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GENE ACTION AND HETEROSIS IN DIALLEL CROSSES AMONG TEN INBRED LINES OF YELLOW MAIZE ACROSS VARIOUS ENVIRONMENTS

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ABSTRACT

Diallel cross (except reciprocals) among 10 diverse inbred lines of yellow maize were done. Fourty-five F_1's and two standard yellow checks (SC155 and pioneer3080) were evaluated at Sakha, Sids and Nubaria Research Stations. Both additive and non-additive genetic effects were operating in the inheritance of all studied traits, with the additive playing the dominant role. The behavior of the two types of gene action varied from one location to another whereas, the variance due to interaction of general (GCA) and specific (SCA) combining ability with locations was highly significant for all traits except resistance to late wilt disease. Parental line Sk-10 was identified as the most useful source for increasing favorable alleles for grain yield, rows/ear, ear length, ear position, earliness and late wilt resistance. Also, inbred lines Sk-121 and Sk-9203 were good (favorable) general combiners for grain yield and late wilt resistance. Four single crosses i.e. SkN-7 x Sk-10, Sk-7070 x Sk-7078, Sk-10 x Sk-6241 and Sk-7070 x Sk-8001 were suitable combinations for SCA effects toward high yielding ability, early maturity and late wilt resistance. The highest and most desirable standard heterosis effects were shown by SC Sk-7070 x Sk-9203 followed by SC Sk-121 x Sk-9203 for grain yield. Five F_1's (Sk-7070 x Sk-9203, Sk-10 x Sk-9203, Sk-121 x Sk-7070, Sk-10 x Sk-121and Sk-121 x Sk-7078) outyielded significantly the check cultivar SC155, they did not significantly differ from the SC3080 for grain yield and they showed high resistance to late wilt disease (over 99.5%). These yellow promising hybrids would be useful and valuable in hybrid breeding programs.

Keywords: ***Maize, Grain yield, Combining ability, Gene action, Heterosis.***

INTRODUCTION

More attention has been given to the development of yellow maize hybrids, which are greatly demanded by poultry producers and feed factories. In addition, breeding efforts are also, directed towards the development of early maturing hybrids and the improvement of plant type especially for shorter plants and lower ear position. Elite single crosses are frequently identified through combining ability analysis of the data on diallel crosses of selected inbred lines. Furthermore, identification and use of heterosis patterns are essential for success of maize hybrid development programs.

Both additive and non-additive genetic effects played an important role in the expression of grain yield, ear length, rows/ear, days to 50% silking, plant height and ear position, however, preponderance of additive gene effects was observed in the genetic control of these traits (Preciado *et al* 1997, Ogunbodede 2000, Nass *et al* 2000 and Yu *et al* 2003). Numerous investigators found significant interaction of combining abilities with environments for grain yield and related traits (Teixeira *et al* 2001, Duarte *et al* 2003, Yousif *et al* 2003, El-Shenawy 2005 and Motawei 2005). Additive gene action and its interaction with locations represent the major portion in the inheritance of No.of ears/100 plant (Nawar *et al* 1979, El-Hosary 1988, Mosa 2001 and Motawei 2005). Late wilt resistance was controlled mainly by additive genetic effect (Galal *et al* 2002, Amer *et al* 2002, Mosa and Motawei 2005 and Motawei 2005).

The objectives of this study were to examine the combining abilities and their interactions with locations of ten selected maize yellow inbred lines in their diallel crosses and to identify candidates for promising hybrid combinations.

MATERIALS AND METHODS

Ten diverse inbred lines of yellow maize (SkN-7, Sk-10, B-73, Sk-121, Sk-6241, Sk-7070, Sk-7078, Sk-8001, Sk-8008 and Sk-9203) were crossed in a half-diallel fashion during summer 2004 at Sakha Station. In the subsequent season, 45 F_1's along with two check hybrids (SC 155 and pioneer 3080) were planted for evaluation in a randomized complete block design with 4 replications at three locations, i.e. Sakha (North Egypt), Sids (South Egypt) and Nubaria (New lands) Agricultural Research Stations. Plots were represented by single rows, 6 m long, 0.80 m apart, 25 cm between hills with 25 plants per plot after thinning. All cultured practices were applied as recommended.

Combined analysis across the three locations was done after testing the homogeneity according to Snedecor and Cochran (1967) for days to 50% silking, plant height (cm), ear position%, no.of ears/100 plants, ear length (cm), rows/ear and grain yield ard/fad (adjusted on 15.5% grain moisture). While, late wilt resistance under natural inoculation was evaluated over two locations (Sakha and Sids) only. The Griffing's 1956 Method-4, Model-I was applied for combining ability analysis. Percentage of standard heterosis over the two used commercial checks for days to 50% silking and grain yield ard/fad was estimated according to Meredith and Bridge (1972).

RESULTS AND DISCUSSION

Combined analysis of variance for nine studied traits (Table 1) revealed highly significant differences among locations for all traits except for resistance to late wilt disease where differences between locations were not significant. This pointed out that markedly environmental variations among Sakha, Sids and Nubaria locations (L) were detected. Mean squares due to crosses (C) and crosses x location (C x L) were found to be significant or highly significant for all studied traits. This result revealed wide genetic diversity between the parental materials used in this study and their hybrid combinations which obviously were affected by change in environmental conditions.

Table 1. Combined analysis of variance for nine studied traits over three locations (Sakha, Sids and Nubaria).

S.O.V	d.f	Days to 50 % silking	Plant height (cm)	Ear position %	Ears/100plants
Location(L)	2	902.88**	67021.19**	2006.8**	772.32**
Error (a)	9	6.57	736.65	13.17	68.63
Crosses(C)	44	34.21**	2113.96**	61.31**	263.94**
C x L	88	3.2**	284.13**	16.63**	133.88**
Error (b)	396	0.91	98.92	7.07	62.90
Mean		60.42	236.01	52.22	103.94
C.V %		1.06	4.2	5.09	7.63
		Ear length (cm)	Rows/ear	Grain yield ard/fad	Late wilt resistance %
Location(L)	2	422.75**	31.93**	637.27**	60.17
Error (a)	9	5.68	2.41	20.38	17.24
Crosses(C)	44	16.34**	13.36**	128.29**	42.12**
C x L	88	2.34**	1.10	20.58**	5.98**
Error (b)	396	1.32	0.83	5.16	2.24
Mean		18.73	15.47	26.98	98.70
C.V %		6.13	5.89	8.42	1.52

*, ** Significant differences at 0.05 and 0.01 levels of probability, respectively.

Mean performance of 45 crosses and two checks for nine studied traits over locations are presented in Table (2). Great variations were found among the F_1 crosses for all traits, where means ranged from 55.83 to 63.75 days for days to 50% silking, from 214.17 to 266.0 cm for plant height, from 46.21 to 56.7% for ear position, from 97.49 to 116.8 ears for ears/100 plant, from 13.8 to 18.2 rows for rows/ear, from 16.75 to 21.32 cm for ear length, from 89.0 to 100% for late wilt resistance and from 20.89 to 33.47 ardabs for grain yield (ard/fad). On the other hand, 9 single crosses (Sk-7070 x Sk-9203 (33.47), Sk-10 x Sk-9203 (32.70), Sk-121 x Sk-7070

Table 2. Means of 45 F_1's and two check hybrids for nine traits across three locations.

Crosses	Days to 50% silking	Plant height cm	Ear position%	Ears/100 plants	Ear length cm	Rows/ear	Grain yield ard/fad	Late wilt resistance %
SkN-7 × Sk-10	57.2	214.1	47.7	101.5	19.0	16.7	23.9	98.12
SkN-7 × B-73	58.4	215.0	52.3	101.2	17.5	18.2	23.8	98.7
SkN-7 × Sk-121	59.3	223.0	53.7	107.4	18.6	15.5	28.4	99.0
SkN-7 × Sk-6241	55.8	209.4	51.1	100.3	18.2	16.3	22.4	89.0
SkN-7 × Sk-7070	57.4	226.8	51 .1	102.9	20.1	15.7	24.8	96.2
SkN-7 × Sk-7078	58.4	217.9	50.69	99.69	18.6	17.4	21.2	97.6
SkN-7 × Sk-8001	58.1	220.5	52.6	102.1	18.2	16.6	22.4	90.2
SkN-7 × Sk-8008	59.1	218.7	53.8	100.1	17.1	15.7	21.7	95.3
SkN-7 × Sk-9203	58.9	225.1	51.4	97.85	19.2	14.6	23.0	98.2
Sk-10 × B-73	60.5	244.1	48.3	102.98	19.1	16.6	29.9	100
Sk-10 × Sk-121	59.3	252.0	53.1	104.4	19.9	15.1	31.6	100
Sk-10 × Sk-6241	58.2	243.4	50.1	103.5	18.7	15.3	29.8	99.6
Sk-10 × Sk-7070	59.9	251.2	52.3	102.9	20.7	14.7	27.9	100
Sk-10 × Sk-7078	59.5	234.3	46.2	103.9	19.2	16.2	29.5	99.5
Sk-10 × Sk-8001	60.2	233.5	52.4	102.3	18.5	16.4	28.7	100
Sk-10 × Sk-8008	60.5	247.3	52.1	103.00	18.7	15.5	30.8	100
Sk-10 × Sk-9203	59.2	244.1	49.9	100.7	18.3	14.5	30.7	99.8
B-73 × Sk-121	61.6	249.3	51.9	110.0	17.8	15.6	28.5	100
B-73 × Sk-6241	60.6	230.0	50.1	103.4	16.8	15.3	25.3	100
B-73 × Sk-7070	60.6	245.2	51.5	104.9	20.2	15.2	25.1	99.2
B-73 × Sk-7078	60.8	233.4	48.9	98.88	17.4	16.3	22.2	99.5
B-73 × Sk-8001	62.8	236.3	54.3	102.7	17.7	17.9	26.6	99.8
B-73 × Sk-8008	61.7	248.5	53.4	111.5	17.2	16.1	27.2	99.5
B-73 × Sk-9203	62.5	245.1	51.7	104.7	19.4	15.0	28.8	100
Sk-121 × Sk-6241	61.2	231.3	52.0	103.0	17.7	14.4	24.5	99.8
Sk-121 × Sk-7070	62.5	266.0	54.2	116.8	20.2	14.8	31.7	99.5
Sk-121 × Sk-7078	61.0	248.5	51.7	102.2	19.0	15.43	31.4	99.8
Sk-121 × Sk-8001	62.0	232.6	56.3	106.1	17.6	15.0	28.1	99.6
Sk-121 × Sk-8008	62.5	248.0	56.3	103.9	18.1	14.9	27.9	99.8
Sk-121 × Sk-9203	62.6	261.4	56.7	104.1	19.6	14.6	32.7	100
Sk-6241×Sk-7070	61.0	244.2	53.8	111.5	19.0	13.8	26.3	99.0
Sk-6241×Sk-7078	58.6	227.5	51.1	102.5	18.0	15.3	27.0	98.0
Sk-6241×Sk-8001	59.5	216.2	52.0	103.4	17.4	15.4	24.0	97.1
Sk-6241×Sk-8008	59.8	225.8	50.9	100.9	17.5	14.6	23.4	98.1
Sk-6241×Sk-9203	60.8	227.4	52.4	114.7	17.0	14.0	27.1	100
Sk-7070×Sk-7078	60.4	244.1	51.0	100.2	21.2	15.0	25.3	99.2
Sk-7070×Sk-8001	61.1	241.4	55.5	113.4	19.4	15.6	26.9	97.3
Sk-7070×Sk-8008	61.7	252.3	54.7	100.9	20.5	14.3	26.4	98.8
Sk-7070×Sk-9203	61.5	252.8	53.3	115.0	21.3	13.6	33.4	100
Sk-7078×Sk-8001	60.0	227.2	51.4	102.2	17.8	17.3	28.1	99.3
Sk-7078×Sk-8008	60.8	241.4	52.6	97.49	19.3	15.7	30.3	99.6
Sk-7078×Sk-9203	61.5	231.6	48.2	106.3	19.1	14.4	30.3	100
Sk-8001×Sk-8008	61.6	223.3	53.9	97.80	16.7	15.4	20.8	96.3
Sk-8001×Sk-9203	62.6	233.5	54.5	101.2	19.1	14.6	25.7	100
Sk-8008×Sk-9203	63.7	233.9	54.5	99.40	19.6	14.2	26.5	100
SC 155	62.5	246.5	54.4	105.0	17.4	15.0	29.1	100
SC 3080	61.9	248.5	52.1	104.6	17.4	15.50	32.0	99.8
LSD 0.05	0.76	7.96	2.13	6.35	0.92	0.73	1.82	1.20
0.01	1.00	10.48	2.80	8.35	1.21	0.96	2.39	1.58

(31.73), Sk-10 x Sk-121 (31.67), Sk-121 x Sk-7078 (31.48), Sk-10 x Sk-8008 (30.82), Sk-10 x Sk- 9203 (30.74), Sk-7078 x Sk-8008 (30.34) and Sk-7078 x Sk-9203 (30.33) did not show significant differences when compared with the best check hybrid pioneer 3080 (32.06) for grain yield (ard/fad). Furthermore, the first five of previous nine crosses outyielded significantly the other check hybrid SC155 (29.13 ard/fad) and exhibited high resistance to late wilt disease (over 99.5%). These promising yellow single crosses would be fruitful and valuable in hybrids production and breeding programs.

Heterosis percentages relative to the two checks for days to 50% silking and grain yield ard/fad are given in Table (3). The highest percentages and positive significant heterotic effects for grain yield were observed in SC Sk-7070 x Sk-9203 (14.88 and 4.41%) followed by SC Sk-121 x Sk-9203 (12.25 and 2.01%) relative to check controls SC155 and 3080, respectively. Moreover, eight other single crosses also exhibited desirable heterotic effects relative to SC155 with respect to yielding ability and early maturity. Conclusion indicated that the previous nine crosses could be used as good hybrids in maize breeding programs for high yield and earliness. Many investigators reported high heterotic effect for grain yield of maize (Akhtar and Singh 1982, Ogunbodede *et al* 2000, San *et al* 2001, Venugopal *et al* 2002 and Motawei 2005).

Mean squares due to general (GCA) and specific (SCA) combining ability and their interactions with locations are presented in Table (4). Highly significant mean squares due to GCA and SCA were detected for all studied traits, indicating that both additive and non-additive genetic effects are operating in the inheritance of these traits. However, additive gene effects exhibited larger contribution in the genetic control of all studied traits than those of non-additive genetic effects, since the ratio GCA/SCA mean squares exceeded the unity (Table 4). These results are in good agreement with those obtained by Ogunbodede *et al* (2000), Nass *et al* (2000), Katna *et al* (2002), Wu *et al* (2003) and Yu *et al* (2003) for days to 50% silking, plant height, ear position, ear length, rows/ear and grain yield, El-Hosary (1988) and Motawei (2005) for no.of ears/100 plants and Galal *et al* (2002), Mosa and Motawei (2005) and Motawei (2005) for resistance to late wilt disease.

Table 3. Standard heterosis percentage for days to 50 % silking and grain yield (ard/fad) relative to two check hybrids over three locations.

Crosses	days to 50 % silking		Grain yield ard/ fad	
	SC155	SC3080	SC155	SC3080
SkN-7 × Sk-10	-8.4**	-7.53**	-17.68**	-25.19**
SkN-7 × B-73	-6.53**	-5.65**	-18.23**	-25.68**
SkN-7 × Sk-121	-5.06**	-4.17**	-2.25	-11.16**
SkN-7 × Sk-6241	-10.66**	-9.82**	-23.00**	-30.02**
SkN-7 × Sk-7070	-8.13**	-7.26**	-14.67**	-22.45**
SkN-7 × Sk-7078	-6.53**	-5.65**	-27.20**	-33.84**
SkN-7 × Sk-8001	-6.93**	-6.05**	-23.07**	-30.09**
SkN-7 × Sk-8008	-5.33**	-4.44**	-25.33**	-32.13**
SkN-7 × Sk-9203	-5.73**	-4.84**	-20.85**	-28.07**
Sk-10 × B-73	-3.2**	-2.28**	2.76	-6.60*
Sk-10 × Sk-121	-5.06**	-4.17**	8.71**	-1.20
Sk-10 × Sk-6241	-6.8**	-5.92**	2.40	-6.92*
Sk-10 × Sk-7070	-4.13**	-3.23**	-4.00	-12.76**
Sk-10 × Sk-7078	-4.66**	-3.76**	1.51	-7.74**
Sk-10 × Sk-8001	-3.6**	-2.69**	-1.49	-10.48**
Sk-10 × Sk-8008	-3.2**	-2.28**	5.78	-3.86
Sk-10 × Sk-9203	-5.2**	-4.30**	5.52	-4.09
B-73 × Sk-121	-1.33*	-0.40	-2.03	-10.97**
B-73 × Sk-6241	-2.93**	-2.01**	-13.83**	-20.77**
B-73 × Sk-7070	-2.93**	-2.01**	-13.58**	-21.46**
B-73 × Sk-7078	-2.66**	-1.75**	-23.81**	-30.76**
B-73 × Sk-8001	0.53	1.47*	-8.700**	-17.03**
B-73 × Sk-8008	-1.20	-0.26	-6.34*	-14.88**
B-73 × Sk-9203	0.00	0.94	-1.08	-10.10**
Sk-121 × Sk-6241	-2.00**	-1.07**	-15.90**	-23.57**
Sk-121 × Sk-7070	0.13	-1.07	8.89**	-1.03
Sk-121 × Sk-7078	-2.40**	-1.48*	8.04*	-1.83
Sk-121 × Sk-8001	-0.66	0.26	-3.29	-12.11**
Sk-121 × Sk-8008	0.00	0.94	-4.09	-12.84**
Sk-121 × Sk-9203	0.26	1.21	12.25**	2.01
Sk-6241×Sk-7070	-2.26**	-1.34*	-9.42**	-17.68**
Sk-6241×Sk-7078	-6.13**	-5.24**	-7.11*	-15.58**
Sk-6241×Sk-8001	-4.66**	-3.76**	-17.45**	-24.98**
Sk-6241×Sk-8008	-4.26**	-3.36**	-19.71**	-27.03**
Sk-6241×Sk-9203	-2.66**	-1.75**	-6.78*	-15.28**
Sk-7070×Sk-7078	-3.33**	-2.42**	-12.94**	-20.87**
Sk-7070×Sk-8001	-2.13**	-1.21	-7.39*	-15.83**
Sk-7070×Sk-8008	-1.20	-0.26	-9.17**	-17.45**
Sk-7070×Sk-9203	-1.60**	-0.67	14.88**	4.41
Sk-7078×Sk-8001	-3.86**	-2.96**	-3.55	-12.40**
Sk-7078×Sk-8008	-2.66**	-1.75**	4.12	-5.37
Sk-7078×Sk-9203	-1.60**	-0.67	4.11	-5.38
Sk-8001×Sk-8008	-1.33*	-0.40	-30.21**	-34.99**
Sk-8001×Sk-9203	0.26	1.21	-11.64**	-19.69**
Sk-8008×Sk-9203	2.00**	2.96**	-8.89**	-17.20**
LSD at 0.05	1.21	1.22	6.25	5.76
0.01	1.60	1.61	8.13	7.45

*, ** Significant differences at 0.05 and 0.01 levels of probability, respectively.

Table 4. Combined analysis of combining ability and its interaction with locations.

S.O.V	d.f	days to 50% silking	Plant height cm	Ear position%	Ears/100plants
GCA	9	147.06**	8874.92**	233.66**	551.88**
SCA	35	5.20**	375.43**	16.98**	189.90**
GCA×L	18	7.17**	703.41**	29.66**	243.44**
SCA×L	70	2.05**	176.36**	13.28**	105.71**
Error	396	0.91	98.92	7.07	62.90
GCA/GCA		28.30	23.60	13.80	2.90
GCA×L/SCA×L		3.50	3.99	2.23	2.30
		Ear length cm	Rows/ear	Grain yield ard/fad	Late wilt resistance%
GCA	9	62.36**	57.14**	417.24**	127.09**
SCA	35	4.50**	2.10**	53.99**	29.27**
GCA×L	18	5.01**	1.44*	38.60**	8.66**
SCA×L	70	1.65	1.02	15.94**	5.30**
Error	396	1.32	0.83	5.16	2.24
GCA/GCA		13.90	27.21	7.73	6.27
GCA×L/SCA×L		3.03	1.41	2.42	1.63

*, ** Significant differences at 0.05 and 0.01 levels of probability, respectively.

Mean squares due to the interaction of GCA or SCA with locations were highly significant for all studied traits except of SCA x L for ear length and rows/ear which were not significant. These results revealed that the behavior of the two types of gene action varied from one location to another. Similar findings were obtained by Teixeria *et al* (2001), Duarte *et al* (2003), Yousif *et al* (2003) and Mosa (2003) for grain yield and other agronomic traits. On the other hand, mean squares due to GCA x L were higher than those due to SCA x L for all studied traits (Table 4), indicating that the additive gene action was more affected by the environmental conditions than the non-additive gene action. Similar trend was reported by Mosa (2003) and Motawei (2005) for grain yield, rows/ear and plant height and El-Shenawy (2005) for ear length and No.of ears/100 plants.

Estimates of GCA effects of the 10 inbred lines for nine studied traits combined across the three locations are given in Table (5). Desirable and highest estimates of g_i effects were achieved by the inbred line SkN-7 for days to 50% silking, plant height and rows/ear, the inbred line Sk-7078 for ear position, Sk-7070 for ears/100 plants and ear length, Sk-121 for grain yield and Sk-9203 for late wilt resistance. Moreover, inbred line Sk-10 was determined as the most useful source of increasing favorable alleles for grain yield, rows/ear. ear length, ear position, days to 50% silking and resistance to late wilt disease. Also, Sk-121 and Sk-9203 were good general combiners for both grain yield and late wilt resistance. From these results it could be concluded that these inbred lines appeared to be promising for breeding improved varieties.

Table 5. General combining ability effects of 10 inbred lines for nine traits over three locations.

Inbred lines	days to 50 % silking	Plant height cm	Ear position%	Ears/100plants
SkN-7	-2.606**	-19.162**	-0.652*	-2.787**
Sk-10	-1.116**	5.035**	-2.17[illegible]**	-1.266
B-73	0.758**	2.900**	-0.891**	0.639
Sk-121	1.081**	11.035**	2.025**	2.795**
Sk-6241	-0.970**	-8.568**	-0.693**	1.066
Sk-7070	0.341	12.535**	0.993**	4.202**
Sk-7078	-0.304	-2.214*	-2.235**	-2.733**
Sk-8001	0.591**	-7.402**	1.670**	-0.495
Sk-8008	0.997**	1.931*	1.566**	-2.527**
Sk-9203	1.227**	3.910**	0.389	1.108
LSD 0.05_ g_i	0.181	1.887	0.505	1.505
0.01	0.238	2.484	0.664	1.981
LSD 0.05_ $g_i - g_j$	0.269	2.813	0.752	2.24
0.01	0.355	3.703	0.99	2.95
Inbred lines	**Ear length cm**	**Rows/ear**	**Grain yield ard/fad**	**Late wilt resistance%**
SkN-7	-0.208	0.966**	-3.845**	-3.212**
Sk-10	0.531**	0.237**	2.466**	1.100**
B-73	-0.593**	0.893**	-0.606**	1.068**
Sk-121	0.010	-0.470**	2.831**	1.178**
Sk-6241	-1.062**	-0.550**	-1.606**	-0.946**
Sk-7070	1.739**	-0.835**	0.685**	0.146
Sk-7078	0.145	0.570**	0.310	0.553**
Sk-8001	-0.708**	0.685**	-1.345**	-1.040**
Sk-8008	-0. 416 **	-0.283**	-0.908**	-0.071
Sk-9203	0. 562**	-1.210**	2.018**	1.225**
LSD 0.05_ g_i	0.218	0.173	0.431	0.347
0.01	0.287	0.227	0.567	0.458
LSD 0.05	0.325	0.257	0.642	0.518
$g_i - g_j$ 0.01	0.428	.339	0.845	0.682

*** , ** Significant differences at 0.05 and 0.01 levels of probability, respectively.**

Estimates of SCA effects of 45 F_1's for nine traits are shown in Table (6). Positive and significant SCA effects were obtained by 13 F_1's for grain yield traits and 4 out of them (SkN-7 x Sk-10, Sk-7070 x Sk-7078, Sk-10 x Sk-6241, and Sk-7070 x Sk-8001) exhibited favorable SCA effects towards early maturity and resistance to late wilt disease beside high yielding ability. These combinations seem also to be the most promising materials for recurrent selection programs for high yielding ability with short growth season and resistance to late wilt disease.

Table 6. Specific combining ability effects of 45 F_1's for nine traits over locations.

Crosses	Days to 50% silking	Plant height cm	Ear position%	Ears/100 plants	Ear length cm	Rows/ear	Grain yield ard/fad	Late wilt resistance %
SkN-7 × Sk-10	0.55*	-7.7**	-1.48*	1.59	0.01	-0.10	-1.7**	1.53**
SkN-7 × B-73	-015	-4.74	1.56*	-0.56	-0.28	0.82**	1.33*	2.19**
SkN-7 × Sk-121	0.44	-4.87	0.14	3.44	0.03	-0.47*	2.64**	2.33**
SkN-7 × Sk-6241	-1.0**	1.14	0.36	-1.82	0.85**	0.35	0.91	-5.5**
SkN-7 × Sk-7070	-0.7**	-2.54	-1.40*	-2.45	-0.11	0.05	1.12	0.61
SkN-7 × Sk-7078	0.90**	3.28	1.32*	1.23	0.06	0.56*	-2.3**	1.58**
SkN-7 × Sk-8001	-0.23	11.0**	-0.58	1.49	0.33	-0.38	0.56	-4.2**
SkN-7 × Sk-8008	0.35	-0.02	0.69	1.52	-1.0**	-0.25	-0.45	-0.04
SkN-7 × Sk-9203	-0.12	4.41	-0.63	-4.44*	0.14	-0.57*	-2.0**	1.53**
Sk-10 × B-73	0.44	0.22	-0.83	-0.33	0.56	0.05	1.18*	-0.87
Sk-10 × Sk-121	-1.0**	-0.07	0.92	-0.9[illegible]	0.62*	-0.08	-0.56	-0.98*
Sk-10 × Sk-6241	-0.08	10.9**	0.97	-0.17	0.53	0.08	2.01**	0.76
Sk-10 × Sk-7070	0.27	-2.32	1.28	-3.89	-0.18	-0.13	-2.2**	0.05
Sk-10 × Sk-7078	0.58*	-4.49	-1.56*	3.95	-0.17	-0.04	-0.81	-0.85
Sk-10 × Sk-8001	0.35	-0.13	0.69	0.05	0.09	-0.01	0.59	1.23**
Sk-10 × Sk-8008	0.20	4.36	0.54	2.83	-0.03	0.22	2.15**	0.26
Sk-10 × Sk-9203	-1.2**	-0.78	-0.52	-3.05	-1.42**	-0.01	-0..60	-1.15*
B-73 × Sk-121	-0.59*	-0.60	-1.27	2.60	-0.16	-0.32	-0.84	-0.95*
B-73 × Sk-6241	0.46	-0.33	-0.55	-2.24	-0.34	-0.40	0.67	1.17*
B-73 × Sk-7070	-0.8**	-6.19*	-0.74	-3.80	0.35	-0.37	-1.7**	-0.66
B-73 × Sk-7078	-0.03	-3.27	-0.10	-2.94	-0.8**	-0.53*	-4.4**	-0.82
B-73 × Sk-8001	1.06**	4.83	1.41*	-1.35	0.30	0.93**	1.58**	1.14*
B-73 × Sk-8008	-0.42	7.74**	0.51	9.51**	-0.40	-0.01	1.89**	-0.20
B-73 × Sk-9203	0.09	2.35	0.02	-0.87	0.86**	-0.16	0.38	-0.99*
Sk-121 × Sk-6241	0.72**	-7.1**	-1.39*	-4.82*	-0.03	0.04	-3.7**	0.94*
Sk-121 × Sk-7070	0.74**	6.42*	-1.08	5.79**	-0.50	0.57*	1.19*	-0.52
Sk-121 × Sk-7078	-0.19	3.75	-0.35	-1.77	0.09	-0.08	1.5**	-0.55
Sk-121 × Sk-8001	-0.01	-6.9**	0.41	-0.17	-0.30	-0.53	-0.19	0.78
Sk-121 × Sk-8008	0.01	-0.97	0.51	-0.31	-0.17	0.10	-1.04	0.06
Sk-121 × Sk-9203	-0.06	10.4**	2.10**	-3.78	0.42	0.78**	0.94	-1.10*
Sk-6241×Sk-7070	1.29**	4.27	1.47*	2.52	-0.42	-0.34	0.21	1.09*
Sk-6241×Sk-7078	-0.47*	2.36	1.86**	0.29	0.08	0.00	1.34*	-0.30
Sk-6241×Sk-8001	-0.45	-3.78	-1.12	-0.94	0.35	-0.11	-0.00	0.41
Sk-6241×Sk-8008	-0.61*	-3.53	-2.1**	-1.49	0.31	0.10	-1.10	0.44
Sk-6241×Sk-9203	0.15	-3.93	0.49	8.69**	-1.3**	0.28	-0.28	1.01*
Sk-7070×Sk-7078	-0.03	-2.16	0.01	-5.17*	0.53	-0.13	-2.6**	-0.15
Sk-7070×Sk-8001	-0.18	0.27	0.60	5.83**	-0.28	0.33	0.70	-0.43
Sk-7070×Sk-8008	-0.01	1.86	-0.03	-4.63*	0.51	-0.03	-0.31	0.09
Sk-7070×Sk-9203	-0.48*	0.38	-0.11	5.81**	0.11	0.06	3.6**	-0.07
Sk-7078×Sk-8001	-0.62*	0.86	-0.24	1.52	-0.35	0.59*	2.27**	1.20*
Sk-7078×Sk-8008	-0.27	5.69*	1.02	-1.19	0.85**	-0.02	4.05 **	0.44
Sk-7078×Sk-9203	0.15	-6.03*	-1.9**	4.08*	-0.20	-0.34	1.04	-0.48
Sk-8001×Sk-8008	-0.34	-7.2**	-1.4**	-3.10	-0.7**	-0.46*	-3.7**	-1.2**
Sk-8001×Sk-9203	0.42	1.06	0.29	-3.32	0.64*	-0.37	-1.7**	1.11*
Sk-8008×Sk-9203	1.10**	-7.9**	0.31	-3.12	0.77**	0.34	-1.39*	0.14
LSD S_{ij} 0.05	0.47	4.96	1.32	3.95	0.57	0.45	1.33	0.91
0.01	0.62	6.53	1.74	5.20	0.75	0.59	1.49	1.20
LSD S_{ij}-S_{kl} 0.05	0.66	6.89	1.84	5.49	0.796	0.631	1.57	1.27
0.01	0.87	9.07	2.42	7.23	1.048	0.831	2.07	1.67
LSD S_{ij}-S_{ik} 0.05	0.714	7.44	1.99	5.93	0.859	0.681	1.70	1.372
0.01	0.939	9.799	2.61	7.81	1.13	0.897	2.33	1.806

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

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التأثير الجينى وقوة الهجين باستخدام نظام الهجن التبادلية بين عشرة سلالات صفراء من الذرة الشامية عبربيئات مختلفة

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مركز البحوث الزراعية – معهد المحاصيل الحقلية – محطة البحوث الزراعية بسخا – قسم الذرة الشامية

تم عمل كل التهجينات التبادلية الممكنة بين عشرة سلالات مختلفة من الذرة الشامية الصفراء فى نظام الدياليل (بدون الهجن العكسية) وذلك لقياس القدرة العامة والخاصة على التآلف وكذلك قياس تأثيرات قوة الهجين. تم تقييم الـــ ٤٥ هجين فردى مع اثنين من هجن المقارنة الصفراء (هجين فردى ١٥٥ و هجين فردى بيونير ٣٠٨٠) وذلك فى ثلاث مواقع هى محطة البحوث الزراعية بسخا و سدس والنوبارية فى تصميم القطاعات الكاملة العشوائية فى أربع مكررات فى موسم ٢٠٠٥. وقد تـــم عمـــل تحليل التباين للقدرة على التآلف عبر المواقع لصفات محصول الحبوب بالإردب/فدان، تـــاريخ ظهـــور

٥٠% حريرة ، ارتفاع النبات ، موقع الكوز ، عدد الكيزان/١٠٠ نبات ، طول الكوز ، عدد السطور بالكوز و مقاومة مرض الذبول المتأخر تبعا لـ Griffing 1956 (Method-4, Model-I).

- كان لتأثير الفعل الوراثى المضيف والغير مضيف دورا فى وراثة كل الصفات المدروسة مع سيادة دور الفعل الوراثى المضيف. كما أختلف سلوك نوعى الفعل الجينى من موقع لأخر حيث كان تباين التفاعل بين القدرة العامة أو الخاصة على الائتلاف مع المواقع عالى المعنوية.
- تميزت السلالة الأبوية سخا- ١٠ بأنها مصدرا مفيدا لزيادة الأليلات المرغوبة لصفات محصول الحبوب ، وعدد السطور بالكوز، طول الكوز، موقع الكوز، التبكير وكذلك مقاومة مرض الذبول المتأخر. كذلك كانت السلالتان سخا-١٢١ و سخا-٩٢٠٣ ذات قدرة تآلف جيدة للمحصول العالى وكذلك للمقاومة لمرض الذبول المتأخر.
- أظهرت الهجن الفردية الأربعة سخا ن-٧ × سخا-١٠ ، سخا-٧٠٧٠ × سخا-٧٠٧٨ ، سخا-١٠ × سخا-٦٢٤١، سخا-٧٠٧٠ × سخا-٨٠٠١ تأثيرات مرغوبة للقدرة الخاصة علـى التـآلف للمحصول مع النضج المبكر و مقاومة مرض الذبول المتأخر.
- لوحظت أعلى قيم لتأثيرات قوة الهجين المرغوبة بالنسبة لصنفى المقارنة المستخدمين فى التجربة فى الهجين الفردى سخا-٧٠٧٠ × سخا-٩٢٠٣ متبوعا بالهجين الفردى سخا-١٢١ × سخا-٩٢٠٣ وذلك لصفة محصول الحبوب بالإردب/فدان.
- زادت خمسة هجن فردية فى محصولها زيادة معنوية عن هجين المقارنة ١٥٥ ولم تختلف معنويا عن هجين المقارنة الآخر ٣٠٨٠ وأعطت مقاومة عالية لمرض الذبول المتأخر (أعلى من ٩٩,٥%) مما يشير إلى أن هذه الهجن الصفراء الحديثة ستكون مثمرة وذات قيمة فى برامج إنتاج الهجن وهذه الهجن هى (هجين فردى سخا- ٧٠٧٠ × سخا -٩٢٠٣ ، سخا-١٠ × سخا- ٩٢٠٣ ، سخا-١٢١ × سخا-٧٠٧٠ ، سخا-١٠ × سخا-١٢١ و سخا-١٢١ × سخا-٧٠٧٨).