J. Agric. Sci. Mansoura Univ., 33 (9): 6291 - 6302, 2008

COMBINING ABILITY ESTIMATES OF MAIZE INBRED LINES BY TOP CROSSES FOR GRAIN YIELD AND OTHER TRAITS

Barakat A. A. and M.M.A. Osman
Maize Res. Section, Field Crops Res. Institute , A.R.C. Giza, Egypt.

ABSTRACT

Twelve new white maize inbred lines derived from Gemmeiza white maize population, (GWP) were top crossed with two elite inbred tester lines, Gm.18 and Sd.7 in 2006 season. Top crosses were evaluated in field trails at Gemmeiza and Sids Agric. Res., Stations during 2007 summer season. Data for grain yield, no. of ears/100 plants, plant and ear height and silking date were recorded and selected superior promising lines and single crosses.

Results from combined analysis of variances over locations indicated significant mean squares due to locations, crosses, lines, testers, line x testers and cross x locations for all studied traits except for no. of ears/100 plants .However T x Loc. was non. significant for plant and ear height and no of ears/100 plants as wall as L x T x Loc. for plant height and ears/100 plants.

Additive genetic variance is considered to be the major source at the total genetic variance responsible for the inheritance of silking date, plant and ear height and no. of ears/100 plant. Where's , dominance genetic variance is considered to be the major source of the total genetic variance responsible for the inheritance of grain yield.

Inbred lines Gm. 99, Gm. I47, Gm. I70 and Gm. 181 over locations had positive and exhibited good general combiners for grain yield. The crosses Gm.132 x Gm. I8, Gm. 166 x Gm. 18, Gm. 167 x Gm. 18, Gm. I68 x Sd. 7 and Gm. 170 x Sd. 7 were positive and significant S.C.A. effects and suitable combinations for grain yield over locations.

Sixteen single crosses were significantly better than the best commercial single cross 10 (25.34 ard./ fed.) i.e. Gm. 99, Gm. 114 , Gm. 132, Gm. 147, Gm. 166, Gm. 170 and Gm. 181 with the tester Gm. 18 which gave the respective grain yield., 29.12 , 28.65 , 30.95 , 27.31 , 29.21 , 32.66 and 27.69 ard./fed. in the same time there were nine inbred lines i.e. Gm. 99, Gm. 114, Gm. 147, Gm. 168, Gm. 169, Gm. 170, Gm. 171 , Gm. 175 and Gm. 181 with the tester inbred line Sids 7 which gave grain yield 32.54 , 28.26 , 32.18 , 32.76 , 30.35 , 30.62 , 30.09 , 30.79 and 32.65 ard./fed respectively This promising genetic materials will serve the breeding program for releasing new white commercial single crosses.

Keywords : Maize, Top crosses, Combining ability, Type of gene action.

INTRODUCTION

To increase white grain yield maize production in Egypt, the National Maize Research program, ARC exerts great efforts for developing high yielding maize hybrids and continuously search for good inbred lines that possess high combining ability effects to replace those in currently used hybrids.

Performance of inbred lines *per se* dose not provide an entirely adequate measure of their value in hybrid combintions. The standard procedure currently followed by the programs to use the best available commercial inbreds as testers to screen newly developed inbred lines.

Matzinger (1953). showed that when the objective is the replacement of any line in a specific combination, specific combining ability (S.C.A.) of prime importance and the most appropriate tester is the opposite inbred line parent of using cross. Hallauer and Miranda (1981). Pointed out that a suitable tester should include simplicity in use and provide information that correctly classifies the relative merits of lines and maximizes genetic gain. They added that low performing testers give a better idea of (G.C.A.) of the lines than the high performing ones.

General (G.C.A.) and specific (S.C.A.) combining ability were firstly defined by Sprague and Tatum (1942). They and other investigators Russell *et al.*, (1973); Lonnquist and Lindsey (1964); Diab *et al.*, (1994); El-Zeir *et al.*, (2000) and Sadek *et al.*, (2001) reported that the variance component due to SCA for grain yield and other agronomic traits was relatively higher than that due to G.C.A. This indicated that the non-additive type of gene action appeared to be more important in materials or lines selected previously for grain yield performance. On the other hand, Nass *et al.*, (2000) and El-Morshidy *et al.*, (2003) stated that when the lines were relatively unselected, GCA or the additive type of gene action became more important.

Hallauer and lopez-perez (1979), Mahgoub *et al.*, (1996), Soliman *et al.*, (2001) and Amer (2004) suggested that narrow genetic base tester com be effectively used to identity lines having good G.C.A. and the most efficient is one having a low frequency of favorable alleles. However, despite the definite advantage of inbred testers, there has been little a vailable information on the relationship of the performance of the tester and its abilty among tested inbreds.

The objectives of this study were (i) to estimate G.C.A., effects for lines as well for testers and S.C.A. effects of crosses for grain yield and other traits, (ii) to estimate the variances for lines, testers and top crosses and their interactions with location, and (iii) identify the most superior line and promising single top crosses for the further use in the breeding program.

MATERIALS AND METHODS

Twelve white maize lines, derived from the wide genetic base Gemmeiza white maize population at Gemmeiza Agric. Res. Station,. In 2006 growing season the Twelve inbred Gemmeiza lines i.e. Gm. 99 , Gm. 114 , Gm.132 , Gm.147 , Gm.166 , Gm.167 , Gm.168 , Gm.169 , Gm.170 , Gm.171 , Gm.175 and Gm. 181 were top crossed to each of the two narrow base inbred testers, Gm. 18 and Sd. 7 at Gemmeiza Agric. Res. Station. In the growing season of 2007, the 24 resultant top crosses along with two commercial check hybrids, S.C.10 and S.C.122, were evaluated in replicated yield trials conducted at Gemmaiza and Sids Agric. Res. Stations, representing Delta and Middle Egypt regions, respectively.

A randomized complete block design with four replications was used in each location. Plots consisted of a singl row, 6m length and 0.8 m apart and hills were spaced 0.25 m along the row. Two kernels were planted per hill and thinned later to one plant per hill to provide a population of approximately 22.000 plants/Feddan. (Feddan = ($4200m^2$). Data were recorded for namber of days to 50% silking, plant height (cm), ear height (cm), number of ears/ 100 plants and grain yield adjusted to 15.5% grain moisture and converted to ardab/faddan (ardab = 140 kg). Analysis of variance was separate as well as combined over location according to Gomez and Gomez (1984) and procedures were followed to obtain in formation about the combining ability of the lines and the testers and also to estimate type of gene efects controlling grain yield and other studied traits in the tested lines.

RESULTS AND DISCUSSION

Analysis of variance :

Mean squares due the twelve white maize inbred lines, two testers and their 24 top crosses at Gemmeiza, Sids and combined over locations for all the studied traits are presented in Table 1.

Analysis of variance revealed significant mean squares due to crosses, lines (L), testers (T) and L x T for all studied traits at Gemmeiza and Sids locations, except testers for plant height at Gemmeiza and crosses, lines, testers, L x T for number of ears/100 plants, and testers, L x T for plant height at Sids. Combined analysis for variance revealed significant mean squares differences among crosses, lines, testers and L x T for all the studied traits except ears/100 plant These results indicated that a great diversity existed among parental lines and among testers over locations, which contributed to the variability among their top crosses.

Environmental components were significant for all studied traits but tester x location was non significant for plant and ear height and number of ears/100 plants and L x T x Loc. For plant height and ears/100 plant The obtained results are in the same line with those obtained by EL-Itriby *et al.*, (1990), Salama *et al.*, (1995) and Soliman *et al.*, (2001).

The magnitude of the variances due to lines for all studied traits was higher than of testers.

Also, the variances due to lines x locations for all studied traits was higher than of testers x locations except for grain yield. These results indicated that the lines contributed much more to the total variation and more affected by the environmental conditions than the testers. Similar results were obtained by Gado *et al.*, (2000), Abd EL- Moula *et al.*, (2004) and Soliman *et al.*, (2007).

Mean performance :

Top crosses performance Mean at all and across locations for the studied traits are show in Table 2. Results revealed that average grain yield ranged from 21.26 ard/fad. for cross (Gm. 167 x Gm. 18) to 39.02 for cross (Gm. 175 x Sd. 7) at Gemmeiza, from 17.42 ard/fad. for cross (Gm. 167 x Gm. 18) to 30.29 for cross (Gm. 170 x Gm. 18) at Sids and from 22.79 ard/fad. for cross (Gm. 167 x Sd. 7) to 32.76 for cross (Gm. 168 x Sd. 7) over location. The cross (Gm. 170 x Gm. 18) had the best cross at all and across locations. Twenty one, 10 and 19 white to crosses exceeded the check S.C.

10. Out of these crosses 17 at Gemmeiza 3 at Sids and 16 crosses i.e. Gm. 99, 114, 132, 147, 166, 170, 181 x Gm. 18 and Gm. 99, 114, 147, 168, 169, 170, 171, 175 and Gm. 181 x Sd. 7 exceeded significantly the hight check S.C.10 over locations for grain yield (ard/fad.) , suggesting the superiorities of these crosses and would be beneficial in maize breeding program for yielding ability. Seven, four and nine crosses were significantly earlier than the check S.C.10 . Fourteen, Five and eleven top crosses had significantly short plants when compared with the short check S.C.10. Eight, one and one crosses had low ear placement than the check S.C.122 at Gemmeiza , Sids and over locations, respectively. Tow white top crosses at all and across locations significantly had hight no. of ears/100 plants than the check S.C. 10.

Table 1 : Mean squares (MS) for grain yield and other traits of 12 inbred lines top crossed with two testers at each and over locations.

S.O.V.	d.f	Mean squares (MS)				
		Silking date	Plant height	Ear height	Ears/100 plant	Grain yield
				Gemmeiza		
Replications	3	1.038	154.484	111.170	653.673**	27.478
Crosses	23	5.418**	526.968**	391.458**	824.405**	112.229**
Lines (L)	11	8.506**	828.725**	512.961**	1172.025*	75.088**
Testers (T)	1	6.338**	14.260	334.885**	501.380**	302.027**
L.xT.	11	2.246*	272.028*	275.027**	506.151	132.116**
Error	69	0.901	117.047	27.456	93.323	2.478
C.V. %		1.647	3.636	3.114	3.564	4.212
				Sids		
Replications	3	45.660	1433.525	457.425	774.096	52.965
Crosses	23	7.385**	255.594*	127.931**	59.986	34.654**
Lines (L)	11	10.433**	356.175**	169.534**	59.319	34.134**
Testers (T)	1	4.135**	194.400	153.600**	45.998	18.452
L.xT.	11	4.543**	160.568	83.093	61.924	36.833**
Error	69	1.709	130.077	48.536	84.549	4.405
C.V. %		2.124	4.509	5.589	5.562	10.251
				Combined		
Locations(Loc.)	1	610.880**	76621.167**	44785.692**	4246.362	2658.617**
Rep/L	6	23.349	839.004	284.342	713.885	28.076
Crosses(C)	23	9.981**	496.813**	407.543**	504.538	98.141**
Lines (L)	11	15.772**	889.937**	537.366**	706.799	88.543**
Testers (T)	1	10.355**	51.680**	471.042**	425.552	234.894**
L. x T.	11	4.157**	332.337**	271.948**	309.456	95.308**
C x Loc.	23	2.822**	195.757*	111.854**	379.852	48.831**
L x Loc.	11	3.256*	294.970**	145.130**	524.545	20.681
T x Loc.	1	0.117**	156.980	17.442	121.826	85.582**
L x T x Loc.	11	2.633*	100.259	87.161*	258.617	73.642**
Pooled Error	138	1.304	123.569	42.177	88.935	3.441
C.V. %		1.917	4.041	4.284	6.768	7.173

, * Significant at 0.01 and 0.05 level of probability.

Table 2: Mean performance for all studied traits at all and across locations.

Crosses		Silking date, days			Plant height, cm			Ear height, cm		
		Gm.	Sids	Com.	Gm.	Sids	Com.	Gm.	Sids	Com.
Gm.99 x Gm.18		49.50	51.98	50.73	259.65	213.53	236.58	144.45	115.43	129.93
Gm.99 x Sd. 7		49.95	52.88	51.41	278.78	225.45	252.11	170.10	118.80	144.45
Gm.114 x Gm.18		49.28	53.10	51.18	238.73	206.10	222.41	141.98	107.55	124.76
Gm.114 x Sd. 7		49.95	53.10	51.53	243.90	208.80	226.35	133.20	111.15	122.18
Gm.132 x Gm.18		47.70	49.73	48.71	255.38	218.48	236.93	146.48	119.25	132.86
Gm.132 x Sd. 7		50.18	50.85	50.51	259.88	224.55	242.21	149.85	122.40	136.13
Gm.147 x Gm.18		47.70	51.98	49.83	243.90	201.60	222.75	135.00	105.98	120.48
Gm.147 x Sd. 7		49.73	51.53	50.63	249.98	205.43	227.70	139.95	108.90	124.43
Gm.166 x Gm.18		49.95	52.20	51.08	249.75	211.95	230.85	137.03	110.48	123.75
Gm.166 x Sd. 7		50.18	53.78	51.98	259.65	214.20	236.93	141.98	114.53	128.25
Gm.167 x Gm.18		49.50	53.10	51.30	243.45	209.93	226.68	136.80	110.25	123.53
Gm.167 x Sd. 7		49.95	54.45	52.20	243.45	214.43	228.93	142.65	117.90	130.28
Gm.168 x Gm.18		50.18	55.13	52.65	264.60	204.08	234.33	139.28	103.73	121.50
Gm.168 x Sd. 7		49.50	52.88	51.18	258.30	220.05	239.18	152.55	119.70	136.13
Gm.169 x Gm.18		49.95	53.78	51.86	257.40	225.23	241.31	148.50	121.28	134.88
Gm.169 x Sd. 7		50.18	53.55	51.86	240.75	211.50	226.13	134.10	112.95	123.53
Gm.170 x Gm.18		50.63	53.10	51.86	256.95	221.40	239.18	152.78	121.05	136.91
Gm.170 x Sd. 7		49.73	53.33	51.53	260.78	219.83	240.30	160.43	119.70	140.06
Gm.171 x Gm.18		48.83	51.75	50.28	250.88	217.80	234.33	134.55	115.43	124.98
Gm.171 x Sd. 7		49.95	54.23	52.08	246.60	228.38	237.48	136.80	117.00	126.90
Gm.175 x Gm.18		47.70	52.88	50.28	252.23	220.50	236.36	144.23	116.55	130.38
Gm.175 x Sd. 7		47.93	51.08	49.50	236.48	210.60	223.53	132.30	110.70	121.50
Gm.181 x Gm.18		47.25	50.63	48.93	276.53	223.43	249.98	146.03	119.25	132.63
Gm.181 x Sd. 7		46.80	52.43	49.61	262.13	223.20	242.66	155.70	121.28	138.48
Check	S.C. 10	50.40	53.10	51.75	261.90	225.23	243.56	151.20	124.20	137.70
	S.C.122	50.63	54.90	52.80	276.75	219.60	248.18	145.80	116.33	126.56
L.S.D. 0.05		1.24	1.68	1.06	13.95	16.70	8.96	7.00	11.93	6.07

Table 2: Cont.

Crosses		No. of ears/100 plants			Grain yield (ard/fad)		
		Gm.	Sids	Com.	Gm.	Sids	Com.
Gm.99 x Gm.18		109.68	105.09	107.39	33.95	24.29	29.12
Gm.99 x Sd. 7		157.37	111.61	134.50	36.13	28.94	32.54
Gm.114 x Gm.18		94.05	97.65	95.85	31.50	25.79	28.65
Gm.114 x Sd. 7		104.73	98.92	101.83	33.94	22.57	28.26
Gm.132 x Gm.18		107.87	101.18	104.53	33.23	28.68	30.95
Gm.132 x Sd. 7		112.80	102.81	107.80	27.39	24.79	26.08
Gm.147 x Gm.18		101.70	103.23	102.47	31.20	23.41	27.31
Gm.147 x Sd. 7		99.77	106.17	102.98	37.59	26.77	32.18
Gm.166 x Gm.18		97.20	101.48	99.34	32.74	25.68	29.21
Gm.166 x Sd. 7		97.03	101.22	99.13	26.66	21.46	24.06
Gm.167 x Gm.18		101.70	98.80	100.25	29.51	17.42	23.46
Gm.167 x Sd. 7		102.01	101.90	101.95	21.26	24.31	22.79
Gm.168 x Gm.18		95.12	105.24	100.18	22.37	24.16	23.27
Gm.168 x Sd. 7		100.47	100.52	100.49	38.47	27.05	32.76
Gm.169 x Gm.18		93.17	102.40	97.79	28.61	23.78	26.20
Gm.169 x Sd. 7		94.50	101.73	98.12	34.23	26.47	30.35
Gm.170 x Gm.18		108.89	105.64	107.26	35.03	30.29	32.66
Gm.170 x Sd. 7		115.48	107.27	111.38	34.57	26.67	30.62
Gm.171 x Gm.18		111.93	103.60	107.77	24.40	22.89	23.64
Gm.171 x Sd. 7		103.97	103.31	103.64	36.38	23.80	30.09
Gm.175 x Gm.18		105.40	103.57	104.49	26.90	24.72	25.81
Gm.175 x Sd. 7		99.67	105.50	102.58	39.02	22.55	30.79
Gm.181 x Gm.18		122.93	101.93	112.43	33.27	22.10	27.69
Gm.181 x Sd. 7		121.08	111.48	116.28	37.49	27.81	32.65
Check	S.C. 10	108.77	98.48	103.63	25.27	25.39	25.34
	S.C.122	91.24	87.90	89.58	21.99	27.06	24.53
L.S.D. 0.05		12.55	8.82	8.77	2.45	2.64	1.70

General (gi) and specific (sij) combining ability effects :

For general combining ability (G.C.A.) effects (Table 3). Desirable and significant values of G.C.A. effects were obtained for inbred lines Gm. 181, 175 and 147 at Gemmeiza, Gm. 132 . 181 , 147 at Sids and Gm. 132 , 181 , 175 and Gm. 147 acrosses locations for days to 50 % siliking. Gm. , 114, 167, 175 at Gemmeiza, Gm. 114, 147 at Sids and Gm. 99, 114, 147 , 167 and Gm. 181 over locations for plant height, Gm. 114 , 147 , 166, 167, 171 and Gm. 175 at Gemmeiza, Gm.114, 147 at Sids and Gm. 114, 147, 166, 171 and Gm. 175 over locations for ear height.

Gm. 99, 166, 169 and Gm. 181 at Gemmeiza, Gm. 99 and Gm. 181 over locations for number of ears/100 plants. Inbred lines Gm. 99 , Gm. 147, Gm.170 and Gm. 180 at Gemmeiza, Gm. 132 and Gm. 170 at Sids and Gm. 99 , Gm. 147, Gm. 170 and Gm. 181 over locations had positive and good combiners for grain yield. These lines could be used to producer new high yielding single crosses in maize breeding program.

Estimation of G.C.A. effects of inbred testers Gm. 18 and Sd. 7 for all traits are presented in Table 3. The results showed that tester Gm. 18 was a good general combiner for days to 50 % siliking and ear height ,while, testers Sd. 7 line had favorable alleles for grain yield.

Specific combing ability effects for the studied traits of top crosses (Table 4) pointed out that the crosses Gm. 132 x Gm. 18 , Gm. 166 x Gm. 18, Gm. 167 x Gm.18, Gm. 168 x Sd. 7, Gm. 171 x Sd. 7, and Gm. 175 x Sd. 7 at Gemmeiza, Gm. 167 x Gm. 18 at Sids and Gm. 132 x Gm. 18 , Gm. 166 x Gm. 18, Gm. 167 x Gm. 18, Gm. 168 x Sd. 7 and Gm. 171 x Sd.7, over location were suitable combination for grain yield also, the results revealed that the crosses Gm. 132 x Gm. 18 at Gemmeiza and Gm. 168 x Sd. 7 at Sids and over location for siliking date. Gm. 99 x Gm. 18 at Gemmeiza , Gm. 99 x Gm. 18 and Gm. 169 x Sd. 7 over location for plant height , Gm. 99 x Gm. 18 , Gm. 168 x Gm. 18, Gm. 114 x Sd. 7, Gm. 169 x Sd. 7, Gm. 175 x Sd. 7 at Gemmeiza, Gm. 168 x Gm. 18 at Sids and Gm. Gm. 99 x Gm. 18 over locations for ear height and cross Gm. 99 x Sd. 7 for number of ears/100 plants they exhibited desirable and significant S.C.A. effects suggesting that these crosses are suitable and good combinations requiring in maize breeding program.

Table 3: General combining ability effects for all studied traits at all and across locations.

Lines	Silking date, days			Plant height, cm			Ear height, cm			No. of ears/100 plants			Grain yield (ard\fad.)		
	Gm.	Sids	Com.	Gm.	Sids	Com.	Gm.	Sids	Com.	Gm.	Sids	Com.	Gm.	Sids	Com.
Gm. 99	0.469	-0.215	0.127	15.459**	3.638	9.548**	13.247**	2.063	7.655**	27.224**	1.630	14.427**	3.130**	1.761*	2.445**
Gm. 114	0.356	0.459	0.408	12.441**	-8.400*	10.420**	-6.440**	-5.700**	-6.070**	-6.912*	-4.175	-5.543*	0.811	-0.665	0.073
Gm. 132	-0.319	-2.354**	-1.337**	3.872	5.663	4.767	4.135*	5.775*	4.955**	0.429	-3.897	-1.733	-1.604*	1.882**	0.139
Gm. 147	-0.544*	-0.890*	-0.717*	-6.816	12.337**	9.576**	-6.553**	-7.612**	-7.082**	-5.568	2.258	-1.655	2.488**	0.237	1.363**
Gm. 166	0.806*	0.347	0.577*	0.947	-2.775	-0.914	-4.528*	-2.550	-3.539*	9.191**	-2.257	-5.724*	-2.210**	-1.282	-1.745**
Gm. 167	0.469	1.134**	0.801*	10.303**	-3.675	-6.989*	-4.303*	-0.975	-2.639	-4.455	0.607	-1.924	-6.522**	-3.985**	-5.253**
Gm. 168	0.581*	1.359**	0.970**	7.697*	-3.787	1.955	1.885	-3.337	-0.726	-8.510*	-0.701	-4.605*	-1.492*	0.754	-0.369
Gm. 169	0.806*	1.022**	0.914**	-4.678	2.513	-1.083	-2.728	2.063	-0.332	12.473**	-0.266	-6.369**	-0.490	0.278	-0.105
Gm. 170	0.919**	0.572	0.745*	5.109	4.727	4.918	12.571**	5.325*	8.948**	5.898	4.991	5.444*	2.888**	3.630**	3.259**
Gm. 171	0.131	0.347	0.239	-5.016	7.238*	1.111	-8.353**	1.163	-3.549*	1.647	1.248	1.447	-1.523**	-1.506*	-1.515**
Gm. 175	-1.444**	-0.665	-1.055**	9.403**	-0.300	-4.851	-5.765**	-1.425	-3.596*	-3.769	0.707	-1.531	1.052	-1.213	-0.080
Gm. 181	-2.231**	-1.115*	-1.673**	15.572**	7.463*	11.517**	6.835**	5.213*	6.024**	15.699**	-0.145	7.777**	3.471**	0.111	1.791**
SE_{gi}	0.266	0.348	0.271	3.628	3.486	2.636	1.757	2.060	1.543	3.240	2.915	2.237	0.527	0.704	0.435
SEgrgj	0.376	0.492	0.383	5.132	4.930	3.728	2.485	2.913	2.178	4.589	4.123	3.163	0.746	0.995	0.622
Gm. 18	-0.244*	-0.196	-0.220*	0.365	1.350	0.858	-1.772**	-1.200	-1.486*	-2.168	-0.656	-1.412	-1.682**	-0.416	-1.049**
Sd. 7	0.244*	0.196	0.220*	-0.365	-1.350	-0.858	1.772**	1.200	1.486*	2.168	0.656	1.412	1.682**	0.416	1.049**
SE_{gi}	0.108	0.142	0.110	1.423	1.423	1.076	0.717	0.841	0.628	1.257	1.190	0.913	0.215	0.287	0.161
SEgrgj	0.153	0.201	0.156	2.012	2.012	1.522	1.014	1.189	0.889	1.778	1.683	1.291	0.304	0.406	0.254

*,** Significant at 0.01 and 0.05 level of probability

Table 4 : SCA effects for all studied traits at all and across locations.

Crosses	Silking date, days			Plant height, cm			Ear height, cm		
	Gm.	Sids	Com.	Gm.	Sids	Com.	Gm.	Sids	Com.
Gm.99x Gm.18	0.019	-0.253	-0.117	-9.928*	-4.613	-7.270*	11.053**	-0.488	-5.771**
Gm.99 x Sd. 7	-0.019	0.253	0.117	9.928*	4.613	7.270*	11.053**	0.488	5.771**
Gm.114x m.18	-0.094	0.197	0.051	-2.953	0.000	-1.476	6.160*	-0.600	2.779
Gm.114x Sd. 7	0.094	-0.197	-0.051	2.953	0.000	1.476	-6.160*	0.600	-2.779
Gm.132x m.18	-0.994*	-0.365	-0.680	-2.615	-1.688	-2.151	0.085	-0.375	-0.146
Gm.132xSd. 7	0.994*	0.365	0.680	2.615	1.688	2.151	-0.085	0.375	0.146
Gm.147x Gm.18	-0.769	0.422	-0.174	-3.403	-0.563	-1.983	-0.703	-0.263	-0.482
Gm.147 x Sd. 7	0.769	-0.422	0.174	3.403	0.563	1.983	0.703	0.263	0.482
Gm.166x Gm.18	0.131	-0.590	-0.230	-5.315	0.225	2.545	-0.703	-0.825	-0.764
Gm.166 x Sd. 7	-0.131	0.590	0.230	5.315	-0.225	-2.545	0.703	0.825	0.764
Gm.167x Gm.18	0.019	-0.478	-0.230	-0.365	-0.900	-0.633	-1.153	-2.625	-1.889
Gm.167 x Sd. 7	-0.019	0.478	0.230	0.365	0.900	0.633	1.153	2.625	1.889
Gm.168x Gm.18	0.581	1.322*	0.951**	2.785	-6.638	-1.926	-4.883*	-6.788	-5.836**
Gm.168 x Sd. 7	-0.581	-1.322*	-0.951**	-2.785	6.638	1.926	4.883*	6.788	5.836**
Gm.169x Gm.18	0.131	0.310	0.221	7.960	8.213	8.086**	8.972**	5.362	7.167**
Gm.169 x Sd. 7	-0.131	-0.310	-0.221	-7.960	-8.213	-8.086**	-8.972**	-5.362	-7.167**
Gm.170x Gm.18	0.694	0.085	0.390	-2.278	2.138	-0.070	-2.053	1.875	-0.089
Gm.170 x Sd. 7	-0.694	-0.085	-0.390	2.278	-2.138	0.070	2.053	-1.875	0.089
Gm.171x Gm.18	-0.319	-1.040	-0.680	1.772	-3.938	-1.083	0.647	0.412	0.529
Gm.171 x Sd. 7	0.319	1.040	0.680	-1.772	3.938	1.083	-0.647	-0.412	-0.529
Gm.175x Gm.18	0.131	1.097	0.615	7.510	6.300	6.905	7.735**	4.125	5.929**
Gm.175 x Sd. 7	-0.131	-1.097	-0.615	-7.510	-6.300	-6.905	-7.735**	-4.125	-5.929**
Gm.181x Gm.18	0.469	-0.703	-0.117	6.835	1.463	4.148	-3.065	0.187	-1.439
Gm.181 x Sd. 7	-0.469	0.703	0.117	-6.835	-1.463	-4.148	3.065	-0.187	1.439
SEsij	0.450	0.620	0.383	4.930	5.410	3.728	2.485	3.304	2.178
SEsij-sik	0.636	0.877	0.541	6.972	7.651	5.272	3.515	4.673	3.080

* **Significant at 0.01 and 0.05 level of probability

Table 4: Cont.

Crosses	No. of ears/100 plants			Grain yield (ard/fad)		
	Gm.	Sids	Com.	Gm.	Sids	Com.
Gm.99 x Gm.18	-21.679**	-1.136	-11.408**	0.593	-1.907	-0.657
Gm.99 x Sd. 7	21.679**	1.136	11.408**	-0.593	1.907	0.657
Gm.114 x Gm.18	-3.175	-0.554	-1.865	0.461	2.023*	1.242*
Gm.114 x Sd. 7	3.175	0.554	1.865	-0.461	-2.023*	-1.242*
Gm.132 x Gm.18	-3.896	-1.919	-2.908	4.603**	2.365*	3.484**
Gm.132 x Sd. 7	3.896	1.919	2.908	-4.603**	-2.365*	-3.484**
Gm.147 x Gm.18	3.130	-1.826	0.653	-1.509	-1.265	-1.388*
Gm.147 x Sd. 7	-3.130	1.826	-0.653	1.509	1.265	1.388*
Gm.166 x Gm.18	2.253	2.519	2.386	4.728**	2.524*	3.625**
Gm.166 x Sd. 7	-2.253	-2.519	-2.386	-4.728**	-2.524*	-3.625**
Gm.167 x Gm.18	2.017	-1.002	0.508	5.810**	3.033**	4.421**
Gm.167 x Sd. 7	-2.017	1.002	-0.508	-5.810**	-3.033**	-4.421**
Gm.168 x Gm.18	-0.503	3.588	1.543	-6.366**	-1.031	-3.698**
Gm.168 x Sd. 7	0.503	-3.588	-1.543	6.366**	1.031	3.698**
Gm.169 x Gm.18	1.501	3.695	2.598	-1.122	-0.929	-1.025
Gm.169 x Sd. 7	-1.501	-3.695	-2.598	1.122	0.929	1.025
Gm.170 x Gm.18	6.074	2.122	4.099	1.913	2.230*	2.072**
Gm.170 x Sd. 7	-6.074	-2.122	-4.099	-1.913	4.030*	-2.072**
Gm.171 x Gm.18	6.152	1.574	3.864	-4.307*	-0.039	-2.174**
Gm.171 x Sd. 7	-6.152	-1.574	-3.864	4.307*	0.039	2.174**
Gm.175 x Gm.18	5.034	-2.478	1.278	-4.379*	1.499	-1.440*
Gm.175 x Sd. 7	-5.034	2.478	-1.278	4.379*	-1.499	1.440*
Gm.181 x Gm.18	3.094	-4.585	-0.745	-0.422	-2.436*	-1.429*
Gm.181 x Sd. 7	-3.094	4.585	0.745	0.422	2.436*	1.429*
SEsij	4.355	4.361	3.163	1.588	0.995	0.615
SEsij-sik	6.160	6.168	4.473	2.246	1.408	0.879

Genetic variances :

Estimates of additive (δ^2A) genetic variances for inbred lines were elatedly higher than those of dominance (δ^2D) genetic variances for all studied traits except grain yield, the dominance variances were higher than additive variance at both locations.

These results indicated that additive genetic variance is considered to be the major source of the total genetic variance responsible for the inheritance of siliking date, plant and ear height and number of ears/100plants. Dominance genetic variance is considered to be the major source of the total genetic variance responsible for the inheritance of grain yield. These results are in agreement with these of Salama *et al.,* (1995), Soliman and Sadek (1999), Soliman *et al.,* (2001) , Amer *et al.,* (2003) and Mahmoud and Abd EL-Azeem (2004). They reported that (δ^2G.C.A.) exceeded that of (δ^2S.C.A.) for grain yield, on the other hand Sadek *et al.,* (2002), Soliman *et al.,* (2001), Gaber (2003), Abd EL-Moula *et al.,* (2004) and Abd EL-Moula (2005) indicted that non additive gene action was involved and comprised most of genetic in the inheritance of grain yield and other traits.

Combined estimates (Table 5) revealed that the magnitude of additive variance x loc. Interaction for parental inbred lines was higher than dominance x loc. interaction for plant height, ear height and number pf ears/100 plants. These results indicated that variance due to additive (δ^2A) was more affected by environmental condition than(δ^2D). Similar results were reported by Sadek *et al.,* (2001) EL-Shenawy *et al.,* (2003), Abd El-Azeem *et al.,* (2004), Barakat and Abd EL-Moula (2008) for grain yield.

Table 5: Estimates of genetic variance components for grain yield and other traits at separate and over locations in a line x tester analysis

S.O.V.	Silking date	Plant height cm	Ear height ,cm	Ears/100 plant	Grain yield
			Gemmeiza		
δ^2 (A) lines	3.130	278.348	118.967	332.937	-28.514
δ^2 (A) testers	0.341	-21.480	4.988	-0.398	14.160
δ^2 (D) for (L.xT.)	0.337	38.745	61.892	103.208	32.409
			Sids		
δ^2 (A) Line	2.945	97.808	43.221	-1.302	-1.349
δ^2 (A) tester	-0.034	2.820	5.875	-1.058	-1.532
δ^2 (D) (LxT)	0.708	7.621	8.639	-5.657	8.107
			Combined		
δ^2 (A) line	2.903	139.399	66.354	99.336	-1.691
δ^2 (A) tester	0.258	-11.694	8.295	4.838	5.816
δ^2 (D) (LxT)	0.356	26.096	28.722	27.565	11.202
δ^2 (A) line x Loc.	0.311	97.356	28.984	132.964	-26.480
δ^2 (A) tester x Loc.	-0.210	4.727	-5.810	-11.399	0.995
δ^2 D (L x T) x Loc.	0.332	-5.828	11.246	42.421	17.550

REFERENCES

Abd El-Azeem, M.E.M., A.A.,Mahmoud and A.M.Atia (2004). Combining ability analysis of yellow maize inbred lines. Egypt J. Plant Breed. 8:239-254.

Abd El-Moula, M.A, A.A.Barakat and A.A.Ahmed. (2004). Combining ability and type of gene action for grain yield and other attributes in maize (Zea maize L.). Assiut J. of Agric. Sci..35(3): 129-142

Abd El-Moula;M.A.(2005). Combining ability estimates of maize inbred lines and its interaction with location. Assiut J. of Agric. Sci. 36 (3) : 57-76

Amer, E.A. (2004). Combining ability of new white inbred lines of maize with three testers tested over two locations. Annal. of Agric. Sci. Moshtohor, 42(2): 461-474.

Amer, E.A.; A.A. El-Shenawy and A.A. Motawei (2003). Combining ability of new maize inbred lines via line \ tester analysis. Egypt J. Plant Breed. 7(l):229-239

Barakat A.A.; and M.A.Abd EL-Moula (2008). Combining ability in maize top crosses for grain yield and other traits. Minia J. of Agric. Res. and Develop.28 (1) : 129 – 147.

Diab, M T., A. M. Shehata and M. I. Dawood (1994). Using inbred lines as testers for estimating combining ability in maize. Egypt. J. Appl. Sci. 9: 208-224.

El-Itriby, H.A., M.A.Ragheb, H.Y. El-Sherbieny and M.M.Shalaby (1990). Estimate of combining ability of maize inbred lines in top crosses and its interaction with locations. Egypt.J AppLSci., 5(8): 354-370.

El-Morshidy, M.A.; E.A.Hassaballa; Sh.F.Aboul- Saad and M.A.Ahmed (2003). Combining ability and type of gene action in maize under favourable and water stress environments. Egypt. J. Plant. Breed. 7 (I) : 55-75.

EL-Shenawy, A.A.; E.A. Amer and H.E. Mosa (2003). Estimation of combining ability on newly-developed inbred lines of maize by (Line x tester) analysis. J. Agric. Res. Tanta Univ., 29(l):50-63.

El-Zeir. F.A. E.A. Amer, A.A. Abd El- Aziz and Mohmoud (2000). Combining ability of new maize inbred lines and type of gene action using top crosses of maize. Egypt. J. Appl ; Sci., 15 : 116 – 128.

Gaber, A. I. Afaf (2003). Combining ability of yellow maize (Zea mays L.) inbred lines. Egypt. J. Appl. Sci., 15(2): 116 - 128.

Gado, H,E., M.S.M. Soliman and M.A.K. Shalaby (2000). Combining ability analysis of white maize (Zea mays L) inbred lines. J. Agric. Sci. Mansoura Univ.25:3719-3729.

Gomez, *K.A.* and A.A. Gomez. (1984). Statistical Procedure for (Agricultural Research. A Wiley Interscince Publication, John Wiley and Sons Inc., New York.

Hallauer, A. R. and E. Lopez-Perez (1979). Comparison among testers for evaluating lines of corn. proc. Ann. Corn Sorghum Res Conf 34: 57-75.

Hallauer, A.R and J.B. Miranda (1981). Quantitative Genetics in I Maize Breeding. Iowa state Univ. press. Ames., USA.

Lonnquist, J.H. and M.F.Lindsey (1964). Top cross versus SI lines performance in corn (Zea mays L.). Crop. Sci., 4: 580 - 584.

Mahgoub, G,M.A.,H.Y.S. El-Sherbiny, M.A.N. Mostafa and A.A. Abd El-Aziz (1996). Combining ability between newly developed yellow inbred lines of maize. J. Agric. Sci. Mansoura Univ. 21 : 1619 – 1627.

Mahmoud, A.A., and M.E.M. Abd El-Azeem. (2004). Estimates of general and specific combining ability of some yellow maize inbred lines using top-cross. Anals of Agric. Sci. Moshtohor, Zagazig Univ. 42(2):427-437

Matzinger, D.F. (1953). Comparison of three types of testers for the evaluation of inbreed lines of corn. Agron. J. 45 : 493 – 495.

Nass, L.L., M.Lima, R.Venocovesky and P.B. Gallo. (2000). Combining ability of maize inbred lines evaluated in three environments in Brazil. Scientia. Agricola, 57(1): 129-134

Russell, W.A., S.A. Eberhart and U.A. Vega (1973). Recurrent selection for specific combining ability in two maize populations. Crop. Sci., 13: 257-261.

Sadek, S. E., H. E. Gado, M. S. M. Soliman (2001). Combining ability and type of gene action for maize grain yield and other attributes J. Agric. Sci. Mansoura Univ. 25 : 2491 – 2502.

Sadek, S.E., M.S.M. Soliman, A.A.Bafakat and K.I. Khalifa (2002). Top crosses analysis for selecting maize lines in the early self generations. Minufiya J. Agric. Res, 27(2); 197-213.

Salama, F.A., Sh. F. Abo El-Saad and M.M. Ragheb (1995). Evaluation of maize (Zea mays L.) top crosses for grain yield and other agronomic traits under different.environmental conditions. J. Agric. Sci. Mansura Univ.20(1): 127-140.

Soliman, F.H.S. and S.E.Sadek. (1999). Combining ability of new maize inbred lines and its utilization in the Egyptian hybrids program. Bult. Fac. Agric., Cairo Univ., 50(1):1- 20.

Soliman, F.H.S., SH.A.Shafay, A.I. El-Agmy and M.A. Mostafa (2007). Inheritance of grain yield and oil content in new maize high oil single crosses. Egypt. J. Plant .Breed, 11(2): 507-530

Soliman, M.S.M, A.A. Mahmoud, F.A. El-Zeir, Afaf A.I. Gaber and F.H. Soliman (2001). Utilization of newly base,. tester for evaluating combining ability of newly maize inbred lines (Zea mays L.). Egypt. J. Plant Breed. 5:61-76.

Sprague, G.F. and L.A.Tatum. (1942). General vs. specific combining ability in single crosses of corn. J. Am. Soc, Agron, 34:923-932.

تقدير القدرة العامة على التآلف لسلالات الذرة الشامية في الهجن القمية لمحصول الحبوب والصفات الأخرى.

عفيفي عبد المعبود بركات و محي الدين محمد أحمد عثمان
برنامج الذرة الشاميـــة – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعيـــة – مصر

تم إجراء التهجين القمي بين ١٢ سلالة من الذرة الشامية البيضاء تم عزلهـا من مجتمع الجميزة الأبيض وهو مجتمع ذات قاعدة وراثيـة عريضة مع أثنين من السلالات الكـشافة همـا جميزة ١٨ وسدس٧ في موسم ٢٠٠٦. تم تقييم الهجن القمية فـي موسـم ٢٠٠٧ فـي محطتـي البحوث الزراعية بالجميزة وسدس وتم أخذ بيانات المحصول وعدد الكيزان لكل ١٠٠نبات وعـدد الأيام حتى ظهور ٥٠% حريره وارتفاع النبات والكوز وذلك بهدف تقدير القدرة على التآلف وفعل الجين وانتخاب أحسن للسلالات والهجن للاستفادة منها في برامج التربية وكانت النتائج المتحـصل عليها هي:–

١. أظهرت النتائج وجود فروق معنوية بين السلالات والكشاف وكذلك التفاعل بـين الـسلالات والكشاف لكل الصفات المدروسة بالجميزة عدا صفة ارتفاع النبات والتفاعل بين الـسلالات والكشاف لصفة عدد الكيزان لكل ١٠٠ نبات في الجميزة وأيضا التفاعـل بـين الـسلالات والكشاف لصفة ارتفاع النبات بسدس. وأظهر التحليل المشترك وجود فروق معنويـة بـين الهجن والسلالات والكشاف والتفاعل بين السلالات والكشاف لكل الصفات المدروسة محـل الدراسة. كان التفاعل بين الموقعين ومكونات التباين معنوياً لجميع الصفات عدا صفة التفاعل بين الكشاف والموقعين لصفة ارتفاع النبات والكوز وعدد الكيزان لكل ١٠٠ نبـات وكـذلك التفاعل المشترك بين السلالات والكشاف والمواقع لصفة عدد الكيزان لكل ١٠٠ نبات.

٢. أظهرت السلالات جميزة ٩٩ ، ١٤٧ ، ١٧٠ ، ١٨١ في الجميزة والتحليل المشترك أيـضاً جميزة ١٧٠ في سدس قدرة عامة موجبة ومرغوبة لصفة محصول الحبوب كمـا أظهـرت الهجن القمية جميزة ١٣٢ × جميزة ١٨ ، جميـزة ١٦٦ × جميـزة ١٨ ، جميـزة ١٦٧ × جميزة ١٨ ، جميزة ١٦٨ × سدس٧ ، جميزة ١٧٠ × سـدس ٧. قـدرة خاصـة موجبـة ومرغوبة لمحصول الحبوب وكذلك أظهرت النتائج أن التفاعل الـوراثي المـضيف لهجـن التفاعل في وراثة صفات عدد الأيام حتى ظهور ٥٠ % حريره وارتفاع النبات والكوز وعدد الكيزان لكل ١٠٠ نبات بينما كان الفعل الوراثي السيادي هو الفعال في وراثة صفة محصول الحبوب.

٣. أظهر ١٦ هجين تفوقا معنوياً على أفضل هجن المقارنة هـــ٠ف ١٠ (٢٥,٣٤إردب للفدان) لصفة محصول الحبوب في التحليل المشترك فيها سبعة هجن للسلالات جميـزة ٩٩ ، ١١٤ ، ١٣٢ ، ١٤٧ ، ١٦٦ ، ١٧٠ ، ١٨١ مع السلالة الكشافـــة جميزة ١٨ بإنتاجيـة قـدرها ٢٩,١٢ ، ٢٨,٦٥ ، ٣٠,٩٥ ، ٢٧,٣١ ، ٢٩,٢١ ، ٣٢,٦٦ ، ٢٧,٦٩ . إردب للفـــدان بالترتيب وتسعة هجن للسلالات ٩٩ ، ١١٤ ، ١٤٧ ، ١٦٨ ، ١٦٩ ، ١٧٠ ، ١٧١ ، ١٧٥ ، ١٨١ مع السلالة الكشافة سدس ٧ بمتوسطات إنتاجية قدرها ٣٢,٥٤ ، ٢٨,٢٦ ، ٣٢,١٨ ، ٣٢,٧٦ ، ٣٠,٣٥ ، ٣٠,٦٢ ، ٣٠,٠٩ ، ٣٠,٧٩ ، ٣٢,٦٥ إردب للفدان على الترتيب وذلك يخدم برنامج التربية بالقسم في استنباط الهجن الفردية التجارية البيضاء المتفوقة.