J. Plant Production, Mansoura Univ., Vol. 3 (5): 807 - 817, 2012

COMBINING ABILITY AND TYPE OF GENE ACTION BY DIALLEL CROSSES OF WHITE MAI ZE

Ibrahim,M. H. A.; I. A. I. El - Gazzar and S.M. K. Abo El-Haress
Maize research section, Field Crops Research Institute, A.R.C. Giza

ABSTRACT

Seven white maize inbred lines were crossed in a diallel cross system at Sakha Research Station in the growing season 2010. The seven parents were (Sk-5, Sd-7, Sd-63, Sk 8238, Sk DM5001/80, Sk 5069/2 and Sk 6006/3). The 21 crosses in addition to three check hybrids (SC 10, SC 128 and SC129) were evaluated at Sakha and Mallawy Agricultural Research Stations in 2011 growing season. Data were collected on number of days to 50% silking (day), plant and ear heights, grain yield (ard/fed), ear length (cm.), ear diameter (cm), number of rows/ear and number of kernels/row and analyzed according to Griffing (1956) method-4 model-1 (fixed model). Mean squares of locations for combined analysis were highly significant for all the studied traits, except number of rows/ear. Significant differences were found among hybrids for all the studied traits, while hybrids x locations were significant for all the studied traits, except for plant and ear heights, ear diameter, No. of rows/ear and No. of kernels/row. Mean squares of general (GCA) and specific (SCA) combining ability were significant, except for ear height and SCA for ear diameter, as well as their interaction with locations was significant for most studied traits, except mean squares of GCA x L for ear diameter and No. of rows/ear. While, mean squares of SCA x L for days to 50%silking, plant and ear heights, ear diameter , No. of rows/ ear and No. of kernels/row were not significant to indicate an importance both additive and non-additive gene action effects in the inheritance of these the studied traits. The ratio δ^2GCA/ δ^2SCA was greater than unity to indicate an importance of additive gene action in the inheritance for all studied traits. Also, the ratio δ^2GCAx loc/ δ^2SCAxloc was exceeded than unity for all the studied traits, except, for ear length and ear diameter, indicating an importance both additive and non-additive gene action effects in the inheritance of the studied traits and they were more affected by environmental conditions (locations). The two inbred lines Sk 6006/3 and Sk 5 exhibited negative and desirable significant GCA effects, towards earliness, shorter plants and lower ear placement, while the inbred lines Sk 8238 and Sd 7exhibited positive and desirable significant GCA effects and they considered the best combiner for grain yield and its components. Moreover, the inbred line Sd 7 enhances in production a lot of single and three way crosses in maize breeding program. The two new hybrids Sk 8238 x Sk 5069/2 and Sd 7 x Sk 8238 (42.85 and 41.29 ard/fed) significantly out-yielded the check hybrids SC10 and SC128 (37.18 and 37.14 ard/fed) by relative increasing (15.25 and 15.37 %) and (11.05 and 11.17 %, respectively), while the two new hybrids did not differ significantly the check hybrid SC129 (39.36 ard/fed). The two new single crosses herein are considered as superior and promising hybrids for highly grain yield and its components and it could be recommended to use the two new crosses in maize breeding program in future after wider testing.

Keyword *:* Combining ability, Diallel,GCA, SCA, Superiority,Gene action, Maize.

INTRODUCTION

It's known that maize (*Zea mays* L.) is the world most widely grown cereal and is the primary staple food in many developing countries. Effective development of superior inbred lines and hybrids involves very complex genetic. Diallel crosses have been widely used in genetic research to investigate the inheritance of important traits among a set of genotypes and to investigate the combining ability of the parental lines for the purpose of identification of superior parents for use in hybrid development programs. The concept of general (GCA) and specific (SCA) combining ability was firstly defind by Sprague and Tatum (1942) and its mathematical modeling was set about by Griffing (1956) in his classical paper in conjunction was the diallel crosses. Katta (1971) and Galal *et al.* (1987) found that the superiority in evaluation the inbred lines of single crosses as narrow genetic base. Ibrahim and El-Ghonemy (2010) reported that additive and additive x additive gene action effects were more important in expression of all the traits under the two locations and their combined performance. Also, the additive effects were the most important comparing with non-additive in the inhretance of yield and its components as reported by (El-Hosary *et al.* 1990 and Mosa, 1996). Also, Ibrahim (2001) and Mosa (2001) mentioned that non-additive effects played the greater role in the inheritance of all the studied traits comparing with additive effects, as well as in this respect (Kalsy and Sharma, 1970, El-Hosary,1988, Sedhom, 1992, El-Shamarka, 1995 and El-Shenawey *et al.*,2002) reported that non-additive effects were more importance comparing with additive effects in the inheritance the yield and some of its components.While, El-Ghonemy and Ibrahim (2010) reported that the additive and non-additive gene action were important in the inheritance for most the studied traits.

Economic superiority of promising hybrids relative to the commercial check cultivars was found in grain yield trait by Venugopal *et al.* (2002), Yang *et al.* (2003), Motawei (2005 & 2006).

The objectives of the present investigation are 1) to estimate general combining ability for the seven white maize inbred lines and specific combining ability for new hybrids and their interaction with locations, 2) to identify superior parental lines and their prospective crosses to be used in hybrids maize breeding programs, 3) and to determine the relative increasing for superior hybrids relative to commerical hybrids as checks.

MATERIALS AND METHODS

Seven white maize inbred lines were used for the purpose of current research. Their names and its sources are presented in Table (1)

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

No.	Name	Sources
1	Sk-5 P_1	Giza-2
2	Sd-7 P_2	A. E.
3	Sd-63 P_3	Tep-5
4	Sk 8238 P_4	POP S/C-1
5	Sk DM 5001/80 P_5	USA
6	Sk 5069/2 P_6	Exotic/Cimmyt
7	Sk 6006/3 P_7	SC6006/3

All possible combinations, without reciprocals, were made between the seven inbred lines at Sakha Agricultural Research station in 2010 season. The 21 single crosses and three check hybrids (SC10, SC 128 and SC 129) were evaluated in 2011 growing season at two locations Sakha and Mallawy Agricultural Research Stations.A randomized complete block design with four replications were 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 row. All agricultural practices were applied as recommended for maize cultivation. Data were recorded for days to 50% silking, plant height, ear height, grain yield (ard/fed), ear length, ear diameter, number of rows/ear and number of kernels/row. Grain yield per plot was converted into grain yield in ardabe/feddan (ard/fed), where one ardabe = 140 kg and one feddan = 4200 m² and adjusted on the basis of 15.5% grain moisture content. The analysis of variance was performed for every location and for the combined data across locations according to Snedecor and Cochran (1967). The genetic analysis for the diallel crosses was computed according to Griffing (1956) Method – 4 model-1 (fixed model) for all the studied traits. Superiority (relative increasing) of promising hybrids over check cultivar (Sup%) for grain yield (ard/fed) was computed according to Meredith and Bridge (1972) as follows:- Sup % = $\overline{F1}$- $\overline{Mch}$ / $\overline{Mch}$ x 100

Where: $\overline{F1}$ is the mean value of promising hybrid and $\overline{Mch}$ is the mean value of the check cultivar.

RESULTS AND DISCUSSION

Combined analysis of variance for eight studied traits are presented in Table (2). Siginificant differences among the two Locations (L) were found for all the studied traits, except for number of rows /ear, where it was not significant, this would indicate that the genotypes were affected from location to another. These results agreed with that obtained by Soliman *et al.* (1995) and El-Zeir *et al.* (1999). Significant differences were obtained among hybrids for all the studied traits as well as their interaction with locations for most studied traits, except for plant height, ear height, ear diameter, number of rows/ear and number of kernels/

row which they were not significant. These results indicated that the genotypes and their interactions with locations differed in performance from location to anther for most the studied traits as reported by, El-Shamarka *et al.* (1994) and Motawei and Mosa (2009).

Table 2. Combined analysis for 21 hybrids for eight traits in 2011 season

S.O.V	df	days to 50% Silking	Plant height (cm)	Ear height (cm)	Grain yield (ard/fed)	Ear length (cm)	Ear diameter (cm)	No.of rows/ear	No. of kernels /row
Locations (L)	1	522.521**	362964.08**	136053.755**	15694.001**	55.041*	7.640**	1.650	207.917**
Rep/loc.	6	11.021	677.181	457.359	28.938	7.101	0.132	1.794	39.496
Hybrids (H)	20	18.923**	1280.866**	800.261**	188.633**	16.924**	0.127**	2.708**	70.779**
HxL	20	3.662**	264.344	214.136	95.368**	3.024**	0.054	0.704	13.353
Error	120	1.760	169.398	146.385	17.518	1.179	0.037	0.404	8.093

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

Mean performance of hybrids for eight traits as an average over the two locations are shown in Table (3) For grain yield, means of hybrids ranged from 21.08 (ard/fed) for (Sk 5 x Sk 63) hybrid to 42.85 (ard/fed) for (Sk 8238 x Sk 5069/2) hybrid. The highest mean performance of hybrids for grain yield were obtained from the following hybrids; Sk 8238 x Sk 5069/2 and (Sd 7 x Sk 8238) (42.85 and 41.29 ard/fed) significantly out-yielded the two check hybrids SC10 and SC128 (37.18 and 37.14 ard/fed) by relative increasing (15.25 and 15.37 %) and (11.05 and 11.17 %, respectively), while the two new hybrids did not differ significantly relative to commercial hybrid SC129 (39.36 ard/fed), indicating an importance both two new hybrids in future through maize breeding program. For number of days to 50% silking trait, means ranged from 60.9 day for (Sk5 x Sk6006/3) hybrid to 67.3 day for (Sd63 x Sk5069/2) hybrid. For plant height trait, means ranged from 242.4 cm. for (Sk 8238 x Sk 6006/3) hybrid to 296.0 cm. for (Sd7x Sd63)hybrid. For ear height trait, means ranged from 127.5 cm. for (Sk 8238 x Sk 6006/3) hybrid to 169.9 cm. for (Sd7x Sd63) hybrid.

For ear length trait, means ranged from 19.6cm for (SkDM 5001/80) hybrid to 24.07cm for (Sd7x Sd63) hybrid. For ear diameter trait, means ranged from 5.07 cm for (Sk 5 x Sd7) hybrid to 5.6 cm. for (Sk8238 x Sk5069/2) hybrid. For number of rows/ear trait ,means ranged from 13.2 rows for (Sd7x Sd63) hybrid to 15.0 rows for (Sk8238 x Sk6006/3) hybrid and for number of kernels /row trait , means ranged from 37.3 kernels for (SkDM5001/80 x Sk5069/2) hybrid to 48.2 kernels for (Sd7 x Sd63) hybrid.

The relative increasing (superiority) for hybrids relative to the three check hybrids (SC 10, SC128 and SC129) for grain yield (ard/fed) are given in Table (4).The hybrid Sk 8238 x Sk 5069/2 and Sd 7 x Sk 8238 (42.85 and 41.29 ard/fed) surpassed significantly the check hybrids SC10 and SC128 (37.18 and 37.14 ard/fed) by (15.25 and 15.37 %) and (11.05 and 11.17 %, respectively), while the two new hybrids did not differ significantly the check hybrid SC129 (39.36 ard/fed), indicating that these hybrids had favorite and desirable genotypes for yield and its components, similar results reported by Mosa (2003) and Motawie and Mosa (2009).

Table 3. Means performance of 21 hybrids for eight traits as an average the two locations in 2011 season.

Hybrids		days to 50% silking	Plant height (cm)	Ear height (cm)	Grain yield (ard/fed)	Ear length (cm)	Ear diameter (cm)	No .of rows/ ear	No. of kernels/row
Sk5	X Sd7	63.6	265.5	143.9	34.55	22.92	5.07	13.7	46.0
Sk5	X Sd63	64.4	264.5	146.9	21.08	20.97	5.11	14.1	44.8
Sk5	X Sk 8238	63.1	258.5	139.0	35.31	22.27	5.35	14.8	44.1
Sk5	XSkDM5001/80	62.9	266.5	141.6	31.29	21.07	5.25	14.2	42.2
Sk5	X Sk5069/2	63.9	257.5	143.9	33.34	22.40	5.27	13.7	43.0
Sk5	X Sk 6006/3	60.9	259.6	136.8	28.90	19.80	5.32	14.8	41.2
Sd7	X Sd 63	65.0	296.0	169.9	36.74	24.05	5.10	13.2	48.2
Sd7	X Sk 8238	64.0	277.4	160.8	41.29	24.07	5.27	14.0	44.2
Sd7	X SkDM5001/80	65.3	273.9	151.5	32.8 2	21.30	5.15	14.1	43.3
Sd7	X Sk5069/2	65.6	274.1	159.5	37.53	21.82	5.22	13.7	46.2
Sd7	X Sk 6006/3	61.4	262.6	136.4	34.03	21.27	5.22	13.9	42.3
Sd 63	X Sk 8238	64.4	263.5	151.3	38.12	22.55	5.30	13.6	46.9
Sd 63	X SkDM5001/80	65.0	262.0	145.5	29.65	21.15	5.17	14.1	42.6
Sd 63	XSk5069/2	67.3	266.5	156.3	35.43	22.42	5.30	13.7	43.1
Sd 63	X Sk 6006/3	63.8	271.5	151.4	31.87	20.20	5.20	14.7	41.4
Sk 8238	X SkDM5001/8	64.1	256.3	139.1	36.21	23.35	5.35	14.9	41.1
Sk 8238	X Sk5069/2	64.3	259.8	148.8	42.85	23.95	5.62	14.8	45.6
Sk 8238	X Sk 6006/3	63.3	242.4	127.5	28.62	20.10	5.25	15.0	37.4
SkDM5001/80	XSk5069/2	67.1	242.6	143.8	28.82	19.75	5.10	13.3	37.3
SkDM5001/80	X Sk 6006/3	62.5	254.0	131.4	28.13	19.60	5.32	14.8	37.7
Sk5069/2	X Sk 6006/3	64.9	255.3	138.1	33.24	20.60	5.30	14.8	40.0
Checks	SC 10	64.4	292.9	158.9	37.18	23.27	5.05	13.0	46.2
	SC 128	62.5	264.5	141.3	37.14	23.90	5.30	14.0	45.5
	SC 129	62.4	275.3	150.5	39.36	21.92	5.07	14.3	44.1
L.S.D	0.05	1.30	12.75	11.85	4.10	1.06	0.19	0.62	2.79
	0.01	1.71	16.78	15.60	5.40	1.40	0.25	0.82	3.67

Table 4. The relative increasing (superiority) of single crosses over the three checks (SC10, SC128 and SC 129) for grain yield as an average of the two locations.

Single crosses		Superiority relative to checks		
		SC 10	SC128	SC129
Sk5	X Sd7	-7.07	-6.97	-12.22*
Sk5	X Sd63	-43.3**	-43.24**	-46.44**
Sk5	X Sk 8238	-5.02	-4.92	-10.28
Sk5	X SkDM5001/80	-15.84*	-15.75**	-20.50**
Sk5	X Sk5069/2	-10.32	-10.23	-15.29**
Sk5	X Sk 6006/3	-22.27**	-22.18**	-26.57**
Sd7	X Sd 63	-1.18	-1.07	-6.65
Sd7	X Sk 8238	11.05*	11.17*	4.90
Sd7	X SkDM5001/80	-11.72	-11.63*	-16.61**
Sd7	X Sk5069/2	0.94	1.05	-4.64
Sd7	X Sk 6006/3	-8.47	-8.37	-13.54*
Sd 63	X Sk 8238	2.52	2.63	-3.15
Sd 63	X SkDM5001/80	-2.25*	-20.16**	-24.66**
Sd 63	X Sk5069/2	-4.70	-4.60	-9.98
Sd 63	X Sk 6006/3	-14.28*	-14.18**	-19.02**
Sk 8238	X SkDM5001/8	-2.60	-2.50	-8.00
Sk 8238	X Sk5069/2	15.25**	15.37**	8.86
Sk 8238	X Sk 6006/3	-23.02**	-22.94**	-27.28**
SkDM5001/80	X Sk5069/2	-22.48**	-22.25**	-26.77**
SkDM5001/80	X Sk 6006/3	-24.34**	-24.25**	-28.53**
Sk5069/2	X Sk 6006/3	-10.59	-10.50	-15.54**

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

Estimates of variance for general and specific combining ability and their interactions with locations are presented in Table (5). Mean squares of the combined data showed significant both general (GCA) and specific (SCA) combining ability for all the studied traits, except for mean squares of SCA for ear height and ear diameter, indicating that the additive and non-additive gene action played an important role in the inheritance of these studied traits herein. The ratio of δ^2 GCA / δ^2 SCA for all the studied traits exceeded than unity to indicate an importance of additive gene action effects in the inheritance those traits comparing with non-additive gene effects as reported by El-Hosary (1988) and Ibrahim and El-Ghonemy (2010). The interaction between the two locations and both types of combining abilities(GCA and SCA) was significant for all the studied traits, except for GCA x L of ear diameter and number of rows/ear. While, SCA x L for number of days to 50% silking, plant height, ear height, ear diameter, number of rows/ear and number of kernels/row, where they were not significant to indicate that the types of gene action (additive and non-additive) differed from location to another and these results were similar with obtained by El-Hosary (1988 and 1989). Moreover, the ratio of δ^2GCA x loc/δ^2SCA x loc was greater than unity for most studied traits (days to 50% silking, plant height, ear height, grain yield, number of rows/ear and number of kernels/ row) to indicate an important additive gene action effects comparing with non-additive gene action effects and additive gene action effects were more affected by environmental conditions (locations) as reported by Matzinger *et al.* (1959) and Mahmoud (1996)), while the ratio of δ^2GCA x loc/δ^2SCA x loc for ear length and ear diameter were less than unity indicating an importance non-additive gene effects in the inheritance of these studied traits and the non-additive gene action effects were more interacted with environmental conditions (locations).These results are in agreement with those obtained by Ibrahim (1996), Amer *et al.* (1998), Amer (2003) and El-Ghonemy and Ibrahim . (2010).

Table 5. Estimates of variance for general and specific combining ability and their interactions with the two locations in 2011 season.

S.O.V	d.f	Days to 50% Silking	Plant height	Ear height	Grain yield (ard/fed)	Ear length	Ear diameter	No .of rows/ear	No. of kernels/row
GCA	6	53.928**	2592.752**	2269.96**	429.08**	41.976**	0.232**	5.832**	200.728**
SCA	14	4.928**	455.488**	224.648	92.856**	5.976**	0.064	1.128**	19.696**
GCA x L	6	7.728**	664.448**	522.116**	231.448**	3.192*	0.032	0.812	25.092**
SCA x L	14	2.124	132.84	92.156	53.208**	3.85**	0.064	0.796	10.648
δ^2GCA / δ^2SCA	-	10.943	5.692	10.104	4.620	7.024	3.625	5.170	1.191
δ^2GCAxloc / δ^2SCAxloc	-	3.638	5.000	5.665	4.349	0.891	0.500	1.020	2.356

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

Estimates of general combining ability effects for seven inbred lines of combined data are presented in Table (6). High positive values would be of interest for all the traits in question except; days to 50% silking , plant and ear heights, high negative ones would be useful from the breeder point of view. Consequently, two, four and three inbred lines exhibited negative and desirable significant GCA effects for number of days to 50% silking , plant height and ear height, while, on the other hand, three, two, two, two and three inbred lines exhibited positive and desirable significant GCA effects for grain yield, ear length, ear diameter, number of rows/ear and number of kernels/row, respectively. The inbred line Sk 5 has negative and significant GCA effects for number of days to 50% silking and ear height, towards earliness and lower ear placement. while the inbred line Sk 6006/3 is considered the best combiner for number of days to 50% silking , plant height and ear height and number of rows/ear, towards earliness, shorter plants, lower ear placement and highly yielding. The commercial inbred line Sd 7 has positive and desirable significant GCA effects for highly yield, ear length and number of kernels/row indicating that the inbred line Sd 7 is considered the best combiner for these studied traits and it has general combining ability with other inbred lines, where it enhances in production a lot of single and three way crosses through maize breeding program. These obtained results that it could be possible to use the previous inbred lines in maize breeding program for improving these traits herein.

Table 6. General combining ability effects of seven inbred lines for combined data in 2011 season.

Inbred lines	Days to 50% Silking	Plant height	Ear height	Grain yield (ard/fed)	Ear length	Ear diameter	No .of rows/ear	No. of kernels/row
Sk 5	-1.192**	-1.657	-4.628**	-3.095**	-0.147	-0.024	0.026	0.877*
Sk 7	0.032	13.807**	9.346**	3.400**	1.052**	-0.092**	-0.493**	2.707**
Sd 63	1.007**	8.807**	9.196**	-1.411*	0.235	-0.064*	-0.338**	2.047**
Sk 8238	-0.317	-4.442*	-1.753	4.492**	1.222**	0.127**	0.371**	0.522
SkDM 5001/80	0.432*	-4.942**	-4.453*	-2.604**	-0.792**	-0.032	0.076	-2.518**
Sk 5069/2	1.655**	-4.842*	3.021	2.250**	0152	0.062*	-0.213*	-0.302
Sk 6006/3	-1.617**	-6.917**	-10.728**	-3.032**	-1.722**	0.022	0.571**	-3.337**
L.S.D 0.05	0.380	3.734	3.471	1.208	0.311	0.055	0.182	0.816
0.01	0.501	4.915	4.569	1.590	0.410	0.073	0.240	1.074

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

Estimates of specific combining ability effects of 21 hybrids for combined are presented in Table (7). Three single crosses i.e.(Sk5 x SkDM5001/80) , (Sd63 x Sk6006/3) and (Sk8238 x Sk 5069/2) exhibited desirable and positive significant SCA effects for grain yield, while the hybrid (Sk8238 x Sk 5069/2) is considered the best combiner for yield and yield components (grain yield, ear length, ear diameter, No of rows/ear and No of kernels /row) While the single cross (Sd 7 x Sk8238) gave highly grain yield but it was not significant. The single cross (Sd7 x Sk 60006/3) exhibited negative and significant SCA effects for number of days to 50 % siliking, plant height and ear height, towards earliness, shorter plants and lower ear placement. Developing hybrids for earliness and shorter plants together with highly yield is the one of objectives of maize breeding program, consequently the crosses Sk 8238 x Sk 5069/2 and Sd 7 x Sk 6006/3 are the best for this purpose under this study. These crosses would to be interest and favorite and it could be recommended to be used in maize breeding program after wider testing.These results are similar with reported by Motawie and Mosa (2009) and El- Ghonemy and Ibrahim (2010).

Table 7. Specific combining ability effects of 21 hybrids for combined data in 2011 season

Hybrids	Days to 50% Silking.	Plant height	Ear height	Grain yield (ard/fed)	Ear length	Ear diameter	No.of rows/ear	No. of Kern./row
Sk5 X Sd7	0.667	-10.17**	-6.700	0.920	0.322	-0.060	-0.048	0.403
Sk5 X Sd63	0.442	-6.07	-3.550	-7.743**	-0.808	-0.050	0.221	-1.018
Sk5 X Sk 8238	0.517	1.18	-0.475	.595	-0.498	-0.005	0.186	-0.068
Sk5 X SkDM5001/80	-0.483	9.68*	4.850	3.664*	0.317	0.055	-0.068	1.042
Sk5 X Sk5069/2	-0.708	0.58	-0.373	0.858	0.697*	-0.015	-0.328	-0.393
Sk5 X Sk 6006/3	-0.433	4.78	6.250	1.705	-0.028	.075	0.036	0.842
Sd7 X Sd 63	0.158	9.96**	5.475	1.428	1.067**	0.005	-0.133	0.702
Sd7 X Sk 8238	0.167	4.58	7.300*	0.073	0.102	-0.012	-0.093	-1.823*
Sd7 X SkDM5001/80	0.667	1.58	.750	-1.306	-0.658*	0.022	0.351	0.337
Sd7 X Sk5069/2	-0.183	1.73	1.275	-1.445	-1.078**	0.002	0.266	1.052
Sd7 X Sk 6006/3	-1.158**	-7.69*	-8.100*	0.330	0.247	0.042	-0.343	0.137
Sd 63 X Sk 8238	-0.433	-4.19	-2.050	1.717	-0.603	-0.015	-0.648**	1.537
Sd 63 X SkDM5001/80	-0.558	-5.19	-5.100	0.347	0.012	0.020	0.221	0.272
Sd 63 X Sk5069/2	0.467	-0.79	-1.825	1.262	0.342	0.050	0.086	-1.438
Sd 63 X Sk 6006/3	0.242	6.28	7.050*	2.990*	-0.008	-0.010	0.251	-0.053
Sk 8238 X SkDM5001/8	-0.108	2.31	-0.525	1.003	1.222**	0.002	0.236	0.272
Sk 8238 X Sk5069/2	-1.208**	5.71	1.625	2.781*	0.877**	0.182**	0.476**	2.612**
Sk 8238 X Sk 6006/3	1.067**	-9.59*	-5.875	-6.169**	-1.098**	-0.152**	-0.158	-2.528**
SkDM5001/80 X Sk5069/2	0.917*	-10.92**	-0.675	-4.154	-1.308**	-0.182	-0.728**	-2.676**
SkDM5001/80 X Sk 6006/3	-0.433	2.53	0.700	0.446	0.417	0.082	-0.013	0.757
Sk5069/2 X Sk 6006/3	0.717	3.68	-0.025	0.698	0.472	-0.037	0.226	0.847
LSD_{sij} 0.05	0.751	7.364	6.845	2.368	0.614	0.109	0.359	1.609
0.01	0.988	9.693	9.011	3.117	0.808	0.143	0.473	2.118

***,** significant at 0.05 and 0.01 levels 9.693of probability, respectively.**

REFERENCES

Amer, E.A. (2003). Diallel analysis for yield and it's components of maize under two different locations. Minufiya. J. Agric. Res., 28 : 1363 – 1373.

Amer, E.A.; A.A. EL- Shenawy and F.A.A. EL-Zeir (1998). Diallel analysis for ten inbred lines of maize (*Zea mays* L.) Egypt. J. Appl. Sci., 13 : 79 – 91.

El- Ghonemy, M.A. and M.H.A. Ibrahim (2010) . Diallel analysis of yellow maize for combining ability and heterosis . J. Agric.Sci. Mansoura Univ., 1 : 779 – 792

EL-Hosary, A.A. (1988). Heterosis and combining ability of ten maize inbred lines as determined by diallel crossing over two planting dates. Egypt. J. Agron., 13 : 13 – 25.

EL-Hosary, A.A. (1989). Heterosis and combining ability of six inbred lines of maize in diallel crosses over two years. Egypt. J. Agron., 14 : 47 – 58.

EL-Hosary, A.A.; G.A. Sary and A. A .Abd El-Sattar (1990). Studies on combining ability and heterosis in maize (*Zea mays* L.*)*.Egypt.J. Agron., 15 : 9 – 22.

El- Shamarka, Sh. A. (1995). Estimation of heterotsis and combining ability for some quantitative characters in maize under two nitrogen levels. Minufiya J. Agric., Res., 20 : 441 – 462.

El-Shamarka, Sh. A.; A.M.I. Dawood and A.M. Shehata (1994). Genetic analysis of diallel crosses in maize under two nitrogen levels. Minufiya J. Agric., Res., 19 : 1051 – 1064.

El-Shenawy, A.A.; H.E.Mosa and R.S.H. Aly (2002). Genetic analysis for grain yield per plant and other traits on maize early inbred lines. J.Agric. Sci. Mansoura univ., 27 :2019- 2026.

EL–Zeir, F.A.A.; E.A. Amer and A. Abd EL- Aziz (1999). Combining ability analysis for grain yield and other agronomic traits in yellow maize inbreeds (*Zea mays* L.) Minufiya. J. Agric., Res., 24 : 829 – 868.

Griffing, B. (1956). Concept of general and specific combining ability in relation to diallel crossing systems. Australian J. Sci. 9 : 363 – 493.

Galal,A.A.; H.A., El-Triby; M.A.Younis and S.E Sadek (1987).Combining ability in Egyptian maize variety composite No. 5.Egypt J. Genet. Cytol., 16 :357-364.

Ibrahim, M.H.A. (1996). Estimation of general and specific combining ability for some inbred lines of maize. M. SC. Thesis, fac. Agric., Kafr EL-Sheikh, Tanta Univ., Egypt.

Ibrahim, M.H.A. (2001). Studies on corn breeding Ph.D. Thesis, Fac. Agric., Kafer EL-Sheikh, Tanta Univ., Egypt.

Ibrahim, M.H.A. and M. A.El-Gonemy (2010). Heterosis and combining ability in maize (*Zea mays* L.) diallel crosses. J . Plant production, Agric .Sci. Mansoura univ.,1 : 733-743

Kalsy, H.S. and D.Sharma (1970). Study of genetic parameters and heterosic effects in cross of maize (*Zea mays* L.) varities with varying chromosome KNOB numbers. Euphytica, 19: 522-530.

Katta,Y.S.M. (1971).The comparative efficiency in evaluating the combining ability of inbred lines of maize. Ph. D. Thesis, Faculty of Agri., Univ. of Ain-Shams.,Egypt.

Mahmoud , A.A. (1996). Evaluation of combining ability of newly developed inbred lines of maize. Ph. D. Thesis, Agric. Cairo. Univ., Egypt.

Matzinger,D.F., G. F. Sprague and C. C. Cockerham (1959). Diallel crosses of maize experiments reported over locations and years. Agron. J. 51: 346-350.

Meredith, W.R. and R.R. Bridge (1972). Heterosis and gene action in cotton (*Gossypium hirsutum* L). Crop Sci. 12 : 304-310.

Mosa, H.E. (1996). Studies on corn breeding. M.Sc. Thesis Faculty of Agriculture. Kafr, El-Sheikh, Tanta University, Egypt.
Mosa, H.E. (2001). A comparative study of the efficiency of some maize testers for evaluation of white inbred lines and their combining ability under different environmental conditions. Ph.D. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta, Egypt
Mosa, H.E. (2003). Heterosis and combining ability in maize *(Zea mays* L) Minufiya J. Agric. Res. 28 : 1375-1386.
Motawei, A.A. (2005). Combining ability and heterosis effect of nine maize inbred lines via diallel cross analysis .Minufia .J.Agric. Res. 30 : 197-214.
Motawei, A.A. (2006). Gene action and heterosis in diallel crosses among ten inbred lines of yellow maize across various environments. Egypt. J. plant Breed., 10 : 407- 418.
Motawei, A.A. and H.E. Mosa (2009). Genetic analysis for some quantitative traits in yellow maize via half diallel. Egypt. J. Plant Breed. 13 : 223 – 233.
Sedhom, S.A. (1992). Development and evaluation of some new inbred lines of maize . Proc. 5th conf. Agron.Zagazig,13-15 Sept., 1: 269-280.
Snedecor, G.W and W.G Cochran (1967). Statistical Methods. 6th ed. Iowa State Univ. Press, Ames., Iowa, USA.
Soliman, F.H.S.;A.A. EL-Shenawy ; F.A. EL-Zeir and E.A. Amer (1995). Estimates of combining ability and type of gene action in top crosses of yellow maize. Egypt. J. Appl. Sci., 10: 212 – 229.
Sprague, G.F. and L.A. Tatum (1942). General vs. specific combining ability in single crosses of corn. J. Amer Soc. Agron., 34 : 923 – 932.
Venugopal, M.; N.A.Ansari and K.G.K. Murthy (2002). Heterosis for yield and its components characters in maize (*Zea mays* L.). Research on Crops., 3 : 72-74.
Yang, P.M.; Z. Lue; Q. Wang; W.Zhu; C.F.Li and Z.Wei (2003). Analysis of ear characters combining ability of elite maize inbred line 87-1 and its demarcation of heterotic groups. J. Henen Agric. Univ., 37: 25-31.

القدره على الإئتلاف ونوع الفعل الجينى بواسطه الهجن التبادليه فى الذره الشاميه البيضاء

محمد حسن علي إبراهيم ، ابراهيم عبد النبى ابراهيم الجزار وسعيد محمد خالد أبو الحارس
قسم بحوث الذرة الشامية – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية بالجيزة –مصر

- تم تهجين سبعه سلالات بيضاء من الذرة الشامية بنظام الدياليل النصف كامل لتعطي ٢١ هجين فردى بمحطة البحوث الزراعية بسخا للموسم الزراعي ٢٠١٠.
- تم تقييم الـ ٢١ هجين فردي الناتجة مع ثلاثه من الهجن التجارية وهما (هـ ف ١٠- هـ ف ١٢٨ و هـ ف ١٢٩) في محطتي البحوث الزراعية بسخا و ملوى للموسم الزراعي الصيفي ٢٠١١.

سجلت القراءات التالية وهي:- عدد الأيام حتى ظهور ٥٠ % حراير ، ارتفاع النبات (سم) ، ارتفاع الكوز(سم) ومحصول الحبوب(أردب\فدان) ،طول الكوز (سم) ، قطر الكوز(سم)، عدد الصفوف للكوز ، عدد الحبوب للصف الواحد وتم تحليل البيانات وراثيا لمتوسط الموسمين و تبعا للطريقة الرابعة الموديل الأول للعالم جرفنج ١٩٥٦ الموديل الثابت وكانت النتائج كالتالي:-

١. التباين الراجع إلى متوسط الموقعين كان معنويالكل الصفات المدروسه عدا صفة عدد الصفوف للكوزفكانت غير معنويه.
٢. وجدت اختلافات معنويه بالنسبه للهجن لكل الصفات المدروسه وكذلك تفاعلاتها مع المواقع كانت معنويه عدا صفه ارتفاع النبات والكوز وقطر الكوز فكانت غير معنويه.
٣- كان التباين الراجع إلى القدرة العامة والخاصة على الائتلاف عالى المعنويه للصفات المدروسة عدا تباين القدره الخاصه لصفه قطر الكوز فكنت غير معنويه ، وكذلك تفاعل كل من القدره العامه والخاصه على التآلف مع المواقع كان معنويا لبعض الصفات المدروسه عدا صفة عدد الأيام حتى ظهور ٥٠ % حراير ، ارتفاع النبات ، ارتفاع الكوز ، قطر الكوز و عدد الحبوب للصف الواحد فكانت غير معنويه حتى تتأكد أهمية كلا من فعل الجين المضيف والغير مضيف فى وراثه هذه الصفات المدروسه.
٤- أظهر فعل الجين المضيف أهميه فى وراثه الصفات المدروسه تبعا للنسبه بين تباين القدره العامه والخاصه على التآلف حيث كانت أكبر من الواحد الصحيح وكذلك النسبه بين تباين القدره العامه والخاصه وتفاعلهما مع المواقع لمعظم هذه الصفات المدروسة يزيد عن الواحد الصحيح فيما عدا طول الكوز وقطر الكوز فكان فعل الجين الغير مضيف الأكثرأهميه فى وراثة هاتين الصفتين وكان كل من فعل الجين المضيف والغير مضيف أكثر تأثرا بالظروف البيئيه المحيطه(المواقع).
٥- أظهرت السلالة (سخا ٥) والسلاله (سخا ٣/٦٠٠٦) تأثيرات مقبوله ومرغوبه للقدره العامه على التآلف لكل من صفه عدد الأيام حتى ظهور ٥٠ % حراير ، ارتفاع النبات و ارتفاع الكوز حيث تمتلكا تراكيب وراثيه مرغوبه وجيده نحو التبكير وقصر النبات وانخفاض موضع الكوزوهذه الصفات جيده ومرغوبه لمربى النبات. كما أظهرت كل من السلاله سخا ٨٢٣٨ والسلاله سدس ٧ تأثيرات جيده ومقبوله للقدره العامه على التآلف للمحصول العالى و مكوناته.وأكثر من هذا تساهم السلاله ٧ فى تكوين هجن فرديه وثلاثيه ممتازه ومعروفه من خلال برنامج تربيه الذره الشاميه.
٦- تفوق الهجينين الفرديين الجديدين (سخا٨٢٣٨ x سخا ٢/٥٠٦٩) و(سدس ٧ x سخا٨٢٣٨) (٨٥ و٤٢- ٢٩و٤١ أ ردب\فدان) تفوقا معنويا لمحصول الحبوب بالنسبة للهجنين الفرديين التجاريين هـ ف١٠ و هـ ف ١٢٨ (١٨و٣٧ - ١٤و٣٧ أردب\فدان) بزياده قدرها (٣٧و١٥ – ٢٥ و١٥%) و (٠٥و١١ - ١٧و١١ % على التوالى) ولم يختلف الهجينين الجديدين معنويا عن الهجين الفردى التجارى ١٢٩ (٣٦و٣٩أردب\فدان).ويعتبرهذين الهجينين الجديدين من الهجن المتفوقه و المبشره من ناحيه محصول الحبوب العالى ومكوناته. ونوصى بإمكانيه إستخدامهما مستقبلا بعد اختبارات موسعه فى برنامج التربيه للذره الشاميه .

قام بتحكيم البحث

أ.د / على السعيد شريف	**كلية الزراعة – جامعة المنصورة**
أ.د / يوسف صلى محمد	**كلية الزراعة – جامعة كفر الشيخ**