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GENERAL AND SPECIFIC COMBINING ABILITY INTERACTIONS WITH YEAR IN MAIZE

BY

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ABSTRACT

General (GCA) and specific (SCA) combining abilities and their interaction with year were investigated in one set of F's among eight inbreeds lines. Significant GCA was detected in the combined analysis for most of the traits except for the date of mid-silking. Also, significant SCA was detected for all traits with the exception of ear height, ear length and mid-tasselling date. Both GCA*year and SCA*year were significant only for mid-silking date, plant height and number of kernels/row. Calculated ratios of GCA*year/GCA was higher than the ratio GCA*year/SCA for mid-silking date indicating that the additive and additive by additive effects were highly influenced by year for this trait. As for plant height and number of kernels/row, the ratio SCA*year/SCA was higher than GCA*year/GCA indicating that the non-additive effects were more influenced by year. Significant GCA by year interaction was detected for mid-tasselling date. On the contrary, significant SCA by year interaction was detected for ear diameter and grain yield/plant.

INTRODUCTION

Interaction of general (GCA) and specific (SCA) combining ability with year is one of the aspects that requires special attention. Diallel cross analysis has been used effectively to estimate the interaction of GCA and SCA by environmental factors. In retrospect, Matzinger *et al.* (1959) reported that the additive genetic variance was much more influenced by environment than the non-additive portion. Singh *et al.* (1977), however, reported that the additive genetic variance was stable over environment for at least 14 characters; only the characters of mid-silking date, ear height and tryptophan content showed the presence of additive by location interaction. Stuber *et al* (1977) reported that estimates of GCA and SCA showed significant interaction with plant density for ear and plant heights. Likewise, El-Zeir (1984) found that both GCA and SCA were stable over plant density with the exception of plant and ear height. Nawar (1985) found that GCA and SCA by year interaction were significant with the latter being of higher magnitude than the former Galal *et al* (1987) indicated that GCA interaction with location was of higher magnitude than SCA by location. Galal *et al* (1977) and El-Hosary *et al* (1988a) found significant interaction of planting date with both types of combining ability with year. El-Hosary *et al.* (1988) reported significant interaction of both types of combining ability and location for mid-tasselling date, plant height, number of rows/ear, 100-kernel weight and grain yield/plant. Badr (1989) and El-Hosary and Sedhom (1990) reported that the additive genetic variance was more biased up by the interaction with the environment than the non-additive effects. Finally, El-Zeir (1990) reported that the effects of location, year and plant density were more prominent on GCA and SCA than nitrogen fertilization.

Here, we report estimates of GCA and SCA in a set of 28 F_1 crosses, derived from 8 inbreds with the aim to elucidate the effect of year on both estimates.

MATERIALS AND METHODS

28-F_1 crosses were used in this study. These were the progeny of 8 inbred parents. These include the six inbreds designated as $Mosht_1$, $Mosht_2$, $Mosht_3$, $Mosht_{18}$, $Mosht_{19}$ and $Mosht_{17}$, respectively. These are referred to herein as P_1, P_2, P_3, P_4, P_5 and P_6, respectively The latter two were G303A and Rg10. Pedigree and credentials of inbreds are given elsewhere by Abo-El-Hassan (1994). In 1991 and 1992 seasons the single crosses were grown at the Experimental station of the Faculty of Agriculture at Moshtohor, Kalubia on the 20th of June. The experimental design was complete randomized blocks with three replications. Plots were two ridges each of 6 m long and 70 cm wide. Intra hills spacing was 20 cm. Hills were thinned to one plant/hill. Plots were treated alike as to fertilization, irrigation and other cultural practices. Data collected in clouded mid-tasselling date, mid-silking date, plant height (cm) ear height (cm), ear length (cm), ear diameter (cm), number of rows/ear number of kernels/row, weight of ear/plant and grain yield/plant.

Data obtained were taken on individual plant basis except for mid-tasselling and mid-silking date which were taken on whole plot basis. The ordinary anova was firstly performed on separate seasons assuming a fixed model. A combined analysis of both seasons was afterwards carried out after checking the homogeneity of the error variance. A one tail F test was used to test the significance of various sources of variations. General and specific combining abilities were computed according to Griffing's (1956) Model 1 (fixed effects) Method 4.

RESULTS AND DISCUSSION

Combined sum of squares for GCA and SCA are shown for various traits in Table (1) together with the calculated ratio GCA/SCA. GCA sum of squares were highly significant for the ten studied characters. SCA sum of squares were highly significant for plant height, mid-dates of tasselling and silking, ear diameter, number of grains/row, ear weight and grain yield/plant and only significant for ear height and ear length and number of rows/ear Such results emphasized the

Table (1): Combined mean squares from ordinary analysis for ten agronomic characters of maize.

S.O.V.	d.f.	Plant height (cm)	Ear heaight (cm)	Mid silking date	Mid tasseling date	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	No. of grains/row	Ear weight (g)	Grain yield (g)/plant
Year (Y)	1	7791.32**	1461.01**	70.72	1.53	9.33	0.23	16.46**	202.61**	984.00	9320.25**
Blocks within	4	124.46	320.20	2.69	4.74	12.85	0.19*	0.53	4.70	905.83*	725.52*
Year Genotypes (G)	27	1817.93**	1075.59**	11.20**	19.36**	10.46**	0.39**	2.50**	58.57**	3554.72**	2146.89**
Genotype X year	27	411.06**	171.31	6.49**	8.54**	2.70	0.13**	3.49**	26.74**	345.52	266.54
GCA	7	6303.84**	3433.47**	12.76**	34.89**	31.29**	1.02**	5.18**	138.88**	9925.08**	5731.12**
SCA	20	247.86**	250.47*	10.65**	13.92**	3.16*	0.17**	1.56*	30.86**	1325.09**	888.36**
GCA X year	7	453.38**	143.05	10.58**	14.36**	3.02	0.10	1.24	33.32**	127.42	111.47
SCA X year	20	396.25**	181.20	5.05**	3.01	2.59	0.14**	4.28	24.48**	421.85	320.83
Error	108	116.23	122.30	1.67	2.74	1.70	0.06	0.82	5.22	311.69	189.13
GCA/SCA		21.39	13.71	1.19	2.51	9.90	6.11	3.32	4.50	7.49	6.45

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

importance of both estimates in the inheritance of the traits in this group of inbred lines. In addition high calculated GCA/SCA ratios exceeding by for the unity were obtained for all traits indicating the overwhelming effect of the additive genetic portion over the non-additive in the inheritance of all ten traits.

GCA*season an SCA*season interaction:

Results in Table (1) show that both GCA and SCA by season sum of squares were significant for mid-silking date, plant height and number of kernels/row. Also the ratios of SCA*season/SCA were higher than the ratio of GCA*season/GCA, for the plant height and number of kernels/row. This indicates that the non-additive genetic variance was influenced more by season than the additive one for these two respective traits. However, for mid-silking date the opposite was true indicating that the additive and additive by additive effects were more influenced by season for this particular trait. Results also show significant GCA*season and insignificant SCA*season for mid-tasselling date indicating that the additive effects only interplayed with season. However, significant SCA*season and insignificant GCA*season was obtained for ear diameter and grain yield/plant indicating that SCA alone interplayed with season.

Data on GCA effects are shown in Table (2). Evidently, P_1 was a good combiner for grain yield/plant, most of yield components and mid silking and mid-tasselling date. P_3 ranked second expressing favorable GCA for grain yield and some yield components. Significant and positive SCA effects are manifested in the five crosses (P_2xP_5), (P_2xP_8), (P_3xP_8), (P_5xP_6) and (P_6xP_7) for grain yield/plant, Table (3). Also, results show that the single crosses (P_1xP_6), (P_2xP_5) and (P_2xP_8) were the best combinations.

Favorable SCA is manifested in seven crosses for mid-silking date, of which P_3xP_4 had the highest negative value. Favorable SCA effects for mid-tasselling is manifested in eleven crosses of which P_3xP_5 had the highest value.

Seven favorable SCA effects for shortening plant height are encounted; the highest negative value is manifested by the cross P_1xP_4.

Five favorable SCA effects in the direction for lowering ear height are encounted of which P_1xP_7 expressed the highest negative value.

For ear characteristics the most favorable SCA effects are shown in the crosses (P_5xP_8) for ear length, (P_1xP_2), (P_2xP_8) and (P_3xP_8) for ear diameter; (P_7xP_8) for number of rows/ear (P_3xP_7), (P_2xP_6) and (P_3xP_8) for number of kernels/row; (P_2xP_8) for ear weight; and (P_1xP_6), (P_3xP_5) and (P_2xP_8) for grain yield/plant.

The results conclusions of this study on the basis of pooled data analysis of variance of combining ability over the two seasons show that both SCA and SCA mean squares were significant for all characters. Although SCA mean squares

Table (2): Estmates of general (GCA) combining ability effects for ten agronomic and yield traits for the eight parants in 1991 and 1992 seasons.

Parent / characters	year	plant height (cm)	Ear height (cm)	Mid silking date	Mid tasseling date	Ear length (cm)	Ear diameter (cm)	No. rows/ear	No. kernels/row	Ear weight (g)	Grain yield (g/plant)
	Y1	21.18	17.32	-1.69	-0.85	0.93	0.31	0.66	1.77	27.29	19.53
P1	Y2	30.98	20.45	N.S.	-1.09	1.51	0.23	0.66	4.50	26.50	23.05
	Comb.	25.97	18.88	-0.90	-1.51	1.22	0.27	0.66	3.08	27.59	21.29
	Y1	9.99	5.93	-1.19	0.38	1.15	0.26	0.34	2.11	19.73	15.41
P2	Y2	14.00	6.05	N.S.	-0.48	1.45	0.11	-0.69	3.63	18.96	12.14
	Comb.	11.92	5.99	-0.56	-0.29	1.30	0.18	0.51	3.08	20.04	13.78
	Y1	-8.46	8.18	0.42	0.26	0.68	-0.07	-0.03	0.73	-12.72	-6.66
P3	Y2	-13.29	10.08	N.S.		-0.72	-0.01				
	Comb.	-10.96	9.13	0.27	0.49	-0.70	-0.04	0.15	-0.91	-11.06	-6.64
	Y1	-10.13	6.07	-0.36	0.65	-0.61	-0.11	-0.37	-0.86	-6.35	-2.02
P4	Y2	-7.84	6.01	N.S.		-0.77	0.03				
	Comb.	-9.05	6.04	-0.06	-0.24	-0.69	-0.07	-0.30	-1.70	-4.92	-3.18
	Y1	-2.57	0.54	0.97	0.32	-0.37	0.05	-0.10	-1.48	2.06	0.29
P5	Y2	2.83	2.76	N.S.		-0.20	-0.08				
	Comb.	0.06	1.68	0.63	0.65	-0.09	0.06	-0.20	-1.68	5.48	3.02
	Y1	-4.90	8.79	-0.31	-1.79	-0.46	-0.13	-0.17	0.18	-12.34	-8.67
P6	Y2	-16.83	7.98	N.S.		-1.60	-0.21				
	Comb.	-10.93	8.42	-0.48	-1.18	-1.03	-0.17	-0.31	-0.76	-14.64	-11.24
	Y1	-9.79	9.84	0.64	0.15	0.81	-0.19	-0.01	-2.35	21.51	-17.50
P7	Y2	-8.50	5.55	N.S.		-0.49	-0.25				
	Comb.	-9.21	7.70	0.38	0.79	-0.65	-0.23	-0.23	-1.02	-22.12	-16.78
	Y1	-4.76	9.10	1.53	0.88	0.86	-0.09	-0.32	-0.11	3.83	-0.35
P8	Y2	-1.31	0.37			0.43	0.08				
	Comb.	1.66	4.74	0.72	1.29	0.65	-0.01	-0.01	-0.08	-0.37	-0.24
L.S.D.	Y1 5%	4.66	4.68	0.68	0.78	0.59	0.12	0.40	0.98	8.25	6.63
(gi)	1%	6.21	6.42	0.90	1.04	0.79	0.16	0.54	1.30	11.00	8.84
	Y2 5%	4.89	5.11								
	1%	6.51	6.82								
	Comb. 5%	2.42	3.41	0.40	0.51	0.40	0.08	0.28	0.70	5.45	9.10
	1%	4.42	4.53	0.53	0.68	0.53	0.10	0.37	0.94	7.24	12.09
L.S.D.	Y1 5%	7.05	7.08	1.02	1.18	0.90	0.18	0.61	1.47	12.47	10.03
(gi-gj)	1%	9.41	9.43	1.36	1.57	1.20	0.24	0.81	1.97	16.63	13.37
	Y2 5%	7.39	7.73				0.85				
	1%	9.86	10.30				1.31				
	Comb. 5%	7.37	7.56	0.88	1.13	0.89	0.17	0.62	1.56	12.06	9.40
	1%	9.78	10.04	1.17	1.50	1.18	0.22	0.82	2.07	16.02	12.48

Table (3): Estimates of specific combining ability effects in 1991 and 1992 seasons and combined data.

Genotype	P2 Y1	P2 Y2	P2 Comb.	P3 Y1	P3 Y2	P3 Comb.	P4 Y1	P4 Y2	P4 Comb.	P5 Y1	P5 Y2	P5 Comb.	P6 Y1	P6 Y2	P6 Comb.	P7 Y1	P7 Y2	P7 Comb.	P8 Y1	P8 Y2	P8 Comb.
Plant height																					
P1	8.52	-11.90*	1.62	-21.14**	24.08**	-22.53**	-31.14**	-17.08**	-24.03**	-10.81*	-9.75*	-10.20**	-13.14*	-22.97**	-17.98**	-16.81**	-25.08**	-20.08**	-6.48	-18.08**	-12.20**
P2				-13.92**	14.22**	0.23	0.74	32.56**	16.73**	22.08**	11.78	17.01**	4.59	12.44*	-6.94	-5.92	-2.44	-3.94	9.74	2.89	6.40
P3							-0.81	-11.17*	-5.91	2.52	7.39	5.04	18.86**	-13.94**	2.54	0.52	-11.27	-5.30	23.52**	19.06**	21.37**
P4										-9.70	0.90	-4.32	-9.03	-28.10**	-18.49**	2.30	-7.10	-2.32	23.63**	-2.14	1.15
P5													9.43	2.22	5.90	-6.59	5.39	-0.52	-1.26	21.56**	10.23**
P6																-5.03	10.22	2.67	6.63	9.22	8.01*
P7																			-1.37	8.62	3.71
L.S.D. sij:																					
5%																			15.77	16.53	11.25
1%																			21.02	22.04	14.94
L.S.D. sij - sik:																					
5%																			14.10	14.78	10.06
1%																			18.80	19.71	13.37
Ear height																					
P1	-3.45	N.S.	-4.33	4.21	N.S.	-2.49	-15.79**	N.S.	-15.29**	-3.45	N.S.	0.21	-16.45**	N.S.	-17.51**	-24.12**	N.S.	18.29**	0.21	N.S.	-3.13
P2				-8.29	N.S.	0.55	7.71	N.S.	12.39**	24.38**	N.S.	17.61**	-12.29*	N.S.	-6.40	2.71	N.S.	3.03	15.05**	N.S.	7.09
P3							-0.62	N.S.	-3.58	-14.95**	N.S.	-4.75	3.71	N.S.	1.08	-10.62*	N.S.	-8.75	26.71**	N.S.	17.25**
P4										-8.67	N.S.	-3.22	-7.34	N.S.	-9.89*	-6.34	N.S.	-5.22	9.99	N.S.	-0.53
P5													9.05	N.S.	3.49	2.38	N.S.	-0.51	18.05**	N.S.	15.32**
P6																3.10	N.S.	3.36	10.77*	N.S.	18.20**
P7																			0.21	N.S.	3.04
L.S.D. sij:																					
5%																			15.82		11.54
1%																			21.10		15.33
L.S.D. sij - sik:																					
5%																			14.15		10.32
1%																			18.87		13.71

Table (3): Cont..

Genotype	P2			P3			P4			P5			P6			P7			P8		
	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb	Y1	Y2	Comb.
										Date of silking											
P_1	0.67	-0.76	0.02	1.67**	1.58*	1.64**	0.33	2.91**	1.64**	1.67**	2.91**	2.31**	-2.67**	0.58	-1.02*	-1.33**	2.24**	0.48	-1.00*	0.58	0.19
P_2				-0.89	-2.53	-1.69**	0.78	0.80	0.81	0.11	-0.20	-0.02	-1.22*	-1.87*	-1.70**	-0.22	2.47**	1.14*	0.11	2.74**	1.31**
P_3							-2.32**	-2.70**	-2.52**	0.00	4.30**	2.14**	0.33	-0.03	0.14	1.00*	2.63**	1.81**	-1.00*	2.63**	0.81
P_4										-1.22*	1.92*	-1.38**	-0.55	1.41	0.45	0.78	-2.92**	1.05*	0.78	1.41	1.12*
P_5													1.33**	-0.64	-0.97*	1.00*	-0.31	0.37	1.67*	2.36**	2.03**
P_6																1.22*	0.36	0.78	0.55	0.36	0.45
P_7																			-2.00	-0.81	-1.41**
L.S.D. sij:																					
5%																			1.51	2.29	1.35
1%																			2.01	3.05	1.80
L.S.D. sij - sik:																					
5%																			1.35	2.05	1.21
1%																			1.80	2.73	1.60
										Tasselling date											
P_1	N.S.	0.18	-0.03	N.S.	1.18	2.30**	N.S.	0.85	1.13*	N.S.	1.35	1.80**	N.S.	0.02	-1.54**	N.S.	1.18	0.80	N.S.	-0.32	-0.87
P_2				N.S.	-1.93*	-2.37*	N.S.	1.07	1.80**	N.S.	-0.43	0.46	N.S.	-0.93	-2.04*	N.S.	1.41	0.63	N.S.	0.07	0.46
P_3							N.S.	1.51	-2.76**	N.S.	2.32**	2.24*	N.S.	0.82*	-0.18	N.S.	2.32**	1.91*	N.S.	1.66*	2.07**
P_4										N.S.	-0.48	-0.76	N.S.	-1.15	-2.26**	N.S.	-1.65*	-1.60**	N.S.	1.68*	2.74**
P_5													N.S.	-0.60	-1.32*	N.S.	0.57	1.85**	N.S.	1.57*	2.18**
P_6																N.S.	0.52	1.21*	N.S.	0.52	1.21*
P_7																			N.S.	-0.29	-0.26
L.S.D. sij:																					
5%																			N.S.	2.32	1.73
1%																			N.S.	3.09	2.34
L.S.D. sij - sik:																					
5%																			N.S.	2.08	1.53
1%																			N.S.	2.77	2.03

Table (3): Cont..

Geno-type	P_2			P_3			P_4			P_5			P6			P7			P8		
	Y_1	Y_2	Comb.	Y_1	Y_2	Comb.	Y_1	Y_2	Comb.	Y_1	Y_2	Comb.	Y_1	Y2	Comb.	Y1	Y2	Comb	Y1	Y2	Comb.
											Ear length										
P_1	1.35*	N.S.	0.59	-1.81**	N.S.	-2.27**	-2.26**	N.S.	-2.07**	-0.68	N.S.	1.01*	-2.66*	N.S.	-2.00**	-2.32**	N.S.	-2.59**	0.64	N.S.	-0.98*
P_2				-0.91	N.S.	-0.41	0.77	N.S.	0.38	-0.58	N.S.	0.49	-1.19	N.S.	-1.94**	0.44	N.S.	0.35	2.14**	N.S.	2.26**
P_3							-0.46	N.S.	0.11	-0.87	N.S.	0.31	1.86**	N.S.	0.89*	-0.43	N.S.	-0.56	2.42**	N.S.	1.58**
P_4										0.01	N.S.	0.28	0.51	N.S.	-0.50	0.32	N.S.	0.09	0.13	N.S.	-0.46
P_5													0.27	N.S.	0.33	-1.18	N.S.	0.16	3.04**	N.S.	2.55**
P_6																0.89	N.S.	0.48	0.64	N.S.	0.78
P_7																			-0.79	N.S.	0.02
L.S.D. sij:																					
5%																			2.00		1.36
1%																			2.67		1.81
L.S.D. sij - sik:																					
5%																			1.79		1.22
1%																			2.39		1.62
											Ear diameter										
P_1	-0.01	0.41**	0.20*	-0.49**	0.11	-0.30**	-0.25	0.05	-0.10	0.02	0.12	-0.07	-0.39	-0.36**	-0.37**	-0.75**	-0.65**	-0.70**	-0.25	-0.45**	-0.35**
P_2				0.01	0.09	0.05	-0.13	-0.33	-0.14	0.36**	-0.35**	0.01	-0.33*	-0.27*	-0.34**	-0.19	0.29*	-0.23	0.14	-0.21	0.22**
P_3							-0.04	-0.21	-0.08	-0.09	0.18	0.05	0.36**	-0.33**	0.01	-0.14	-0.42**	-0.28**	0.01	0.49**	0.25**
P_4										-0.32*	0.00	-0.16	-0.15	-0.09	-0.12	-0.04	-0.34**	-0.19	-0.15	-0.04	-0.09
P_5													-0.17	-0.01	0.08	-0.47**	0.15	0.03	-0.03	0.30	0.14
P_6																0.01	0.31**	0.16	-0.20	0.12	-0.04
P_7																			0.11	0.05	0.08
L.S.D. sij:																					
5%																			0.40	0.35	0.26
1%																			0.54	0.47	0.34
L.S.D. sij - sik:																					
5%																			0.36	0.32	0.23
1%																			0.48	0.42	0.30

Table (3): Cont..

Geno-type	P2 Y1	P2 Y2	P2 Comb.	P3 Y1	P3 Y2	P3 Comb.	P4 Y1	P4 Y2	P4 Comb.	P5 Y1	P5 Y2	P5 Comb.	P6 Y1	P6 Y2	P6 Comb.	P7 Y1	P7 Y2	P7 Comb	P8 Y1	P8 Y2	P8 Comb.
Number of rows/ear																					
P1	0.04	0.24	0.14	-1.71**	-0.69	-1.20**	-0.52	-0.44	0.48	-0.96*	0.03	-0.50	0.44	-1.07	-0.75*	0.06	-2.09**	-1.02**	0.52	-1.43**	-0.45
P2				-0.20	-0.05	-0.12	-0.24	0.44	0.63*	1.23**	-1.07*	0.08	-1.02*	0.39	-0.32	-0.11	-0.60	-0.35	-0.55	0.92*	0.19
P3							0.65	-0.07	0.29	-0.36	0.29	-0.04	2.58**	-1.39	0.60	-0.02	-0.34	-0.18	-0.46	-.41**	0.48
P4										-2.36**	0.35	-1.01**	0.17	-0.07	0.05	0.99*	-0.38	0.31	0.06	-0.41	-0.18
P5													1.21**	-0.02	0.59	0.10	-0.39	-0.15	0.89*	0.62	0.75*
P6																-1.01*	0.70	-0.15	-2.34**	0.58	-0.89*
P7																			0.26	1.42**	0.84*
L.S.D. sij:																					
5%																			1.36	1.36	0.94
1%																			1.80	1.80	1.26
L.S.D. sij - sik:																					
5%																			1.21	1.21	0.85
1%																			3.43	2.43	3.93
Kernel/row																					
P1	3.23**	3.13**	2.98**	-5.39**	-5.73**	-5.76**	-2.83**	-5.55**	-4.30**	-0.68	-6.87**	-3.97**	-4.06**	-6.73**	-5.59**	-5.44**	-5.14**	-5.49**	-1.41	-3.01*	-2.41**
P2				-2.21*	-0.86	-1.73	-1.13	1.43	-0.05	-2.04*	4.27**	0.62	-2.14	6.81**	-4.67**	-4.99**	0.92	-0.50	1.60	4.23**	2.71**
P3							-0.77	3.48**	1.44	-2.53*	-1.66	-2.00*	3.59**	3.78**	3.77**	5.53**	-2.64*	-0.27	3.70**	3.85**	3.63**
P4										-0.78	1.31	0.34	2.36*	-0.38	1.07	0.43	3.47**	1.98	0.41	-6.17**	-2.80**
P5													1.19	0.29	0.82	-4.18	1.12	-1.45	0.41	0.63	0.60
P6																2.57*	3.66**	2.92**	-1.07	2.99*	0.77
P7																			-2.61*	2.55	-0.23
L.S.D. sij:																					
5%																			3.30	3.54	2.38
1%																			4.40	4.72	3.17
L.S.D. sij - sik:																					
5%																			2.95	3.17	2.13
1%																			3.93	4.22	2.83

Table (3): Cont..

Genotype	P2 Y_1	P2 Y_2	P2 Comb.	P3 Y_1	P3 Y_2	P3 Comb.	P4 Y_1	P4 Y_2	P4 Comb.	P5 Y_1	P5 Y_2	P5 Comb.	P6 Y_1	P6 Y2	P6 Comb.	P7 Y1	P7 Y2	P7 Comb	P8 Y1	P8 Y2	P8 Comb.
Ear weight																					
P_1	9.06	15.83	11.65	-42.28*	-44.06**	-43.96**	-19.54*	-30.50	-20.81**	-2.74	1.79	-1.27	-38.20**	-27.67**	-33.73**	-68.07**	-59.61**	-64.64**	-35.93**	-25.00**	-15.09*
P_2				-4.38	2.55	-4.26	8.31	5.45	6.09	20.16*	22.90**	20.73**	-30.27**	-44.01**	37.97**	-5.27	-4.94	-5.90	31.69**	26.63**	28.37**
P_3							-3.98	21.29*	-7.53	-17.19	29.29**	2.79	24.94**	-10.38	6.50	-14.61	-22.00**	-19.10	22.47*	24.06**	22.47**
P_4										-5.23	-7.67	-7.24	11.06	-5.81	-9.23	-19.24	15.67	-19.75**	-2.17	-24.06**	-13.91*
P_5													24.60**	-6.49	8.26	-3.24	-4.72	-7.78	-3.81	12.70	3.65
P_6																4.61	23.39**	15.98*	-1.39	5.11	3.84
P_7																			10.93	4.19	-4.34
L.S.D. sij:																					
5%																			27.89	24.92	18.42
1%																			37.19	33.23	24.47
L.S.D. sij - sik:																					
5%																			24.95	22.29	16.48
1%																			33.26	29.72	21.89
Grain yield/plant																					
P_1	1.41	13.31*	7.36	-27.50**	-24.69**	-25.99**	-9.42	-14.44*	-11.93*	5.62	2.53	1.55	36.45**	-18.96**	-27.11**	-49.24**	-46.02**	-47.63**	-12.04	-14.69*	-13.36**
P_2				-9.76	-1.57	-5.66	6.75	4.99	5.87	11.56	19.77**	15.67**	-23.35**	-33.63	-28.49**	-7.98	-15.19*	-11.50	26.37**	16.89**	21.63**
P_3							-2.90	-11.79	-7.34	-14.38	31.58**	3.60	14.07	-5.81	4.13	-16.52*	-19.41**	-17.87**	16.67*	15.92*	16.29**
P_4										-11.19	-9.28	-10.23*	-4.74	-2.95	-3.85	-17.49*	-14.50*	-15.99**	-1.25	-13.45*	-7.35
P_5													26.49**	-6.09	10.20*	-9.14	-3.94	-6.54	-15.30*	8.00	-3.65
P_6																5.67	18.75*	12.19*	-6.22	2.45	1.88
P_7																			8.87	0.27	7.90
L.S.D. sij:																					
5%																			22.42	18.61	14.35
1%																			29.89	24.82	19.06
L.S.D. sij - sik:																					
5%																			20.05	16.65	12.84
1%																			26.73	22.20	17.05

were significant for all characters, still most of the total genetic variance was associated with GCA as shown by its greater magnitude. GCA and SCA were found to interact with season for plant height, mid-silking date and number of kernels/row. This indicates that both additive and non-additive effects of parents were bound to change by season. No interaction of season with GCA or SCA was detected for ear height, ear length, number of rows/ear, ear weight and grain yield/plant indicating the stability of GCA effects over seasons for these traits. For ear diameter only SCA showed sensitivity to change over season.

These results support earlier work by Singh *et al.* (1977), Stuber *et al.* (1977), Nawar (1985) and El-Hosary (1985, 1988 and 1989). Hence, additive and additive by additive epistasis, if present could be exploited in breeding for various characters of corn. Thus, selection on the basis of GCA effects, as suggested by Jensen (1970) in cereal crops is by far of great importance. Interestingly enough, the parents P_1 and P_3 showing favorable GCA for yield are also blessed with high number of favorable SCA effects.

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دراسة للقدرة العامة والخاصة على التألف وتفاعلها بالبيئة
فى بعض سلالات الذرة الشامية

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أجرى هذا العمل بهدف دراسة القدرة العامة والخاصة على التألف وتفاعلها مع السنوات لبعض سلالات الذرة الشامية. أستخدم لهذا الغرض ثمانية سلالات تمثل مدى الأختلافات الوراثية لعشرة من الصفات وفى ١٩٩٠ تمت زراعة السلالات الأبوية وأجرى بينهم جميع التهجينات الفردية الممكنة عدا الهجن العكسية وتم الحصول على ثمانية وعشرون هجينا فرديا. وفى سنة ١٩٩١، ١٩٩٢ تم تقييم هذه الهجن الفردية. أجريت التجربتان فى التصميم القطاعات الكاملة العشوائية فى ثلاث مكررات بالنسبة لعامى الدراسة.

أجرى التحليل التجميعى لنباتات التجربتان تمت تقديرات القدرة العامة والخاصة على التألف طبقا للطريقة الرابعة فى النموذج الأول لجريفنج.

وكانت أهم النتائج كما يلى :

١- كان التباين الراجع للسنوات معنويا لجميع الصفات المدروسة: وهى :طول النبات - ارتفاع الكوز - قطر الكوز - عدد صفوف الكوز - عدد حبوب الصف - وزن الكوز - وزن الحبوب/نبات - موعد خروج ٥٠٪ للحريرة والنورة المذكرة.

٢- كان تباين الهجن عالى المعنوية لجميع الصفات المدروسة.

٣- كان التباين الراجع لتفاعل كلا من القدرة العامة والخاصة على التألف مع السنوات معنويا لميعاد خروج الحريرة وارتفاع النبات وعدد حبوب الصف وكان تفاعل القدرة الخاصة للتألف فى السنوات معنويا ومصحوبا بعدم معنوية القدرة العامة على التألف بالنسبة لصفتى قطر الكوز ومحصول الحبوب/نبات.

٤- أستأثر مجموع المربعات الخاص بالقدرة العامة على جزء كبير من مجموع مربعات التباين الوراثى مما يدل على أهمية هذا الجانب فى توريث الصفات المدروسة.

٥- أظهرت النتائج وجود تفاعل عالى المعنوية بين القدرة العامة للأتلاف والسنوات مشيرا الى حساسية هذا التقدير لظروف السنوات بالنسبة لصفات ارتفاع النبات، عدد الحبوب/صف - خروج ٥٠٪ حريرة وخروج ٥٠٪ شوشة.

٦- أظهرت النتائج وجود تفاعل عالى المعنوية بين القدرة الخاصة للأتلاف والسنوات مشيرا الى حساسية هذا التقدير لظروف السنوات بالنسبة لصفات ارتفاع النبات قطر الكوز، عدد حبوب الصف.

٧- لم يتأثر كل من القدرة العامة والخاصة للأتلاف بالنسبة للصفات الأتيه: ارتفاع الكوز، طول الكوز، عدد صفوف الكوز، وزن الكوز ووزن الحبوب/نبات مما يدل على ثبات هذه التقديرات تحت ظروف البيئة.