4.26	1.99
X 7	0.762	2.268*	1.515*	-4.411	-6.90	-5.658	-0.69	-4.91	-2.80
X 8	0.429	-1.607	-0.589	-1.036	1.85	0.405	1.10	1.55	1.31
5 X 6	0.804	1.851*	1.327*	-12.286*	-14.2*	-8.841*	-8.64**	-12.80*	-8.24*
X 7	0.429	0.435	0.432	5.339	-9.20	-1.929	0.94	-8.24	-3.65
X 8	0.595	-0.190	0.202	-2.536	-9.20	-5.866	0.19	-6.79	-3.30
6 X 7	-1.363**	-1.824*	-1.193*	3.506	-6.90	-1.699	1.36	-4.29	-1.46
X 8	0.054	-0.399	-0.173	3.131	6.85	4.988	0.11	4.67	2.39
7 X 8	-0.571	1.435	0.432	-2.244	-3.15	-2.699	-1.31	-4.49	-2.90
L.S.D 0.05	1.35	1.80	1.18	10.31	13.56	8.79	6.02	11.28	6.86
Sij 0.01	1.78	2.38	1.56	13.57	17.84	11.57	7.92	14.85	9.02
L.S.D 0.05	2.07	2.76	1.81	15.76	20.70	13.43	9.19	17.23	10.47
Sij-Sik 0.01	2.72	3.64	2.38	20.74	27.24	17.67	12.10	22.7	13.78
L.S.D 0.05	1.85	2.47	1.62	14.09	18.52	12.01	8.23	15.41	9.36
Sij-Skl 0.01	2.44	3.25	2.13	18.55	24.38	15.82	10.84	20.28	12.33

Table 6. Cont:

Crosses		Resistance to late wilt %			Grain yield (ton/ha)		
		Gm	Sd	Comb	Gm	Sd	Comb
1 X 2		1.024	-1.743	-0.390	-1.539**	-1.659**	-1.479**
X 3		0.854	0.411	0.568	-1.319**	-1.043**	-1.188**
X 4		-3.396	-1.880	-2.619	2.692**	0.771*	1.646**
X 5		-0.117	3.040	1.464	0.777**	0.721*	0.125
X 6		0.549	0.374	0.443	-2.256**	0.956*	-0.625
X 7		0.266	-4.522	-2.036	0.470	0.647	0.500
X 8		0.820	4.320	2.568	1.176**	1.149**	1.021**
2 X 3		0.499	0.861	0.673	2.170**	1.409**	0.458
X 4		6.924	-1.430	2.735	-0.196	0.130	-0.083
X 5		-9.346**	3.490	-2.932	-1.164**	1.152**	-0.104
X 6		-1.305	2.903	-0.202	1.934**	0.246	1.146**
X 7		0.587	2.903	1.693	-1.517**	0.924	-0.354
X 8		1.616	-4.905	-1.577	0.316	0.616	0.417
3 X 4		2.654	4.599	2.068	-0.762**	0.945	0.083
X 5		1.658	2.420	2.027	0.668**	0.832*	0.735*
X 6		-4.776	-5.322	-4.994*	0.305	0.882	0.663*
X 7		-3.659	1.832	-0.848	0.180	1.270**	0.688*
X 8		2.770	-1.801	0.506	-1.038**	-1.278**	-1.167**
4 X 5		2.633	-0.847	0.964	0.127	0.184	0.146
X 6		-0.551	-3.714	-2.182	-1.133**	-0.332	-0.854*
X 7		-1.084	3.640	1.339	-0.936	-1.474**	-1.104
X 8		-7.180*	2.632	-2.307	0.209	-0.125	0.167
5 X 6		1.154	2.382	1.777	0.422	-0.033	0.250
X 7		8.445*	-6.114*	1.048	0.378	-0.756*	-0.250
X 8		-4.426	-4.372	-4.348	-1.007**	-0.458	-0.729*
6 X 7		-3.013	1.795	-0.598	0.905**	-1.213**	0.125
X 8		7.941*	6 .661*	5.756*	-0.176	-0.506	-0.354
7 X 8		-1.542	0.465	-0.598	0.521*	0.602	0.646
L.S.D	0.05	7.07	5.58	4.494	0.477	0.746	0.654
Sij	0.01	9.31	7.35	5.915	0.628	0.982	0.861
L.S.D	0.05	10.81	8.53	6.860	0.727	1.139	1.027
Sij-Sik	0.01	14.22	11.23	9.030	0.957	1.500	1.352
L.S.D	0.05	9.66	7.62	6.140	0.651	1.019	0.919
Sij-Skl	0.01	12.72	10.04	8.083	0.857	1.342	1.210

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

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القدره على التآلف لبعض سلالات الذرة الصفراء بواسطه الهجن التبادليه

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تم تهجين ثمانيه سلالات صفراء من الذرة الشامية (في جيل الإخصاب الذاتي السادس) بنظام الدياليل النصف كامل لتعطي ٢٨ هجين فردى صفراء بمحطة البحوث الزراعية بالجميزة للموسم الزراعي ٢٠٠٩.

تم تقييم الـ ٢٨ هجين فردي الناتجة مع اثنين من الهجن التجارية وهما (هـ ف ١٦٢- هـ ف ١٦٦) في محطتي البحوث الزراعية بالجميزة وسدس للموسم الزراعي الصيفي ٢٠١٠ وأخذت القراءات التالية وهي. عدد الأيام حتى ظهور ٥٠ % حراير ، ارتفاع النبات (سم) ، ارتفاع الكوز (سم) ، المقاومة لمرض الذبول المتأخر (%) حيث تم تحويلها بطريقة (ال Arcsine) ومحصول الحبوب (طن\هكتار) وتم تحليل البيانات وراثيا للموسمين والتحليل المشترك لهما تبعا للطريقة الرابعة الموديل الأول للعالم جرفنج ١٩٥٦ الموديل الثابت

وكانت النتائج كالتالي:-

١. التباين الراجع إلى الموقعين والمتوسط لهما كان معنويا للصفات المدروسة عدا صفة عدد الأيام حتى ظهور ٥٠% للحرايرفكانت غيرمعنويه.

٢. التباين الراجع إلى التراكيب الوراثيه ومجزئاتها وهي الهجن(القدرة العامة والخاصة على الائتلاف) - والهجن القياسيه – والهجن مقارنة بالهجن القياسيه كان معنوياً لمعظم الصفات المدروسة وكذلك التفاعل بين التراكيب الوراثيه ومجزئاتها وبين المواقع أظهر فروقاً معنوية أيضا عدا بعضها كان غير معنوى تحت ظروف كل موقع على حده أو متوسط الموقعين.

٣. أظهر كل من التباين المضيف والتباين الغير مضيف أهمية فى وراثة الصفات المدروسة وكذلك التفاعل بينها وبين المواقع لمعظم الصفات المدروسة .

٤. أظهرت السلالة (جميزة ٧٤٣) تأثرات مقبوله ومرغوبه لصفة عدد الايام حتى ظهور ٥٠ % حراير (نحو التبكير) ، كما أظهرت السلاله (جميزه ٧٤٩) تأثيرات مقبوله ومرغوبه للقدره العامه على الإئتلاف لصفه ارتفاع النبات والكوز وذلك نحو التربيه للنباتات القصيره وإنخفاض موقع الكوز، كما أعطت السلاله (جميزه ٧٣٠) تأثيرات مرغوبه للقدره العامه لصفه مقاومه مرض الذبول المتأخر وصفه محصول الحبوب وأيضا أعطت السلاله (جميزه ٧٣٩) تأثيرات موجبه ومعنويه ومرغوبه لصفه محصول الحبوب بالطن\هكتار.

٥. أظهرت ثلاثة هجن وهى (١ × ٨ ، ١× ٤ ، ٣× ٥) تفوقا معنويا لمحصول الحبوب بالنسبة للهجين الفردى التجارى ١٦٢ (٩,١٢ طن/هكتار) بنسب قدرها (١١,٩٥ ، ١٠,٩ ، ٨,٧ % على التوالى)

٦- تعتبرهذه الهجن من الهجن المبشره مقارنة بالهجين الفردى التجارى ١٦٢ تحت ظروف هذه الدراسه.

قام بتحكيم البحث

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Table 2. Analysis of variance of the studied traits for Gemmeiza and Sids locations and their combined permorfance 2010 season.

Source of variance	df	Mean squares								
		Days to 50 % silking (day)			Plant height (cm)			Ear height (cm)		
		Gm	Sd	Com	Gm	Sd	Com	Gm	Sd	Com
Locations (Loc)	1	-	-	1.84ns	-	-	3322.7**	-	-	12600.5**
Rep/Loc	6	-	-	6.61	-	-	925.35	-	-	636.33
Genotypes	(29)	8.154**	13.32**	15.20**	463.51**	661.46**	605.65**	143.50**	477.68**	249.63**
Crosses	27	6.755**	12.86**	13.99**	78.73**	671.45**	442.27**	41.11ns	496.03**	251.40**
Checks	1	4.500**	0.13ns	1.56**	159.13**	903.13**	1010.25**	91.13**	200.00**	280.65**
Cr vs Ch	1	49.581**	54.60**	61.31**	11156.92**	150.03**	4612.31**	2960.33**	259.93**	170.68**
GCA	7	10.856**	12.37**	18.40**	83.02ns	948.74**	674.21**	53.75*	640.77**	262.75**
SCA	20	5.320**	12.25**	12.45**	77.23ns	574.40**	361.09**	36.69ns	445.37**	247.43**
G X Loc	(29)	-	-	6.28**	-	-	519.32**	-	-	371.55**
Cr X Loc	27	-	-	5.04**	-	-	307.91**	-	-	85.74**
Ch X Loc	1	-	-	3.07ns	-	-	52.01ns	-	-	10.48ns
Cr vs Ch X Loc	1	-	-	42.97**	-	-	6097.56**	-	-	3049.5**
GCA x Loc	7	-	-	4.83**	-	-	357.54**	-	-	431.77**
SCA x Loc	20	-	-	5.12**	-	-	290.54**	-	-	234.63**
Error	174	1.10	1.35	1.23	47.30	27.30	37.30	23.97	21.5	22.74
δ^2GCA/δ^2SCA	-	2.10	1.01	1.540	1.07	1.65	2.053	1.46	1.44	1.163
δ^2 GCA x Loc δ^2SCA x Loc	-	-	-	0.99	-	-	1.266	-	-	1.077
CV%	-	1.66	3.30	2.62	3.32	4.83	4.03	5.50	8.11	6.60