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COMBINING ABILITY OF NEW MAIZE YELLOW INBRED LINES BY USING LINE X TESTER ANALYSIS

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ABSTRACT

New eighteen yellow inbred lines of maize were top crossed with two testers, i.e. line Gz 649 and S.C 52 at Sakha during summer season of 2003. The 36 top crosses and two checks (S.C 3080 and T.W.C. 352) were evaluated at Sakha and Mallawy Agricultural Research Stations during summer season of 2004. Mean squares due to locations were significant for all studied traits except number of rows/ear. Mean squares due to crosses were also significant for all studied traits except ear diameter, while, those due to crosses x loc. interaction were significant for grain yield, plant height and ear height. Mean squares due to lines were significant for all studied traits; those due to testers were significant for grain yield, number of rows/ear, ear diameter, ear length and silking date and those due to lines x testers were significant for grain yield and silking date. On the other hand, mean squares due to (lines x loc.) and (testers x loc.) interactions were significant for some traits, while those due to (Lines x Testers x loc.) interaction were significant for grain yield only.

Both additive and non-additive gene action played important role in the inheritance of different studied traits. The inbred lines Sk-6015/23, Sk-6015/24 and Sk-6015/28 exhibited positive and significant GCA effects for grain yield and some of its components. The inbred lines Sk-6015/26 and Sk-6015/34 exhibited negative and desirable significant GCA effects for silking date (towards earliness), while ,the lines Sk-6022/45, Sk-6023/49, Sk-6026/50 and Sk-6026/52 showed negative and favorable significant GCA effects for plant and ear heights (towards shortness). The tester inbred line Gz-649 had desirable significant GCA effects for ear length, while, the tester S.C 52 had desirable significant GCA effects for earliness, ear diameter and number of rows/ear. Four top crosses: Gz-649 x Sk-6015/28 (43.49 ard./fed.), Gz-649 x Sk-6015/35 (42.43 ard./fed.), S.C 52 x Sk 6015/23 (43.34 ard./fed.) and S.C 52 x Sk 6015/28 (44.57 ard./fed.) out yielded significantly the commercial hybrid S.C-3080 (36.08 ard./fed.) for grain yield and some other traits. Also, six top crosses did not differ significantly form the check hybrid T.W.C. 352 (34.74 ard./fed.) for grain yield and most of agronomic traits. These crosses would be prospective, more fruitful, resistant to late wilt disease and there for could be used in maize Breeding program.

Key words : *Maize , Zea mays , Line x Tester ,Combining ability ,Gene action , Top crosses.*

INTRODUCTION

It is known that top cross procedure was first suggested by *Davis (1927)* to test the superiority of inbred lines for hybrid development of maize programs. Rawlings and Thompson (1962) concluded that a good tester should have a narrow genetic base, low yielding or possess a considerable number of homozygous recessive loci so that the masking effects of dominance would be at minimum. Al-Naggar *et al* (1997) found that the tester with the narrowest genetic base exhibited the highest genetic variation in test crosses for most of the studied traits. Katta (1971) and Galal *et al* (1987) reported the superiority of single crosses as narrow genetic base testers. Some investigators found that the estimates of additive genetic variance were more important in the inheritance of grain yield i.e. Matzinger *et al* (1959), El-Zeir *et al* (1993), Mostafa *et al* (1995), El-Zeir *et al.* (2000) and Amer *et al* (2002), While, Lonnqist and Gardner (1961), Mahmoud (1996), Soliman and Sadek (1999), Ibrahim (2001), El-Shenawy *et al* (2003) found the reverse. Furthermore, Soliman *et al.* (2001) and El-Morshidy *et al* (2003) found that the magnitude of δ^2 SCA x E interaction was higher than that of δ^2 GCA x E interaction for most traits.

The objectives of this investigation were as follows:

1. Evaluation of combining ability effects for 18 new inbred lines of maize.
2. Estimating the type of gene action controlling grain yield and other traits.
3. Identifying the superior inbred lines and top crosses.

MATERIALS AND METHODS

Description of used inbred lines in this study

New eighteen yellow maize inbred lines of different genetic sources i.e. Sk-6015/23, Sk-6015/24, Sk-6015/26, Sk-6015/28, Sk-6015/34, Sk-6015/35, Sk-6015/37, Sk-6015/39, Sk-6105/42, Sk-6015/43, Sk-6022/44, Sk-6022/45, Sk-6022/46, Sk-6023/47, Sk-6023/48, Sk-6023/49, Sk-6026/50 and Sk-6026/52 were used in this study (Table 1). These inbred lines were developed at Sakha Agricultural Research Station .The inbred line Gz-649 having the narrowest genetic base and S.C 52 having a narrow genetic base were used as testers to produce thirty six top crosses during the summer season of 2003. The thirty six top crosses plus two different checks (S.C 3080 and T.W.C.352 were evaluated under two different locations (Sakha and Mallawy Agricultural Research Stations) during summer season of 2004.

Table 1. Inbred lines used in this study and their pedigree.

No.	Inbred Line	Pedigree.
1	SK. 6015 / 23	L – 121 x Sk. 7266 / 1 – 1 - 2
2	SK. 6015 / 24	L – 121 x Sk. 7266 / 1 – 1 - 2
3	SK. 6015 / 26	L – 121 x Sk. 7266 / 1 – 1 - 2
4	SK. 6015 / 28	L – 121 x Sk. 7266 / 1 – 1 - 2
5	SK. 6015 / 34	L – 121 x Sk. 7266 / 1 – 1 - 2
6	SK. 6015 / 35	L – 121 x Sk. 7266 / 1 – 1 - 2
7	SK. 6015 / 37	L – 121 x Sk. 7266 / 1 – 1 - 2
8	SK. 6015 / 39	L – 121 x Sk. 7266 / 1 – 1 - 2
9	SK. 6015 / 42	L – 121 x Sk. 7266 / 1 – 1 - 2
10	SK. 6015 / 43	G. 5384 / 4 –3
11	SK. 6022 / 44	G. 5384 / 4 – 3
12	SK. 6022 / 45	G. 5384 / 4 – 3
13	SK. 6022 / 46	G. 5384 / 4 – 3
14	SK. 6023 / 47	EXP. 9372 / 7 – 2
15	SK. 6023 / 48	EXP. 9372 / 7 – 2
16	SK. 6023 / 49	EXP. 9372 / 7 – 2
17	SK. 6026 / 50	G. 639 x Sk. 6241 / 2 – 9
18	SK. 6026 / 52	G. 639 x Sk. 6241 / 2 – 9

A Randomized Complete Block Design (RCBD) was used with four replications in each location. The plot size was one row 6 m long and 80 cm apart with 25 cm between hills. All agronomic operations were done according recommendations during summer season of 2004.

Measured data

The data were measured on: silking date (days from planting to 50% silking), plant height(cm), ear height (cm), resistance to late wilt disease, grain yield (ard./fed.) adjusted to 15.5% grain moisture content, ear length (cm), ear diameter (cm), number of rows/ear, number of kernels/row and resistance to late wilt (%).

Analysis of variance

The analysis of variance of RCBD for each location and across the two locations was performed according to Steel and Torrie (1980). Combining ability analysis was computed using the line x tester procedure suggested by Kempthorne (1957). Combined analysis between the two locations was done based on the homogeneity test.

RESULTS AND DISCUSSION

Combined analysis of variance for the nine studied traits across the two locations (Sakha and Mallawy) is shown in Table (2). Mean squares due to locations were significant for all studied traits except number of rows/ear indicating that these traits differed from one location to another. This result agreed with that reported by El-Zeir *et al* (2000), Amer *et al* (2002) and Ibrahim *et al* (2004). Mean squares due to crosses were highly significant for most traits except resistance to late wilt disease and ear diameter. Also, mean squares due to crosses x loc. interactions highly significant for grain yield, plant and ear heights, while, for other traits were not significant.

Table 2 .Combined analysis of variance for nine traits across Sakha and Mallawy locations.

S.O.V.	df	Mean squares								
		Silking Date	Plant Height	Ear Height	Resistance to late wilt	Ear length	Ear diameter	No. of rows/ear	No. of kernels /row	Grain yield
Locations (loc.)	1	152.10**	3165.66**	5995.1**	44.52**	9.42**	39.01**	1.02	74.51**	51.16*
Reps/locations	6	16.90	870.74	669.51	1.07	2.81	0.62	0.63	16.81	18.04
Crosses (Cr)	35	7.37**	352.86**	270.03**	3.15	13.26**	0.20**	8.67**	32.26**	333.34**
C x Loc	35	1.33	304.01**	194.20**	2.18	1.78	0.12	0.54	13.67	133.83**
Error	210	1.36	122 .92	63.43	2.53	1.05	0.06	0.84	8.23	11.27
C.V. %		1.81	4.04	5.04	1.60	5.01	4.45	5.71	6.85	10.31

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

Mean squares due to lines, testers and their interactions across two different locations (Sakha and Mallawy) are presented in Table (3). Mean squares due to lines exhibited highly significant differences for most studied traits except resistance to late wilt traits which was significant only. Mean squares due to testers were highly significant for grain yield, number of rows/ear, ear diameter, ear length and silking date but were not significant for the other traits. Mean squares due to lines x testers interaction were highly significant for grain yield and silking date, mean squares due to lines x loc. interaction were significant for grain yield, plant and ear heights and resistance of late wilt, those due to tester x loc. interaction were significant for ear diameter, ear length, plant height, ear height and silking date while mean squares due to lines x testers x loc. interaction were not significant for all traits except grain yield trait.

Table 3. Mean squares due to lines, testers and their interactions across two locations (Sakha and Mallawy).

S.O.V.	dF	Mean squares								
		Silking Date	Plant height	Ear height	Resistance to late wilt	Ear Length	Ear diameter	No. of rows/ear	No. of kernels /row	Grain yield
Lines (L)	17	8.34**	605.45**	462.83**	4.19	19.27**	0.20**	10.65**	44.80**	521.11**
Testers (T)	1	49.17**	106.34	9.75	4.50	81.28**	1.25**	87.78**	5.56	57.78**
L x T	17	3.95**	114.77	92.53	2.03	3.25	0.13	2.03	21.3	161.78**
L x loc.	17	2.34	525.84**	329.16**	3.20	1.63	0.11	0.60	20.54	136.72**
T x loc.	1	3.34	850.56**	169.49**	4.50	15.32	0.08	1.53	2.72	1.00
L x T x loc.	17	0.20	50.03	60.70	1.02	1.13	0.10	0.43**	7.54	138.75*
Error	210	1.36	122.92	63.43	2.53	1.05	0.06	0.84	8.23	11.27

Mean performances for the nine studied traits of 36 top crosses across two different locations are given in Table (4). Four top crosses Gz-649 x Sk 6015/28 (43.49 ard./fed.), Gz-649 x Sk-6015/35 (42.43 ard./fed.), S.C 52 x Sk-6015/23 (43.34 ard./fed.) and S.C 52 x Sk-6015/28 (44.57 ard./fed.) out-yielded significantly the check hybrid S.C 3080 (36.08 ard./fed.) for grain yield and some other traits. Moreover, six top crosses did not differ significantly from the check hybrid T.W.C. 352 (34.74 ard./fed.) for grain yield and some other traits and therefore could be recommended to use in maize breeding program.

Estimates of variance for general (δ^2 GCA) and specific (δ^2 SCA) combining ability and their interactions with the two locations are shown in Table (5). The results exhibited that the values of δ^2 SCA were higher than those of δ^2 GCA for grain yield, number of kernels/row and resistance of late wilt disease , while, δ^2 GCA was higher than δ^2SCA for silking date, plant and ear heights and ear length. This indicated the importance of both additive and non-additive genetic variance in the inheritance of these studied traits. On the other side, the values of the δ^2 GCA x loc. interaction were higher the δ^2 SCA x loc. for silking date, plant and ear heights, ear length and number of kernels/row. This result showed that the additive gene action was more influenced and interacted by locations than non-additive gene action, while, the non-additive gene action was more sensitive to locations (environmental conditions) than additive gene action for grain yield, resistance to late wilt disease and number of rows/ear. These results were similar to those reported by Amer *et al* (2003).

Table 4. Mean performance of 36 top crosses for the nine traits of maize combined across two locations (Sakha and Mallawy).

Top crosses		Silking date	Plant height	Ear height	Resistance to late wilt	Ear length	Ear diameter	No. of rows /ear	No. of kernels /row	Grain yield
Gz-649	x SK-6015/23	64.75	277.50	156.75	100.00	22.28	5.5	14.8	41.12	35.05
Gz-649	x SK-6015/24	64.63	276.75	159.00	100.00	21.88	5.3	14.5	44.13	32.17
Gz-649	x SK-6105/26	63.63	275.38	159.50	100.00	20.65	5.3	15.1	41.00	29.35
Gz-649	x SK-6105/28	64.25	287.63	170.88	100.00	23.25	5.5	15.5	44.55	36.16
Gz-649	x SK-6105/34	64.00	276.13	162.13	98.50	21.18	5.2	16.5	44.75	43.49
Gz-649	x SK-6105/35	65.13	276.88	164.75	100.00	21.55	5.3	15.7	45.18	42.43
Gz-649	x SK-6105/37	64.25	284.25	167.00	100.00	21.58	5.0	15.1	41.73	30.10
Gz-649	x SK-6105/39	64.25	276.75	159.25	99.50	22.03	5.5	15.5	42.25	30.42
Gz-649	x SK-6105/42	66.00	284.63	165.13	100.00	21.58	5.4	16.3	42.49	33.29
Gz-649	x SK-6016/34	65.75	280.00	166.38	100.00	21.48	5.5	16.4	45.00	29.94
Gz-649	x SK-6022/44	64.75	269.38	154.88	98.96	21.23	5.2	16.2	42.45	32.64
Gz-649	x SK-6022/45	64.75	268.38	151.25	99.00	20.73	5.1	15.4	43.05	29.37
Gz-649	x SK-6022/46	64.38	270.38	156.13	99.50	20.76	5.4	17.6	42.63	29.39
Gz-649	x SK-6023/47	65.38	265.00	148.00	100.00	20.90	5.1	15.5	43.08	34.14
Gz-649	x SK-6023/48	64.63	273.25	157.13	100.00	21.20	5.2	15.7	40.50	32.77
Gz-649	x SK-6023/49	64.63	267.38	149.75	100.00	20.15	5.2	16.1	39.63	33.91
Gz-649	x SK-6026/50	65.38	260.75	147.63	98.00	17.90	5.0	14.3	36.45	18.04
Gz-649	x SK-6026/52	66.88	261.13	147.75	97.00	17.70	4.7	14.0	37.23	14.43
S.C 52	x SK-6015/23	63.25	275.75	155.75	100.00	20.61	5.5	15.0	41.30	35.68
S.C 52	x SK-6015/24	63.75	275.13	157.88	100.00	20.35	5.5	16.0	45.05	43.34
S.C 52	x SK-6105/26	62.75	270.88	152.25	100.00	20.50	5.6	16.0	42.40	34.23
S.C 52	x SK-6105/28	63.88	286.13	163.25	100.00	21.93	5.4	16.3	43.93	44.57
S.C 52	x SK-6105/34	62.50	273.13	162.75	99.50	19.53	5.2	16.2	40.70	28.75
S.C 52	x SK-6105/35	63.00	270.88	160.00	99.00	20.35	5.4	17.3	41.80	37.22
S.C 52	x SK-6105/37	63.50	281.13	161.00	99.50	21.00	5.4	17.7	42.15	35.97
S.C 52	x SK-6105/39	63.25	282.88	162.38	99.50	21.33	5.8	17.0	41.23	32.40
S.C 52	x SK-6105/42	64.75	283.63	165.88	100.00	21.19	5.4	17.3	43.98	29.78
S.C 52	x SK-6016/34	62.25	228.25	164.38	100.00	20.05	5.6	17.0	42.75	34.28
S.C 52	x SK-6022/44	65.25	276.75	158.38	100.00	18.68	5.4	17.2	40.10	27.92
S.C 52	x SK-6022/45	64.63	265.38	151.25	99.00	18.93	5.5	17.6	41.15	27.20
S.C 52	x SK-6022/46	65.50	275.13	157.88	100.00	18.70	5.4	18.1	41.40	34.20
S.C 52	x SK-6023/47	65.38	275.00	155.88	100.00	19.80	5.3	16.1	41.25	25.91
S.C 52	x SK-6023/48	64.50	272.38	156.13	100.00	19.83	5.3	16.3	40.23	36.73
S.C 52	x SK-6023/49	64.25	269.30	155.50	100.00	18.93	5.5	18.2	39.75	34.77
S.C 52	x SK-6026/50	63.13	270.88	154.50	99.50	19.14	5.3	15.5	41.18	24.09
S.C 52	x SK-6026/52	64.00	271.00	154.88	99.00	18.49	5.2	15.4	4.085	24.71
Average		64.42	274.56	158.17	99.62	20.43	5.4	16.1	41.88	32.54
S.C. 3080		64.00	266.88	151.13	100.00	19.24	5.7	15.2	43.53	36.08
T.W.C 352		64.25	281.38	166.25	100.00	19.66	5.7	16.1	39.73	34.74
L.S.D.	0.05	1.14	10.87	7.81	1.56	1.00	0.24	0.90	2.81	3.29
	0.01	1.50	14.30	10.27	2.05	1.32	0.32	1.18	3.70	4.33

Table 5. Estimates of variance of general (δ^2GCA) and specific (δ^2SCA) combining ability and their interaction with locations.

Variances	Silking date	Plant height	Ear height	Resistance of late wilt (%)	Ear length	Ear diameter	No. of rows /ear	No. of kernels/ raw	Grain yield
δ^2 GCA	0.276	-4.963 #	-0.940 #	-0.041 #	0.496	0.003	0.607	-0.050 #	2.470
δ^2 SCA	0.201	-2.638 #	-0.660 #	-0.395 #	0.203	0.003	0.179	0.095	3.133
δ^2 GCA/δ^2SCA	1.373	1.881	1.424	0.104	2.443	1.000	3.391	-0.526	0.788
δ^2 GCA x loc.	0.066	15.954	4.717	0.095	0.184	0.009	-0.035 #	0.102	-1.747 #
δ^2 SCA x loc.	-0.290 #	-18.223 #	0.683	0.378	0.020	0.010	0.398	-0.173 #	31.870
δ^2 GCA x loc./ δ^2SCA x loc.	-0.228	-0.875	6.905	0.251	9.200	0.900	-0.088	-0.335	-0.055

 # Variance estimate preceded by negative sign is considered zero.

Estimates of general combining ability effects for 18 new inbred lines and two testers across two locations (Sakha and Mallawy) are given in Table (6).Significant and desirable GCA effects were shown by seven inbred lines (Sk-6015/23, Sk-6015/24, Sk-6023/28, Sk-6015/34, Sk-6015/35, Sk-6023/48 and Sk-6023/49) for grain yield ; four inbred lines (Sk-6015/24, Sk-6105/28, Sk-6105/35 and Sk-6016/34) for number of kernels /row, five inbred lines (Sk-6105/42, Sk-6016/43, Sk-6022/45, Sk-6022/46 and Sk-6023/49) for number of rows/ear ; five inbred lines (Sk-6015/23, Sk-6015/24, Sk-6105/28, Sk-6105/39 and Sk-6105/42) for ear length. On the other side, desirable significant GCA effects were exhibited by two inbred lines (Sk-6026/50 and Sk-6026/52) for resistance to late wilt disease; two inbred lines (Sk-6105/34, Sk-6026/52) for ear diameter; four inbred lines(Sk-6105/26, Sk-6105/34, Sk-6105/37,Sk-6105/39) for silking date (towards earliness) ,while, four inbred lines (Sk-6022/45, Sk-6023/49, Sk-6026/50 and Sk-6026/52) showed negative and favorable significant GCA effects for plant and ear heights (towards shortness). These inbred lines could be used in hybrid breeding program to produce new high yielding crosses. On the other hand, high desirable GCA effects for the testers were obtained from the line tester Gz-649 for ear length, the tester S.C 52 for silking date (towards earliness) and number of rows/ear. Ali and Tepora (1986), Mahmoud (1996) and Al-Naggar *et al* (1997) reported that most efficient testers for yield and its components were inbred lines which had the narrowest genetic base and the lowest yield potential.

Estimates of specific combining ability effects for 36 top crosses across two different locations (Sakha and Mallawy) are shown in Table (7). The results exhibited that the best SCA effects were observed in eight top crosses i.e., (Gz-649 x Sk-6015/34), (Gz-649 x Sk-6015/35), (Gz-649 x Sk-6022/44), (Gz-649 x Sk-6023/47), (S.C 52 x Sk-6015/23), (S.C 52 x Sk-6015/37), (S.C 52 x Sk-6026/50) and (S.C 52 x Sk-6026/52) for grain yield; two top crosses i.e.,(S.C 52 x Sk-6026/50) and (S.C 52 x Sk-6026/52) for number of kernels and ear length ; two top crosses i.e.,(Gz-649 x Sk-6105/34) and (S.C 52 x Sk-6105/37) for number of rows /ear. While, some top crosses exhibited negative and desirable SCA effects i.e., (Gz-649 x Sk-6022/46) and (S.C 52 x Sk-6026/52) for silking date towards earliness and (Gz-649 x Sk-6026/52) for ear diameter. These results exhibited that the line tester Gz-649 was the best tester for estimating combining ability of the inbred lines for grain yield and some other traits.

Table 6 .Estimates of general combining ability effects for 18 new inbred lines and 2 testers across two locations (Sakha and Mallawy).

Inbrd lines or testers		Silking date	Plant height	Ear height	Resistance of late wilt (%)	Ear length	Ear diameter	No. of rows/ear	No. of kernels /row	Grain yield
Inbred lines										
SK-6015/23		-0.441	2.045	-1.892	0.403	0.976**	0.108	-1.135**	-0.701	2.997**
SK-6015/24		-0.254	1.358	0.295	0.403	0.601*	0.045	-1.010**	2.674**	8.809**
SK-6105/26		-1.254**	-1.455	-2.267	0.403	0.226	0.045	-0.510*	-0.201	-0.691
SK-6105/28		-0.379	12.295**	8.920**	0.403	2.101**	0.045	-0.135	2.299**	8.122**
SK-6105/34		-1.191**	0.045	4.295*	0.597	-0.274	-0.142*	0.240	0.799	3.747**
SK-6105/35		-0.379	-0.705	4.233*	-0.097	0.413	-0.017	0.365	1.611*	7.434**
SK-6105/37		-0.566	8.108**	5.858**	0.153	0.726	-0.080	0.302	-0.014	0.622
SK-6105/39		-0.691	5.233	2.670	-0.097	1.226**	0.108	0.177	-.076	-0.879
SK-6105/42		0.934	9.545**	7.358**	0.403	0.976**	0.170**	0.615**	1.236	-0.879
SK-6016/34		1.059**	4.545	7.233**	0.403	0.101	0.170**	0.615**	2.049**	-0.254
SK-6022/44		0.559	-1.517	-1.517	-0.097	-0.587*	-0.017	0.427	-0.514	-2.004*
SK-6022/45		0.247	-7.705*	-6.892*	-0.597	-0.712**	-0.017	0.490*	0.236	-4.066**
SK-6022/46		0.497	-1.830	-1.142	0.153	-0.712**	0.045	1.615**	0.049	-0.691
SK-6023/47		0.934**	-4.580	-6.205**	0.403	-0.024	0.045	-0.385	0.299	-2.316**
SK-6023/48		0.122	-1.767	-1.517	0.403	0.163	-0.080	-0.010	-1.514*	2.309**
SK-6023/49		-0.004	-6.330*	-5.517**	0.403	-0.899**	-0.080	0.990**	-2.264**	1.934*
SK-6026/50		-0.191	-8.767**	-7.080**	-0.847*	-2.024**	-0.080	-1.323**	-3.139**	-11.316**
SK-6026/52		0.998**	-8.517**	-6.830**	-1.597**	-2.24**	-0.267**	-1.323**	-2.826**	-12.879**
Testers										
Gz 649		0.413**	-0.608	-0.184	-0.125	0.531**	-0.066**	-0.552**	0.139	-0.448
S.C. 52		-0.413**	0.608	0.184	0.125	-0.531**	0.066**	0.552**	-0.139	0.448
L.S.D.$_{gi}$ lines	0.05	0.57	5.43	3.90	0.78	0.50	0.12	0.45	1.41	1.64
	0.01	0.75	7.15	5.14	1.03	0.66	0.15	0.59	1.85	2.16
L.S.D g_i- g_j	0.05	0.81	7.68	5.53	1.10	0.71	0.17	0.63	1.99	2.38
	0.01	1.06	10.11	7.28	1.45	0.93	0.22	0.84	2.62	3.13
L.S.D.$_{gi}$Testers	0.05	0.19	1.81	1.30	0.26	0.17	0.04	0.15	0.47	0.55
	0.01	0.25	2.38	1.71	0.34	0.22	0.05	0.20	0.62	0.72
L.S.D g_i- g_j	0.05	0.38	3.62	2.60	0.52	0.33	0.08	0.30	0.94	1.10
	0.01	0.50	4.77	3.42	0.68	0.44	0.11	0.39	1.23	1.44

Table 7. Estimates of specific combining ability effects for 36 top-crosses across two locations (Sakha and Mallawy).

Top crosses		Silking date	Plant height	Ear height	Resistance to late wilt (%)	Ear length	Ear diameter	No. of rows /ear	No. of kernels /row	Grain yield
Gz-649	x SK-6015/23	0.337	1.483	0.684	0.125	0.281	0.066	0.302	-0.326	0.198
Gz-649	x SK-6015/24	0.024	1.420	0.747	0.125	0.156	0.003	-0.323	-0.701	-1.740
Gz-649	x SK-6105/26	0.240	2.858	3.809	0.125	-0.469	0.003	0.052	-0.826	-1.865
Gz-649	x SK-6105/28	-0.226	1.358	3.997	0.125	0.156	0.128	0.177	0.171	-3.802**
Gz-649	x SK-6105/34	0.337	2.108	-0.128	-0.375	0.281	0.066	0.677*	1.924	7.823**
Gz-649	x SK-6105/35	0.649	3.608	2.559	0.625	0.094	-0.059	-0.198	1.611	3.135**
Gz-649	x SK-6105/37	-0.038	2.170	3.184	0.375	-0.219	0.122	-0.760*	-0.389	-2.427*
Gz-649	x SK-6105/39	0.087	-2.455	-1.378	0.125	-0.094	0.066	-0.135	0.424	-0.552
Gz-649	x SK-6105/42	0.212	1.108	-0.191	0.125	-0.344	0.128	0.177	-0.889	2.323
Gz-649	x SK-6016/34	-0.163	1.483	1.184	0.125	0.156	0.003	0.302	0.924	-1.552
Gz-649	x SK-6022/44	-0.663	-3.180	-1.566	-0.375	0.719	-0.059	-0.010	0.986	2.823*
Gz-649	x SK-6022/45	-0.351	2.108	0.184	0.125	0.344	-0.059	-0.448	0.861	1.635
Gz-649	x SK-6022/46	-0.976*	-1.767	-0.691	-0.125	0.469	0.128	0.302	0.424	-1.990
Gz-649	x SK-6023/47	-0.413	-4.392	-3.753	0.125	0.156	0.003	0.302	0.674	4.635**
Gz-649	x SK-6023/48	-0.351	1.045	0.684	0.125	0.094	0.003	0.302	-0.014	-1.490
Gz-649	x SK-6023/49	-0.226	-0.267	-2.691	0.125	0.156	0.003	-0.448	-0.264	0.10
Gz-649	x SK-6026/50	0.712	-4.455	-3.253	-0.625	-1.094**	-0.122	-0.135	-2.514*	-2.615*
Gz-649	x SK-6026/52	1.024	-4.330	-3.378	-0.875	-0.844	-0.181*	-0.135	-2.076*	-4.552**
S.C 52	x SK-6015/23	-0.337	-1.483	-0.684	-0.125	-0.281	-0.066	-0.302	0.326	-0.198
S.C 52	x SK-6015/24	-0.024	-1.420	-0.747	-0.125	-0.156	-0.003	0.323	0.701	1.740
S.C 52	x SK-6105/26	-0.024	-2.858	-3.809	-0.125	0.469	-0.003	-0.052	0.826	1.865
S.C 52	x SK-6105/28	0.226	-1.358	-3.997	-0.125	-0.156	-0.128	-0.177	-0.174	3.802**
S.C 52	x SK-6105/34	-0.337	-2.108	0.128	0.375	-0.281	-0.066	-0.677	-1.924	-7.823**
S.C 52	x SK-6105/35	-0.649	-3.608	-2.559	-0.625	-0.094	0.059	0.198	-1.611	-3.135**
S.C 52	x SK-6105/37	0.038	-2.170	-3.184	-0.375	0.219	0.22	0.760*	0.389	2.427*
S.C 52	x SK-6105/39	-0.087	2.455	1.378	-0.125	0.094	-0.066	0.135	-0.424	0.552
S.C 52	x SK-6105/42	-0.212	-1.108	0.191	-0.125	0.344	-0.128	-0.177	0.889	-2.323
S.C 52	x SK-6016/34	0.163	-1.483	-1.184	-0.125	-0.156	-0.003	-0.302	-0.924	1.552
S.C 52	x SK-6022/44	0.663	3.180	1.566	0.375	-0.719*	0.059	0.10	-0.986	-2.823*
S.C 52	x SK-6022/45	0.351	-2.108	-0.184	-0.125	-0.344	0.059	0.448	-0.861	-1.635
S.C 52	x SK-6022/46	0.976*	1.767	0.691	0.125	-0.469	-0.128	-0.302	-0.424	1.990
S.C 52	x SK-6023/47	0.413	4.392	3.753	-0.125	-0156	-0.003	-0.302	-0.674	-4.635**
S.C 52	x SK-6023/48	0.351	-1.045	-0.684	-0.125	0.156	-0.003	-0.302	0.014	1.490
S.C 52	x SK-6023/49	0.226	0.267	2.691	-0.125	-0.156	-0.003	0.448	0.264	-0.10
S.C 52	x SK-6026/50	-0.712	4.455	3.253	0.625	1.094**	0.122	0.135	2.514*	2.615*
S.C 52	x SK-6026/52	-1.024**	4.330	3.378	0.875	0.844*	0.184*	0.135	2.076*	4.552**
$L.S.D._{sij}$	0.05	0.80	7.68	5.52	1.10	0.71	0.17	0.64	2.02	2.33
	0.01	1.06	10.11	7.26	1.45	0.93	0.22	0.84	2.65	3.06
$L.S.D.s_{ij} - s_{ik}$	0.05	1.14	10.87	7.81	1.56	1.00	0.24	0.90	2.81	3.29
	0.01	2.51	14.30	10.27	2.05	1.32	0.32	1.18	3.70	4.33

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القدرة على الائتلاف لبعض سلالات الذرة الصفراء الجديدة باستخدام تحليل السلالة × الكشاف

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تم تهجين ١٨ سلالة جديدة من الذرة الصفراء مع كشافين وهما سلالة جيزة ٦٤٩ وهجين فردى ٥٢ وذلك بمحطة البحوث الزراعية بسخا موسم ٢٠٠٣م.

تم تقييم ٣٦ هجين قيمى مع أثنين من هجن المقارنة المعروفة (هـ.ف ٣٠٨٠ ، هـ.ث ٣٥٢) في محطتي البحوث الزراعية بسخا وملوي في الموسم الزراعي ٢٠٠٤. واستخدمت طريقة تحليل السلالة × الكشاف للعالم كمبثورن ١٩٥٧م وذلك لصفات ظهور ٥٠% حراير ــ ارتفاع نبات ــ ارتفاع الكوز ــ المقاومة لمرض الذبول المتأخر ــ محصول الحبوب ــ طول الكوز ــ قطر الكوز ــ عدد الصفوف بالكوز ــ عدد الحبوب بالصف ــ وزن ١٠٠ حبة.

وكانت أهم النتائج كما يلي:-

- ***وجدت اختلافات معنوية بين المواقع لكل الصفات المدروسة ماعدا صفة عدد الصفوف للكوز.***
- ***أظهرت التراكيب الوراثية فروق معنوية فيما بينهما للصفات المدروسة ماعدا قطر الكوز.***

- كان تباين تفاعل التراكيب الوراثية × المواقع معنويا لصفة محصول الحبوب ــ ارتفاع النبات وارتفاع الكوز.
- أظهرت السلالات في هجنها فروقا معنوية لكل الصفات المدروسة وأظهرت الكشافات في هجنها فروقا معنوية لبعض الصفات المدروسة مثل: محصول الحبوب ــ عدد الصفوف للكوز ــ قطر الكوز ــ طول الكوز و ظهور ٥٠% الحرائر. بينما كان تباين التفاعل بين السلالات والكشافات معنويا لصفة محصول الحبوب ، ظهور ٥٠% الحرائر.
- لعب كل من التأثير المضيف وغير المضيف دورا هاما في وراثة الصفات المدروسة.
- أظهرت السلالات سخا ٦٠١٥/٢٣ وسخا ٦٠١٥/٢٤ و سخا ٦٠١٥/٢٨ وسخا ٦١٠٥/٣٤وسخا٦١٠٥/٣٥وسخا ٦٠٢٣/٤٨و سخا ٦٠٢٣/٤٩قيما موجبة وتأثيرات مرغوبة للقدرة العامة على الائتلاف لصفة المحصول وبعض مكوناته كما أظهرت السلالات سخا ٦١٠٥/٢٦ وسخا ٦١٠٥/٣٤ وسخا٦١٠٥ / ٣٧ وسخا ٦١٠٥/٣٩ تأثيرات مرغوبة نحو التبكير بينما أظهرت السلالات سخا ٦٠٢٢/٤٥ ــ سخا ٦٠٢٣/٤٩ ــ سخا ٦٠٢٦/٥٠ وسخا ٦٠٢٦/٥٢ تأثيرات مرغوبة نحو قصر النبات وانخفاض موقع الكوز وهي صفات مرغوبة وهامة لمربي النبات.
- أظهر الكشاف هـ.ف ٥٢ تأثيرات مرغوبة نحو صفة التبكير وبعض الصفات الأخرى بينما أظهر الكشاف سلالة جيزة ٦٤٩ تأثيرات مرغوبة لصفة طول الكوز وقطر الكوز.
- أظهرت أربعة هجن قمية وهي سلالة جيزة ٦٤٩ × سلالة سخا ٦٠١٥/٢٨ (٤٣,٤٩ إردب/فدان) ، سلالة جيزة ٦٤٩ × سلالة سخا ٦٠١٥/٣٥ (٤٢,٤٣ إردب/فدان) ، هـ . ف ٥٢ × سلالة سخا ٦٠١٥/٢٣ (٤٣,٣٤ إردب/فدان)، هـ.ف سخا ٥٢ × سخا ٦٠١٥/٢٨ (٤٤,٥٧ إردب/فدان) تفوقا معنويا عن الهجين التجاري هـ.ف ٣٠٨٠ (٣٦,٠٨ إردب/فدان) بالنسبة لصفة المحصول وبعض الصفات الأخرى.
- أيضا وجدت ست هجن قمية لم تختلف معنويا عن الهجين الثلاثي ٣٥٢ (٣٤,٧٤ إردب/فدان) بالنسبة لصفة محصول الحبوب ومعظم الصفات المدروسة.
- لذا يمكن الاستفادة من هذه الهجن كهجن جديدة و متفوقة وعالية المحصول عن الهجن التجارية المستخدمة للمقارنة كما أظهرت مقاومة عالية لمرض الذبول المتأخر و يمكن استخدامها في برنامج تربية وتحسين الذرة الشامية.