COMBINING ABILITY OF WHITE EARLY MATURITY MAIZE (*ZEA MAYS* L.) GERMPLASM

By

Mosa H.E.; A. A. El-Shenawy and A.A. Motawei

Maize Research Section, FCRI, Sakha ARS, ARC, Egypt

ABSTRACT

Half diallel cross among 10 white early maize inbred lines were evaluated for silking date, plant height and grain yield at two locations i.e., Delta region (Sakha) and middle Egypt (Sids).

Significant deferences between the two location for all studied characters were detected. GCA and SCA were significant for all characters under and over both locations. Preponderance of additive gene action in genetic expression was obtained for silking date and plant height under and over both locations. Whereas, non-additive gene action seemed to have played an important role in the expression of grain yield in general. Significant interaction between GCA x locations was reported for all characters while, SCA x locations interaction was significant for grain yield only.

The best combiners for GCA effects were i.e., Sk-6004, Sk -6005 and Sk-8055 inbred lines for silking date and plant height. Sk -8050, Sk -7/7, Sk-34/1 and Sk-63/1 inbred lines for grain yield. The highest desirable SCA effects were obtained for the crosses Sk-6001 x Sk-34/1 for silking date, Sk-8050 x Sk-7/7 for plant height and Sk-8055 x Sk-63/1 for grain yield.

The crosses Sk-6004 x Sk-34/1, Sk-6056 x Sk-8050, Sk-6056 x SK-7/7, Sk-8050 x Sk-58/8, Sk-8050 x Sk-63/1, SK-7/7 x Sk-58/8, Sk-7/7 x Sk-63/1 and Sk-34/1 x Sk-63/1 had grain yield over 27.5 ard/fed, short plants and earliness (harvest at 100 days from planting date). Therefore, such crosses could be recommended in maize breeding program as early and high yielding. Herein, it will be possible to save one irrigation and accept some delay in planting dates.

INTRODUCTION

Breeding for earliness has been one of the main activities of the National Maize Program (NMP), in order to save at last one irrigation and more over, can fit better in the crop rotation at many areas in the Delta region that grows maize late in the summer after

vegetable crops. Beck *et al.*(1990), studied heterosis and combining ability of CIMMYT'S tropical early and intermediate maturing maize. General combining ability effects (GCA) were significant for grain yield and silking date. Heterosis for plant height and days to silking were generally low. Crossa *et al.*(1990), found that additive gene effects were important in controlling silking date (69%) and plant height (79%) and heterosis effects were significant for grain yield and silking date. Pal and Prodhan (1994), suggested a greater influence of additive component of gene action in the expression of maturity. Gama *et al.*(1995), obtained that the variation due to GCA was 68% of the variation among crosses for grain yield, indicating that additive genetic effects were more important than non-additive genetic effects. Zelleke (2000), Desai and Singh (2001), Mahto and Ganguly (2001) and Yadav *et al.* (2003) found that variances due to general combining ability and specific combining ability were significant for silking date and grain yield. El-Rouby *et al.*(1973), El-Shenawy *et al.*(2002) and Mosa (2005) found that the magnitude of the interaction for GCA x locations was higher than that for SCA x locations for silking date, plant height and grain yield. The purposes of this investigation was to study type of gene action for ten early inbred lines and their interaction with locations and choose the best early and yielding crosses to be use in maize breeding program.

MATERALIS AND METHODS

Ten white early inbred lines: i.e, Sk-6001, Sk-6004, Sk-6005, Sk-6056, Sk-8050, Sk -8055, Sk-7/7, Sk-34/1, Sk-58/8 and Sk-63/1 were obtained by Maize Research Program at Sakha Agricultural Research Station. The ten parental lines were crossed in half diallel crosses in 2004season. In 2005 season, the 45 F_1's and check hybrid SC10 were tested with four replications a randomized complete block design at Sakha and Sids Research Stations. A plot included one row, 6 m long, 80 cm apart and 25 cm hill spacing. Three kernels were planted in each hill that were later thinned to one plant per hill. Recommended cultural practices were applied at the proper time. The harvest was done after 100 days from planting date. Datas were recorded on number of days from planting to 50% silk emergence, plant height (cm) and grain yield

ard/fed (1 ardab = 140 kg, 1 feddan =4200 m^2), adjusted on 15.5% basis grain moisture content and shelling percent. An ordinary analysis of variance for the data was performed for each location and combined over two locations was done according to Steel and Torrei (1980). General and specific combining ability effects were calculated using Model-1, Mothod-4 of Griffing (1956).

RESULTS AND DISCUSSION

Mean squares of diallel analysis of 10x10 inbred lines at Sakha, Sids locations and their combined for the three characters are presented in Table(1). Mean squares due to locations were highly significant for silking date and grain yield and significant for plant height. As a consequent to the different climate and soil conditions that were markedly different from Sakha to Sids locations. Mean squares due to general combining ability (GCA) and specific combining ability (SCA) for silking date, plant height and grain yield were highly significant in both locations and over locations. The ratio of K^2GCA/ K^2SCA was more than unity for silking date and plant height, indicating the preponderance of additive gene action in the genetic expression of these characters under each location and over both locations. Thus, phenotypic selection could be effective in isolating earlier genotypes and shorter plants. Meanwhile, the ratio K^2GCA/ K^2SCA was less than unity for grain yield under each location and over both locations, meaning that non-additive gene action seem to have played an important role in the expression of grain yield. Such results support the findings of Nawar *et al.* (1979), El-Hosary (1988), Shafey (1993), El-Shenawy (1995) and Amer (2003) for silking date and plant height and Piovarci, A.(1975), Nawar (1985), Eberhart *et al.*, (1966), Haggag and El-Hennawy (1992), Abdel-Sattar *et al.* (1999), Mosa (2003) and Motawei (2005) for grain yield.

Significant interaction mean squares between locations and general combining ability were detected for all characters, while, the interaction mean squares between SCA x locations were not significant for all characters except for grain yield. The magnitude of the interactions for GCA by locations were higher than those for SCA ones for all traits. These findings indicate that additive gene actions appeared to be more affected by

environments than non-additive gene action. These results are in agreement with those previously research by Matzinger *et al.* (1959), El-Rouby *et al.* (1973), Debanth and Sarkar (1987), El-Hosary (1988) and Mosa (2005) where the additive effects were reported to be more influenced by interaction with environments than the non-additive ones.

Table (1): Mean squares for general combining ability (GCA) and specific combining ability (SCA) for three characters in 10 x 10 diallel crosses under Sakha and Sids location and over locations

S.O.V	Silking date days			Plant height (cm)			Grain yield ard/fed.		
	Sk	Sd	Comb	Sk	Sd	Comb	Sk	Sd	Comb
Locations (loc.)	---	---	1247.04**	---	---	16563.76*	---	---	536.35**
Error GCA	---	---	4.84	---	---	1777.49	---	---	5.87
GCA	41.92**	84.0**	117.2**	3488.36**	2541.92**	5773.76**	303.92**	218.0**	456.68**
SCA	4.4**	3.96**	6.2**	335.88**	317.12**	564.12**	54.12**	40.2**	78.23**
GCA x loc.	---	---	8.72**	---	---	256.52**	---	---	65.24**
SCA x loc.	---	---	2.16	---	---	88.88	---	---	16.09**
Error	1.95	1.94	1.94	121.30	77.29	99.30	9.87	6.10	7.98
K^2GCA/K^2SCA	2.03	5.07	3.38	1.96	1.28	1.45	0.83	0.77	0.79

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

The estimates of combining ability effects for the ten inbred lines for the three studied characters under Sakha and Sids locations and their combined data are presented in Table (2). Results revealed that inbred lines, Sk-6004, Sk-6005, Sk-6056 and Sk-8055 had significant negative GCA effects for silking date and plant height, indicating that these inbreds contained the highest concentrations of favorable genes for earliness and short stalk. Thus, it could be involved in breeding program for improving both characters. Positive and significant GCA effects were recorded for Sk-8050, Sk-7/7, Sk-34/1 and Sk-63/1 inbred lines in grain yield. Therefore, results suggest that a greater opportunity for selection would be possible for grain yield. These results are ture in both locations and their combined data, indicating the stability of performance of inbred lines for these characters.

Table (2): Estimates of the general combining ability effects for ten inbred lines for three characters at Sakha and Sids locations and their combined data.

S.O.V	Silking date days			Plant height (cm)			Grain yield ard/fed.		
	Sk	Sd	Comb	Sk	Sd	Comb	Sk	Sd	Comb
Sk-6001	-0.63*	1.41*	1.02*	8.00*	12.41*	10.20*	-2.21*	-2.54*	-2.37*
Sk-6004	-0.80*	-0.43*	-0.61*	-8.50*	-6.40*	-7.45*	-0.43	-0.01	-0.22
Sk-6005	-1.80*	-2.30*-	-2.05*	-11.59*	-9.93*	-10.76*	-3.65*	-4.10*	-3.87*
Sk-6056	-0.39	-1.36*	-0.87*	-14.65*	-9.99*	-12.32*	-3.68*	0.36	-1.65*
Sk-8050	-.051*	-1.14*	-0.83*	1.21	-2.99*	-0.88	2.72*	1.67*	2.20*
Sk-8055	-0.76*	-1.58*	-1.17*	-10.31*	-7.40*	-8.85	-3.21*	-2.32*	-2.76*
Sk-7/7	0.16	1.35*	0.76*	15.96*	13.66*	14.81*	4.72*	1.95*	3.34*
Sk-34/1	0.04	-0.11	-0.03	6.37*	8.19*	7.28*	2.16*	4.39*	3.27*
Sk-58/8	1.54	1.54	1.54*	6.03*	0.56	3.30*	0.69	-1.48*	-0.39
Sk-63/1	1.98	2.51*	2.24*	7.046*	1.88	4.67*	2.88*	2.08*	2.48*
L.S.D. g_i 0.05	0.46	0.43	0.31	3.58	2.86	2.30	1.02	0.81	0.65

* significant at the 0.05 level of probability.

The estimates of specific combining ability effects for the 45 F_1's under two locations and their combined data are presented in Table (3). In Delta region (Sakha), the cross combination Sk-6001 x Sk-8050, Sk-6001 x Sk-7/7, Sk-6005 x Sk-58/8, Sk-8050 x Sk-63/1 and Sk-34/1 x Sk-63/1 exhibited desirable and significant SCA effects for silking date. In middle Egypt (Sids), significant desirable SCA effects were observed in crosses i.e., Sk-6001x Sk-8055, Sk-6001 x Sk-34/1 and Sk-6004 x Sk-8055 for silking date. The desirable and significant SCA effects under both locations and their combined data were observed for plant height in crosses, Sk-6001 x Sk-63/1, Sk-6005 x Sk-34/1 and Sk-8050 x Sk-7/7 and for grain yield in the crosses Sk-6005 x Sk-7/7, Sk-6056 x Sk-7/7, Sk-8050 x Sk-58/8, Sk-8055 x Sk-63/1 and Sk-7/7 x Sk-63/1, indicating that these crosses are stable for these characters and could be used for improving shorter plant height and high grain yield.

Table (3): Estimates of specific combining ability effects for 45 F_1s for three characters under Sakha and Sids locations and their combined data.

S.O.V	Silking date days			Plant height (cm)			Grain yield ard/fed.		
	Sk	Sd	Comb	Sk	Sd	Comb	Sk	Sd	Comb
Sk-6001 x Sk-6004	0.93	0.53	0.73	-2.86	-6.78	-4.82	1.15	0.32	0.736
x Sk-6005	0.84	1.00	0.92*	10.98*	6.25	8.61	0.12	1.16	0.64
x Sk-6056	1.93	-0.93	0.50	-7.20	4.31	-1.45	-2.85*	2.44*	-0.20
x Sk-8050	-1.19*	1.34*	0.07	-7.58	-1.44	-4.51	-0.76	-0.61	-0.68
x Sk-8055	-0.44	-1.21*	-0.82	10.20*	7.47	8.83*	0.43	2.12	1.28
x Sk-7/7	-1.62*	0.59	-0.51	19.42*	8.15*	13.79*	3.49*	-0.64	1.42
x Sk-34/1	-1.00	-1.43*	-1.21*	-3.24	-5.88	-4.56	2.56	1.41	1.98*
x Sk-58/8	-0.25	0.16	-0.04	-4.14	3.00	-0.57	0.77	0.29	0.53
x Sk-63/1	0.80	-0.05	0.37	-15.58*	-15.07*	-15.32*	-4.91*	-6.52*	-5.71*
Sk-6004 x Sk-6005	-0.62	-0.24	-0.43	-5.52	-2.94	-4.23	1.09	1.13	1.11
x Sk-6056	0.46	0.81	0.64	9.05	-2.63	3.21	-1.63	-2.58*	-2.10*
x Sk-8050	0.34	-0.40	-0.03	14.92*	14.12*	14.52*	1.90	1.60	1.70
x Sk-8055	-1.16	-1.21*	-1.18*	-1.80	5.03	1.61	-0.10	3.60*	1.75*
x Sk-7/7	-0.84	-0.90	-0.84	-1.33	2.22	0.44	-0.79	1.07	0.14
x Sk-34/1	-0.47	-0.68	-0.57	0.76	-1.57	-0.40	2.52	0.63	1.58
x Sk-58/8	0.52	0.16	0.34	-2.89	-2.94	-2.92	-2.26	-1.99	-2.12*
x Sk-63/1	0.84	1.94*	1.39*	-10.33*	-4.50	-7.42*	-1.94	-3.80*	-2.87*
Sk-6005 x Sk-6056	-0.12	-0.46	-0.29	-2.86	2.90	0.02	2.34	0.26	1.29
x Sk-8050	-0.25	-0.93	-0.59	0.26	-6.60	-3.17	-0.82	-0.05	-0.43
x Sk-8055	0.74	-0.49	0.12	5.80	10.81*	8.30*	-1.38	0.94	-0.21
x Sk-7/7	-0.69	-0.18	-0.43	2.76	4.50	3.63	3.68*	2.91*	3.29*
x Sk-34/1	-0.06	0.78	0.35	-18.39*	-14.28*	-16.34*	-2.01	-4.77*	-3.38*
x Sk-58/8	-1.56*	-0.62	-1.09*	6.70	1.84	4.27	0.46	1.10	0.79
x Sk-63/1	1.74*	1.16	1.45*	0.26	-2.47	-1.10	-3.48*	-2.70*	-3.09*
Sk-6056 x Sk-8050	-1.16	0.37	-0.76	1.33	6.22	3.77	5.21*	2.22*	3.72*
x Sk-8055	0.59	1.56*	1.07*	-3.64	-8.88*	-6.26*	0.40	-4.27*	-1.93*
x Sk-7/7	-0.84	-1.12	-0.98	-4.67	5.31	0.32	3.96*	3.19*	3.58*
x Sk-34/1	-0.47	0.09	-0.18	5.67	4.03	-4.85	-1.23	2.76*	0.76
x Sk-58/8	0.02	0.19	0.10	-1.49	-0.10	-0.79	-3.01*	-2.36*	-2.68*
x Sk-63/1	-0.41	0.22	-0.09	3.83	-11.16*	-3.67	-3.19*	-1.67	-2.43*
Sk-8050 x Sk-8055	0.21	1.34*	0.78	0.23	-1.63	-0.70	2.49	-0.08	1.20
x Sk-7/7	2.27*	1.16	1.71*	-14.80*	-21.44*	-18.12*	-12.69*	-5.36*	-9.03*
x Sk-34/1	1.15	-0.62	0.26	-1.70	0.28	-0.71	-1.63	-1.55	-1.59
x Sk-58/8	-0.09	-0.52	-0.31	2.39	9.90*	6.15*	3.09*	3.07*	3.08*
x Sk-63/1	-1.28*	-0.99	-1.14*	4.95	0.59	2.77	3.15*	0.76	1.95*
Sk-8055 x Sk-7/7	-0.22	-0.90	-0.56	-7.52	-6.78	-7.15*	-0.76	-2.11	-1.43
x Sk-34/1	0.15	0.81	0.48	-0.42	-2.82	-1.62	2.06	-1.05	0.50
x Sk-58/8	0.65	0.66	0.65	-7.83	-11.44*	-9.64*	6.48	-3.42*	-4.95*
x Sk-63/1	-0.53	0.55	-0.54	4.98	8.25*	6.61*	3.34*	4.26*	3.79*
Sk-7/7 x Sk-34/1	1.71*	1.87*	1.79*	-5.20	-2.38	-3.79	-3.63*	-5.08*	-4.35*
x Sk-58/8	0.21	0.22	0.21	-2.11	-2.50	-2.31	3.84*	1.79	2.81*
x Sk-63/1	0.02	-0.74	-0.35	13.45*	12.93*	13.19*	2.90*	4.22*	3.56*
Sk-34/1 x Sk-58/8	0.34	-0.05	0.14	16.73*	6.72	11.72*	0.40	1.85	1.12
x Sk-63/1	-1.34*	-0.77	-1.06*	5.80	15.90*	10.85*	0.96	5.79*	3.37*
Sk-58/8 x Sk-63/1	0.15	-0.18	-0.01	-7.36	-4.47	-5.92	3.18*	-0.33	1.42
L.S.D sij 0.05	1.2	1.2	0.85	9.48	7.52	6.08	2.70	2.13	1.72

* significant at the 0.05 level of probability.

Heterosis of three characters expressed as the percentage deviation of F_1 mean performance from SC10 in the combined

analysis are presented in Table (4). Forty four crosses had significantly negative heterotic effects relative to SC10 for silking date, meaning that these crosses were earlier than SC10. Also, all crosses exhibited significant negative heterotic effects relative to SC10 for plant height, indicating that all the crosses were shorter than SC10, therefore possibility use these crosses to resist stalk lodging when sowing in late planting dates. Forty two crosses exhibited significant negative heterotic effects relative to SC10 for grain yield, while, two crosses i.e., Sk-34/1 x Sk-63/1 and Sk-7/7 x Sk-63/1, exhibited negative heterotic effects but not significant relative to SC10 for grain yield. Generally, the crosses i.e., Sk-6004 x Sk-34/1, Sk-6056 x Sk-8050, Sk-6056 x Sk-7/7, Sk-8050 x Sk-58/8, Sk-8050 x Sk-63/1, Sk-7/7 x Sk-58/8, SK-7/7 x SK-63/1 and Sk-34/1 x Sk-63/1 had grain yield over 27.5 ard/fed, short plants and earliness, (harvest at 100 days from planting date); showing progress in earliness thus the white commercial crosses in Egypt are harvested at 120 days from planting date. Therefore, the above mentioned crosses could be recommend for use in maize breeding program as early yielding crosses in order to save one irrigation and tolerate lateness in planting according to the used cropping system.

Table (4): Mean performance of 45 F_1s and check hybrid SC10 and its percentage of heterotic effects over check hybrid SC10 for three characters over tow locations.

Crosses	Silking date (days		Plant height (cm)		Grain yield (ard/fed.)	
	x̄	SC10	x̄	SC10	x̄	SC10
Sk-6001 x Sk-6004	56.7	-5.5*	242.25	-17.63*	21.42	-37.93*
x Sk-6005	55.5	-7.5*	252.37	-14.19*	17.49	-49.31*
x Sk-6056	56.2	-6.31*	240.75	-18.14*	18.96	-45.05*
x Sk-8050	55.8	-7.00*	249.12	-15.29*	22.38	-35.14*
x Sk-8055	54.6	-9.00*	254.50	-13.47*	19.42	-43.72*
x Sk-7/7	56.8	-5.33*	283.12	-3.73*	25.36	-26.51*
x Sk-34/1	55.3	-7.83*	257.25	-12.53*	26.04	-24.54*
x Sk-58/8	58.1	-3.16*	257.25	-12.53*	20.86	-39.55*
x Sk-63/1	59.2	-1.33	243.87	-17.08*	17.42	-49.52*
Sk-6004 x Sk-6005	52.2	-12.5*	221.87	-24.56*	20.08	-41.79*
x Sk-6056	54.7	-8.83*	227.75	-22.56*	19.14	-44.53*
x Sk-8050	54.1	-9.83*	250.50	-14.83*	26.91	-22.02*
x Sk-8055	52.6	-12.33*	229.62	-21.92*	21.92	-36.48*
x Sk-7/7	54.8	-8.66*	252.12	-14.27*	26.36	-23.61*
x Sk-34/1	54.3	-9.5*	243.75	-17.12*	27.72	-19.67*
x Sk-58/8	56.8	-5.33*	237.25	-19.33*	20.27	-41.26*
x Sk-63/1	58.6	-2.33*	234.12	-20.39*	22.58	-34.56*
Sk-6005 x Sk-6056	52.3	-12.83*	221.25	-24.77*	18.92	-45.17*
x Sk-8050	52.1	-13.16*	229.50	-21.97*	20.91	-39.40*
x Sk-8055	52.5	-12.5*	233.00	-20.78*	16.40	-52.47*
x Sk-7/7	53.8	-10.33*	252.00	-14.32*	25.95	-24.80*
x Sk-34/1	53.8	-10.33*	224.50	-23.67*	19.10	-44.65*
x Sk-58/8	54.0	-10.00*	241.12	-18.01*	19.52	-43.36*
x Sk-63/1	57.2	-4.66*	237.12	-19.37*	18.69	-45.84*
Sk-6056 x Sk-8050	53.1	-11.5*	234.87	-20.14*	27.50	-20.42*
x Sk-8055	54.6	-9.0*	216.87	-26.26*	16.69	-51.63*
x Sk-7/7	54.5	-9.16*	247.12	-15.97*	28.33	-17.90*
x Sk-34/1	54.5	-9.16*	244.12	-16.99*	25.29	-26.71*
x Sk-58/8	56.3	-6.16*	234.50	-20.27*	18.34	-46.85*
x Sk-63/1	56.8	-5.33*	233.00	-20.78*	21.34	-38.16*
Sk-8050 x Sk-8055	54.3	-9.5*	233.87	-20.48*	23.72	-31.26*
x Sk-7/7	57.2	-4.66*	240.12	-18.35*	19.72	-42.85*
x Sk-34/1	55.0	-8.33*	250.00	-15.00*	26.93	-21.96*
x Sk-58/8	56.0	-6.66*	252.87	-14.02*	27.91	-19.12*
x Sk-63/1	55.8	-7.00*	250.87	-14.70*	29.61	-14.19*
Sk-8055 x Sk-7/7	54.6	-9.00*	243.12	-17.33*	22.16	-35.78*
x Sk-34/1	54.8	-8.66*	241.12	-18.01*	24.08	-30.22*
x Sk-58/8	56.6	-5.66*	229.12	-22.09*	14.95	-56.67*
x Sk-63/1	56.1	-6.5*	246.75	-16.10*	26.53	-23.12*
Sk-7/7 x Sk-34/1	58.1	-3.166*	262.62	-10.70*	25.50	-26.10*
x Sk-58/8	58.1	-3.16*	260.12	-11.55*	29.06	-15.79*
x Sk-63/1	58.2	-3.00*	277.00	-5.82*	32.50	-5.82
Sk-34/1 x Sk-58/8	57.2	-4.66*	266.62	-9.34*	27.22	-21.12*
x Sk-63/1	56.7	-5.50*	267.12	-9.17*	32.24	-6.57
Sk-58/8 x Sk-63/1	59.3	-1.16	246.37	-16.23*	26.48	-23.26*
SC10	60.0	---	294.12	---	34.51	---

* significant at the 0.05 level of probability.

REFERENCES

Abdel-Sattar, A.A.; A.A. El-Hosary and M.H. Motawea (1999). Genetic analysis of maize grain yield and its component by diallel crossing. Minufiya. J. Agric. Res., 34 No.1:43-63.

Amer E.A. (2003). Diallel analysis for yield and its components of maize under two different locations. Minufiya J. Agric. Res., 28 No. 5(1): 1363-1373.

Beck, D.L.; S.K.Vosal and J. Crossa (1990). Heterosis and combining ability of CIMMYT'S tropical early and intermediate maturity maize (*Zea mays* L.) germplasm. Maydica, 35 No.3:279-285.

Crossa, J.; S.K. Vasal and D.L. Beck (1990). Combining ability estimates of CIMMYT'S tropical late yellow maize germplasm . Maydica, 35 No3: 273-278.

Dabanth, S.C. and K.R. Sarkar (1987). Genetic analysis of grain yield and other characters in maize (*Zea mays* L.). J. Genetic. Cytol., 17:49-61.

Desai, S.A. and R.D. Singh (2001). Combining ability studies for some morpho-physiological and biochemical traits relative to drought tolerance in maize (*Zea mays* L.). Indian Genetics and Plant Breed., 61 No.1:34-36.

Eberhart, S.A.; R.H. Moll, H.F. Robinson and C.C. Cockerhan (1966). Epistasis and other genetic variances in two variances in two varieties of maize. Crop Sci., 6: 275-280.

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 No.(1,2): 13-25.

El-Rouby, M.M.; Y.S. Koraiem and A.A. Nawar (1973). Estimation of genetic variance and its components in maize under stress and non-stress environment. I. Planting date. Egypt. J. Genetic and Cytol., 2:10-19.

El-Shenawy, A.A. (1995). Breeding for disease resistance in maize. Ph.D. Thesis, Fac. Agric., Minufiya Univ., Egypt.

El-Shenawy, A.A ; H.E. Mosa and R.S.H. Aly (2002). Genetic analysis of grain yield per plant and other traits on maize early inbred lines.J. Agric. Sci. Mansoura Univ., 27 (4): 2019-2026.

Gama, E.E.G.E.; A.R. Hallauer; R.G. Ferrao and D. Barbosa (1995). Heterosis in maize single crosses derived from a yellow Tuxpone variety in Brazil. Revista Brasileira de genetica, 18 No.1:81-85.

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

Haggag, M.E. and M.A.El-Hennawy (1992). Early for heterosis and combining ability in maize using tissue culture techniques. Annals Agric. Sci., Ain Shams Univ., Cairo, 37(1): 77-83.

Matzinger, D.F.; G.F. Sprgue and C.C.Cockerhan (1959). Diallel crosses of experiments repeated over locations and years. Agron. J.,51:346-349.

Mohto, R.N. and D.K. Ganguly (2001). Heterosis and combining ability studies in maize (*Zea mays* L.). J. Res. Birsa. Agric. Univ., 13, No.2: 197-199.

Mosa, H.E. (2003). Heterosis and combining ability in maize (Zea mays L.). Minufiya. J. Agric. Res., 28 No.5(1):1375-1386.

Mosa, H.E. (2005). Combining ability of eight yellow maize (Zea mays L.) inbred lines for different characters in diallel crosses J. Agric. Res. Tanta Univ., 31 (4-A) : 604-615.

Motawei A.A. (2005). Combining ability and heterotic effect of nine maize inbred lines via diallel cross analysis. Minufiya J. Agric. Res., 30 No.1: 197-214.

Nawar, A.A. (1985). Diallel analysis of the combining ability of inbred lines and its utilization in breeding maize hybrids. Minufiya. J. Agric. Res., 10 No.4:2015-2026.

Nawar, A.A.; M.E. Gomaa and M.S. Rady (1979). Heterosis and combining ability in maize. Egypt. J. Genet. Cytol., 9:255-267.

Pal, A.K. and H.S. Prodhan (1994). Combining ability analysis of grain yield and oil content along with some other attributes in maize (*Zea mays* L.). Indian. J. Genetics and Plant Breed., 54, No.4:376-380.

Piovarci, A. (1975). Genetic analysis and combining ability of grain yield components of maize inbred lines. Genetic and selection. Chekoslovakia, Tranava. 11(1):3-8.

Shafey, S.A. (1993). Diallel analysis of some agronomic characters and yield in yellow maize (*Zea mays* L.). Egypt. J. Appl. SCi., 8:602-616.

Steel, R.G. and J.H. Torrie (1980). Principles and procedures of statistics. A Biometrical Approach. 2nd Ed. Me. Graw Hill, N.Y.USA.

Yadav, T.P.; R.D. Singh and J.S. Bhat (2003). Genetic studies under different levels of moisture stress in maize (*Zea mays* L.). Indian . J. genetics and Plant Breed., 63 No.2:119-123.

Zelleke, H. (2000). Combining ability for grain yield and other agronomic characters in inbred lines of maize (*Zea mays* L.). Indian J. Genetic and plant Breed., 60 No.1:63-70.

الملخـــــص العربى

القدرة على الائتلاف لمواد وراثية مبكرة من الذرة الشامية البيضاء

حاتم الحمادى موسى- عباس عبد الحي الشناوي- عاصم عبده مطاوع

برنامج الذرة الشامية -معهد بحوث المحاصيل الحقلية-مركز البحوث الزراعية

قيمت الهجن الناتجة من التهجين نصف الدوري بين عشرة سلالات مبكرة بيضاء الحبوب لصفات تاريخ ظهور ٥٠% من حرائر النـــورات المؤنثة وارتفاع النبات ومحصول الحبوب فى موقعين فى منطقة الـــدلتا بسخا ومصر الوسطى بسدس

- كانت الاختلافات بين الموقعين معنوية لجميع الصفات.
- اظهر تباين القدرة العامة والخاصة على الائتلاف معنويـــة فـــى كـــلا الموقعين والتحليل المشترك لهما كذلك تبين أن الفعل الوراثى المضـــيف متحكما فى وراثة صفات تاريخ ظهور ٥٠% من حرائر النورات المؤنثة وارتفاع النبات فى كلا الموقعين والتحليل المشترك لهما. بينما كان الفعل الوراثى غير المضيف هو الأكثر تحكما فى وراثة صفة محصول الحبوب فى كلا من الموقعين والتحليل المشترك بينهما.
- اظهر التفاعل بين القدرة العامة على الائتلاف والمواقع معنوية لجميع الصفات بينما كان التفاعل بين القدرة الخاصة على الائـــتلاف والمواقـــع معنويا لصفة محصول الحبوب فقط.

- تبين ان أفضل السلالات للقدرة العامة على الائتلاف كانت السلالات سخا٦٠٠٤و سخا ٦٠٠٥ و سخا ٨٠٥٥ لصفات تاريخ ظهور ٥٠% من حرائر النورات المؤنثة وارتفاع النبات والسلالات سخا ٨٠٥٠و سخا ٧/٧و سخا ١/٣٤و سخا ١/٦٣ لصفة محصول الحبوب. وكانت أفضل الهجن فى القدرة الخاصة على الائتلاف الهجين سخا ٦٠٠١ x سخا ١/٣٤ لصفة تاريخ ظهور ٥٠% من حرائر النورات المؤنثة وسخا ٨٠٥٠ x سخا ٧/٧ لصفة ارتفاع النبات وكان الهجين سخا ٨٠٥٥ x سخا ١/٦٣ هو الأفضل لصفة محصول الحبوب.
- أعطت الهجن سخا ٦٠٠٤x سخا ١/٣٤، سخا ٦٠٥٦ x سخا ٨٠٥٠ وسخا ٦٠٥٦ x سخا٧/٧ وسخا ٨٠٥٠x سخا ٨/٥٨ وسخا ٨٠٥٠ x سخا ١/٦٣ و سخا ٧/٧ x سخا ٨/٥٨ وسخا ٧/٧ x سخا ١/٦٣ وسخا١/٣٤ x سخا ١/٦٣محصول حبوب أعلى من٢٧,٥ أردب للفدان كما إنها كانت مبكرة التزهير وقصيرة الارتفاع وتحصد عند ١٠٠ يوم من الزراعة ولذلك يمكن التو صية بها لزراعتها فى برنامج التربية كهجن تعطى محصول جيد ومبكرة حيث تمكن من توفير ريه كما يمكن زراعتها فى عروات الزراعة المتأخرة تبعا للتركيب المحصولى المستخدم.