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Combining Ability of Some New White Inbred Lines of Maize for Grain Yield and other Traits

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ABSTRACT

Nineteen inbred lines of white maize divered from S_5 generation at Sakha Agricultural Research Station were crossed with two inbred lines as testers in 2014 summer season. The 38 topcrosses were evaluated at Sakha and Mallawy Research Stations during summer season 2015 for eight studied traits, namely days to 50% silking, plant and ear heights, grain yield (ton/ha) adjusted on 15.5% grain moisture content, ear length (cm), ear diameter (cm), number of rows per ear and number of kernels per row. Mean squares due to lines , testers and line×tester were highly significant for most traits. While the interaction between lines, testers and locations were not significant for most traits. One topcross Sk5002/9×Sk13 (14.5 ton/ha) outyielded the check SC128 (13.2 ton/ha), also 13 topcrosses outyielded significantly the single cross SC10. These crosses could be used in the maize breeding program in the future. Highly significant and desirable GCA effects were exhibited in Sk5001/2, Sk5002/9, Sk5002/10, Sk5002/11 and Sk5003/15 inbred lines for grain yield. Generally these inbred lines could be used in future stage of evaluation in the maize breeding program.

Keywords: Line × tester analysis, GCA, SCA, *Zea mays*.

INTRODUCTION

The best tester is one that is capable of giving higher maximum grain yield of its top cross hybrids (Allison and Curnow 1966). The preliminary evaluation of the combining ability of new inbred lines can be achieved through topcross test. However, the effectiveness of this test depends mainly upon the type of tester to be used in the evaluation program. Rawlings and Thompsom (1962), Ayad (1986), Mosa *et al.* (2004) and El-Shenawy *et al.* (2005) found that using narrow genetic base as a tester (inbred line) was effective in the evaluation process. The study of genetic components of combining ability, general combining ability (GCA) and specific combining ability (SCA) is very important to plant breeders to select the good combiner parents and can be used in hybrid production. Also, the combining ability of inbred lines is the ultimate factor determining their usefulness in developing the hybrids. The main objectives of this study were to estimate combining ability of some new white inbred lines for several traits of maize, to identify superior single crosses and determine the superiority of single crosses over the best commercial maize hybrids.

MATERIALS AND METHODS

New white nineteen inbred lines of maize, derived from five different sources in S_5 generation at Sakha Agricultural Research Station are shown in Table 1. These nineteen inbred lines were crossed by handle with inbred lines Sk-13 and Sk-8 as testers during 2014 summer season. The 38 crosses and the two check hybrids SC10 and SC128 were evaluated at Sakha and Mallawy stations in 2015 summer season. The total of 38 ccrosses and 2 check hybrids were arranged in a randomized complete block design, with four replications at each location. Plot size was one row, 6m long, 80 cm apart with 25 single hill plants. All Agricultural practices were done completely as per recommendation book.

Data were recorded on number of days to 50% silking, plant and ear heights, grain yield (ton/ha) adjusted on 15.5% grain moisture content, ear length (cm), ear diameter (cm), number of rows per ear and number of kernels per row. Analysis of variance for the combined data across two locations was done according to Steel and Torrie (1980). The line × tester analysis was done according to Kempthorne (1957).

Table 1. The source and pedigree of the 19 white maize inbred lines.

No.	Inbred lines	Source/ Pedigree	No.	Inbred lines	Source/ Pedigree
1	Sk5001/1	Pop Sk-7S_1C_1	12	Sk5003/14	SC10×pop CIMMYT
2	Sk5001/2	″	13	Sk5003/15	
3	Sk5001/3	″	14	Sk5004/16	Gz-2×pop CIMMYT
4	Sk5001/4	″	15	Sk5004/17	″
5	Sk5002/6	Pop Sk-7 S_1C_2	16	Sk5004/18	″
6	Sk5002/7	″	17	Sk5005/19	SC Sk30
7	Sk5002/8	″	18	Sk5005/20	″
8	Sk5002/9	″	19	Sk5005/21	″
9	Sk5002/10	″			
10	Sk5002/11	″			
11	Sk5002/12	″			

Gz= Giza, Sk= Sakha, SC= single cross, Pop= population

RESULTS AND DISCUSSION

The mean squares of combined analysis across two locations for eight traits are shown in Table 2. Mean squares of locations was highly significant for days to 50% silking, plant and ear heights, ear length, ear diameter and number of kernels per row, indicating that the environmental conditions at the two locations were different for growing maize. These results are in agreement with El-Zeir *et al.* (2000), Amer *et al.* (2003), El-Shenawy (2003), Mosa (2004) and Motawei (2011). The mean squares due to crosses were highly significant for all studied traits. The mean squares due to crosses × locations were significant for plant and ear heights, grain yield and number of kernels per row .

Mean performance for eight studied traits of the 38 top crosses and two check hybrids across two locations are presented in Table 3. Number of days to 50% silking ranged from 60.75 days for SC Sk5002/7 × Sk13 to 68.5 days for SC Sk5005/19 ×Sk8. The data showed that the topcrosses Sk5001/4 ×Sk13, Sk5001/4 ×Sk8, Sk5002/7×Sk13 and Sk5002/8×Sk13 were significantly earlier than the check SC128. Plant height ranged from 233.75cm for SK5002/7×Sk8 to 272.62cm for SK5005/19×Sk8. Ear height ranged from 124 cm for Sk5002/6×Sk13 and SK5002/7×Sk8 to 146.25 cm for

Sk5002/21×Sk8. Ear length ranged from 19.75 cm for Sk5004/16 × Sk8 to 23 cm for Sk5004/17×Sk13. Ear diameter ranged from 4.8 cm for topcross Sk5003/14×Sk13 to 5.37 cm for topcross Sk5002/8 ×Sk8. No. of rows per ear ranged from 12.7 for SC10 to 16.65 for Sk5002/10×Sk8. No. of kernels per row ranged from 39.22 for Sk5004/18 ×Sk8 to 45.87 for Sk5005/21×Sk13. Grain yield ranged from 9.93 ton/ha for SK5005/21×SK13 to 14.5 ton/ha for Sk5002/9×Sk13, Also data showed that one hybrid SK5002/9×Sk13 (14.5 ton/ha) outyielded the check SC128. Also, 13 topcrosses outyielded significantly SC10. These crosses could be used in maize breeding program for yielding ability in future.

Table 2. Combined analysis of variance for eight traits across the two locations .

S.O.V.	df	Mean squares: days to 50% silking	Plant height	Ear height	grain yield	ear length	ear diameter	No. of rows per ear	No. of kernels /row
Location (Loc)	1	12675.61**	75798.828**	28842.012**	46.239	747.253**	6.0500**	0.4205	2674.98**
Rep (Loc)	6	22.11	1080.9989	1121.931	13.155	0.9329	0.0789	0.5645	14.0709
Crosses (Cr)	39	23.75**	759.044**	290.212**	8.644**	5.552**	0.1333**	5.7371**	19.2613**
Cr ×Loc	39	2.88	367.885**	138.198**	8.199**	1.1172	0.0315	0.6979	17.7027**
Error	234	2.80	125.47	71.48	1.364	1.1651	0.0278	0.6152	6.8171

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

Table 3. Mean performance for eight studied characters of the 38 topcrosses and two check hybrids across two locations.

Crosses	days to 50% silking	plant height (cm)	ear height (cm)	grain yield (ton/ha)	ear length (cm)	ear diameter (cm)	No. of rows per ear	No. of kernels /row
Sk5001/1× Sk13	62.87	249.00	132.37	12.36	22.45	5.05	14.47	41.45
Sk5001/1 ×Sk8	63.37	244.12	134.37	12.02	22.15	5.12	15.00	40.77
Sk5001/2× Sk13	63.87	242.62	128.62	13.41	21.70	5.05	14.15	44.00
Sk5001/2×Sk8	63.87	248.75	131.62	11.76	21.15	5.02	14.30	41.42
Sk5001/3 × Sk13	64.25	246.75	133.87	11.40	22.80	5.20	15.75	44.35
Sk5001/3 ×Sk8	64.12	250.87	135.25	10.46	21.65	5.12	15.85	42.00
Sk5001/4 × Sk13	61.25	242.12	129.00	11.71	20.15	4.82	13.30	40.30
Sk5001/4×Sk8	61.75	244.87	131.50	10.36	19.85	4.82	13.50	40.10
Sk5002/6× Sk13	63.62	234.62	124.00	11.38	20.95	4.82	14.25	41.67
Sk5002/6 ×Sk8	62.87	240.37	125.12	11.23	20.92	4.90	14.65	41.17
Sk5002/7 × Sk13	60.75	239.12	124.25	12.08	21.82	4.95	14.75	42.55
Sk5002/7×Sk8	62.25	233.75	124.00	11.77	21.07	5.15	15.90	41.95
Sk5002/8 × Sk13	61.00	238.00	126.00	12.81	20.40	5.15	14.80	40.12
Sk5002/8 ×Sk8	63.37	244.12	130.00	11.61	21.20	5.37	16.00	41.07
Sk5002/9 × Sk13	62.50	252.75	136.75	14.50	21.80	5.02	14.40	42.67
Sk5002/9×Sk8	64.12	250.87	135.12	11.44	21.60	5.00	14.50	41.62
Sk5002/10 × Sk13	61.62	252.37	134.75	11.94	20.05	5.00	15.35	41.67
Sk5002/10×Sk8	62.25	251.25	134.87	13.21	20.77	5.25	16.65	41.82
Sk5002/11 × Sk13	62.75	254.62	133.75	12.58	21.15	4.97	14.65	42.82
Sk5002/11 ×Sk8	63.87	255.25	139.62	14.17	21.52	5.05	15.05	43.12
Sk5002/12× Sk13	63.37	265.25	140.37	13.06	21.67	4.90	14.20	44.82
Sk5002/12×Sk8	61.75	262.87	138.00	11.49	21.02	4.87	13.55	42.57
Sk5003/14× Sk13	65.00	246.75	133.00	11.61	20.35	4.80	13.90	42.60
Sk5003/14×Sk8	64.87	258.87	142.50	11.35	20.12	5.12	14.05	42.27
Sk5003/15× Sk13	62.25	245.25	132.25	12.52	20.77	4.95	13.62	41.02
Sk5003/15×Sk8	64.37	245.87	131.12	12.78	20.97	4.95	13.85	42.17
Sk5004/16× Sk13	63.00	251.62	129.75	11.81	20.12	4.85	13.75	40.72
Sk5004/16×Sk8	62.00	248.50	136.62	10.93	19.75	4.82	13.35	40.40
Sk5004/17× Sk13	66.37	242.37	127.87	12.33	23.00	4.90	14.35	43.12
Sk5004/17×Sk8	64.75	235.87	124.62	11.57	22.55	5.02	14.45	43.27
Sk5004/18× Sk13	65.25	253.50	129.62	11.37	22.30	5.02	13.80	40.77
Sk5004/18×Sk8	64.87	258.25	134.87	10.14	21.37	4.97	13.90	39.22
Sk5005/19× Sk13	65.37	258.50	135.25	12.28	22.12	5.00	13.47	44.72
Sk5005/19×Sk8	68.50	272.62	142.75	10.22	21.60	4.90	13.40	41.65
Sk5005/20× Sk13	65.25	259.37	138.00	13.15	21.52	4.95	14.32	44.05
Sk5005/20×Sk8	66.12	267.25	143.12	11.66	21.67	4.85	13.40	43.77
Sk5005/21× Sk13	65.37	250.12	133.87	9.93	22.45	4.90	14.35	45.87
Sk5005/21×Sk8	65.87	270.12	146.25	11.26	22.12	4.97	14.10	43.85
SC10	66.87	268.12	147.00	11.09	21.92	4.85	12.70	45.32
SC128	63.12	249.75	126.75	13.20	21.35	5.05	14.45	41.75
LSD 0.05	1.63	10.97	8.28	1.14	1.05	0.16	0.76	2.55
0.01	2.15	14.44	10.90	1.50	1.39	0.21	1.01	3.36

The mean squares for lines (L), testers (T), lines × testers (L×T) and their interaction with location (Loc) for eight traits across two locations are presented in Table 4. The results show that the mean squares for L, T and L×T were significant for all studied traits, except ear length for (T) and plant height, ear height, ear length and No. of kernels/row for L×T . This indicates that the inbred lines significantly differ in their performance with respect to testers. Also the two testers were different from each other in topcrosses. The significance of L×T would suggest the mean of certain topcross production is a function of both the male and female parent. These results are in agreement with those of Mosa (2001), Amer *et al.* (2003) and El-Shenawy *et al.* (2005), Mosa (2010), El-Hosary (2014), Abo El-Haress (2015) and Motawei *et al.* (2016). The interaction between L×Loc, T×Loc and L×T×Loc were not significant for all studied traits, except plant and ear height, grain yield and No. of kernels/row for L×Loc, plant height and grain yield for T×Loc and grain yield for L×T×Loc.

The general combining ability effects of inbred lines for eight studied traits across two locations are presented in Table (5). Highly significant and favorable GCA effects were shown in the inbred lines, Sk5001/2, Sk5002/9, Sk5002/10, Sk5002/11 and Sk5003/15 for grain yield, Sk5001/4, Sk5002/7, Sk5002/8, Sk5002/12 and Sk5004/16 for earliness, Sk5002/6, Sk5002/7, Sk5002/8 and Sk5004/17 for short plant and ear height in addition to Sk5001/4 for short plant only, Sk5001/1, Sk5001/3, Sk5004/17, Sk5005/19 and Sk5005/21 for ear length, Sk5001/3, Sk5002/7, Sk5002/8, Sk5002/10 and Sk5002/11 for No. of rows per ear and Sk5002/12, Sk5005/20 and Sk5005/21 for No. of kernels per row. Generally these inbred lines could be used in future stage of evaluation. On the other side in Table (6) the inbred line, Sk13 as a tester was the best general combiner for grain yield and short plant.

The estimates of SCA effects of 38 top crosses for the eight traits across two locations are presented in Table 7. The results showed that the significant desirable SCA effects were obtained from the topcrosses Sk5002/9 × Sk13, Sk5002/10 × Sk8, Sk5002/11 × Sk8 and Sk5005/21 × Sk8 for grain yield, Sk5005/19 × Sk13 for earliness, Sk5005/21× Sk13 for short plant and Sk5002/10 × Sk8 and Sk5005/20 × Sk13 for No. of rows/ear, these top crosses could be useful in the maize hybrid program.

Table 4. Mean squares of lines (L), testers (T), line×testers and their interaction with locations (Loc) for eight traits across two locations.

S.O.V.	df	days to 50% silking	Plant height	ear height	grain yield	ear length	ear diameter	No. of rows per ear	No. of kernels /row
Lines (L)	18	39.159**	1265.812**	417.030**	10.055**	10.584**	0.206**	9.683**	28.933**
Testers (T)	1	18.013**	751.592*	708.211**	34.536**	4.263	0.211**	3.040*	47.843**
L×T	18	6.777**	198.168	70.398	5.715**	1.059	0.061**	1.327**	5.793
L×Loc	18	3.62	587.419**	181.198**	9.025**	1.188	0.052	0.849	29.763**
T×Loc	1	1.592	802.75*	222.368	75.311**	2.506	0.033	1.316	2.19
L×T×Loc	18	2.384	93.938	92.431	4.027**	1.045	0.01	0.547	5.396
Error	222	2.870	125.897	70.227	1.364	1.157	0.028	0.632	1.745

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

Table 5. Estimates of GCA effects for nineteen inbred lines for eight traits across two locations.

Inbred lines		days to 50%silking	Plant height	ear height	grain yield	ear length	ear diameter	No. of rows per ear	No. of kernels/row
Sk5001/1		-0.5789	-3.6809	0.0921	0.3061	0.9658**	0.0967*	0.3401	-1.0882
Sk5001/2		0.1711	-4.5559	-3.1579	0.6984*	0.0908	0.0467	-0.1724	0.5118
Sk5001/3		0.4836	-1.4309	1.2796	-0.9557**	0.8908**	0.1717**	1.4026**	0.9743
Sk5001/4		-2.2039**	-6.7434*	-3.0329	-0.8486**	-1.3342**	-0.1658**	-0.9974**	-2.000**
Sk5002/6		-0.4539	-12.7434**	-8.7204**	-0.5789*	-0.3967	-0.1283**	0.0526	-0.7757
Sk5002/7		-2.2039**	-13.8059**	-9.1579**	0.0401	0.1158	0.0592	0.9276**	0.0493
Sk5002/8		-1.5164**	-9.1809**	-5.2829*	0.3254	-0.5342*	0.2717**	1.0026**	-1.600*
Sk5002/9		-0.3914	1.5691	2.6546	1.0839**	0.3658	0.0217	0.0526	-0.050
Sk5002/10		-1.7664**	1.5691	1.5296	0.6868*	-0.9217**	0.1342**	1.6026**	-0.450
Sk5002/11		-0.3914	4.6941	3.4046	1.4901**	0.0033	0.0217	0.4526*	0.774
Sk5002/12		-1.1414**	13.8191**	5.9046**	0.3888	0.0158	-0.1033**	-0.5224**	1.499**
Sk5003/14		1.2336**	2.5691	4.4671*	-0.4069	-1.0967**	-0.0283	-0.4224*	0.2368
Sk5003/15		-0.3914	-4.6809	-1.5954	0.7629**	-0.4592	-0.0408	-0.6599**	-0.600
Sk5004/16		-1.2039**	-0.1809	-0.0954	-0.5184	-1.3967**	-0.1533**	-0.8474**	-1.638*
Sk5004/17		1.8586**	-11.1184**	-7.0329**	0.0659	1.4408**	-0.0283	0.0026	0.9993
Sk5004/18		1.3586**	5.6316*	-1.0329	-1.1281**	0.5033	0.0092	-0.5474**	-2.200**
Sk5005/19		3.2336**	15.3191**	5.7171**	-0.6365*	0.5283*	-0.0408	-0.9599**	0.9868
Sk5005/20		1.9836**	13.0691**	7.2796**	0.5171	0.2658	-0.0908*	-0.5349**	1.7118**
Sk5005/21		1.9211**	9.8816**	6.7796**	-1.2924	0.9533**	-0.0533	-0.1724	2.6618**
LSD g_{ii}	0.05	0.83	5.49	4.10	0.57	0.52	0.08	0.38	1.27
	0.01	0.90	7.23	5.40	0.75	0.69	0.10	0.51	1.67
LSD gi-gj	0.05	1.17	7.77	5.80	0.80	0.74	0.11	0.55	1.79
	0.01	1.54	10.23	7.64	1.06	0.98	0.15	0.72	2.36

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

Table 6. Estimates of GCA effects for two testers for eight traits across two locations.

Inbred lines		days to 50% silking	plant height	Ear height	Grain yield	ear length	Ear diameter	No. of rows per ear	No. of kernels /row
Sk13		-0.243	-1.57	-1.52*	0.34**	0.12	-0.026*	-0.10	-0.40
Sk8		0.243	1.57	1.52*	-0.34**	-0.12	0.026*	0.10	0.40
LSD g_{ij}	0.05	0.26	1.78	1.33	0.18	0.17	0.026	0.12	0.41
	0.01	0.35	2.34	1.75	0.24	0.22	0.035	0.16	0.54
LSD gi-gj	0.05	0.38	2.52	1.88	0.26	0.24	0.037	0.17	0.58
	0.01	0.50	3.32	2.48	0.34	0.31	0.049	0.23	0.76

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

Table 7. Estimates of SCA effects of 38 top crosses for eight traits across two locations.

Crosses	days to 50% silking	plant height	Ear height	Grain yield	ear length	ear diameter	No. of rows per ear	No. of kernels /row
Sk5001/1× Sk13	-0.006	4.0098	0.5263	-0.1682	0.0315	-0.011	-0.162	-0.059
Sk5001/1 ×Sk8	0.006	-4.0098	-0.5263	0.1682	-0.0315	0.011	0.162	0.059
Sk5001/2× Sk13	0.243	-1.4901	0.0263	0.4905	0.1565	0.038	0.02	0.890
Sk5001/2×Sk8	-0.243	1.4901	-0.0263	-0.4905	-0.1565	-0.038	-0.025	-0.890
Sk5001/3 × Sk13	0.305	-0.4901	0.8388	0.1288	0.4565	0.063	0.05	0.778
Sk5001/3 ×Sk8	-0.305	0.4901	-0.8388	-0.1288	-0.4565	-0.063	-0.05	-0.778
Sk5001/4 × Sk13	-0.006	0.1973	0.2763	0.3381	0.0315	0.026	0.00	-0.296
Sk5001/4×Sk8	0.006	-0.1973	-0.2763	-0.3381	-0.0315	-0.026	0.00	0.296
Sk5002/6× Sk13	0.618	-1.3026	0.9638	-0.260	-0.1059	-0.011	-0.100	-0.146
Sk5002/6 ×Sk8	-0.618	1.3026	-0.9638	0.260	0.1059	0.011	0.100	0.146
Sk5002/7 × Sk13	-0.506	4.2598	1.6513	-0.1806	0.2565	-0.073	-0.475	-0.096
Sk5002/7×Sk8	0.506	-4.2598	-1.6513	0.1806	-0.2565	0.073	0.475	0.096
Sk5002/8 × Sk13	-0.944	-1.4901	-0.4736	0.262	-0.5184	-0.086	-0.500	-0.871
Sk5002/8 ×Sk8	0.944	1.4901	0.4736	-0.262	0.5184	0.086	0.500	0.871
Sk5002/9 × Sk13	-0.569	2.5098	2.3388	1.1928**	-0.0184	0.038	0.050	0.128
Sk5002/9×Sk8	0.569	-2.5098	-2.3388	-1.1928**	0.0184	-0.038	-0.050	-0.128
Sk5002/10 × Sk13	-0.069	2.1348	1.4638	-0.973*	-0.4809	-0.098	-0.550*	-0.471
Sk5002/10×Sk8	0.069	-2.1348	-1.4638	0.973*	0.4809	0.098	0.550*	0.471
Sk5002/11 × Sk13	-0.319	1.2598	-1.4111	-1.1352**	-0.3059	-0.011	-0.100	-0.546
Sk5002/11 ×Sk8	0.319	-1.2598	1.4111	1.1352**	0.3059	0.011	0.100	0.546
Sk5002/12× Sk13	1.055	2.7598	2.7138	0.445	0.2065	0.038	0.425	0.728
Sk5002/12×Sk8	-1.055	-2.7598	-2.7138	-0.445	-0.2065	-0.038	-0.425	-0.728
Sk5003/14× Sk13	0.305	-4.4901	-3.2236	-0.2079	-0.0059	-0.136*	0.025	-0.234
Sk5003/14×Sk8	-0.305	4.4901	3.2236	0.2079	0.0059	0.136*	-0.025	0.234
Sk5003/15× Sk13	-0.819	1.2598	2.0888	-0.4634	-0.2184	0.026	-0.012	-0.971
Sk5003/15×Sk8	0.819	-1.2598	-2.0888	0.4634	0.2184	-0.026	0.012	0.971
Sk5004/16× Sk13	0.743	3.1348	-1.9111	0.104	0.0690	0.038	0.300	-0.234
Sk5004/16×Sk8	-0.743	-3.1348	1.9111	-0.104	-0.0690	-0.038	-0.300	0.234
Sk5004/17× Sk13	1.055	4.8223	3.1513	0.0450	0.1065	-0.036	0.050	-0.471
Sk5004/17×Sk8	-1.055	-4.8223	-3.1513	-0.0450	-0.1065	0.036	-0.050	0.471
Sk5004/18× Sk13	0.430	-0.8026	-1.0986	0.2778	0.3440	0.051	0.050	0.378
Sk5004/18×Sk8	-0.430	0.8026	1.0986	-0.2778	-0.3440	-0.051	-0.050	-0.378
Sk5005/19× Sk13	-1.319*	-5.4901	-2.2236	0.6968	0.1440	0.076	0.137	1.140
Sk5005/19×Sk8	1.319*	5.4901	2.2236	-0.6968	-0.1440	-0.076	-0.137	-1.140
Sk5005/20× Sk13	-0.194	-2.3651	-1.0361	0.4079	-0.1934	0.076	0.562*	-0.259
Sk5005/20×Sk8	0.194	2.3651	1.0361	-0.4079	0.1934	-0.076	-0.562*	0.259
Sk5005/21× Sk13	-0.006	-8.427*	-4.6611	-1.0011*	0.0440	-0.011	0.225	0.615
Sk5005/21×Sk8	0.006	8.427*	4.6611	1.0011*	-0.0440	0.011	-0.225	-0.615
LSD S_{ij} 0.05	1.17	7.77	5.80	0.80	0.74	0.11	0.55	1.70
0.01	1.50	10.23	7.64	1.06	0.98	0.15	0.72	2.36
LSD S_{ij}-S_{kl} 0.05	1.66	10.99	8.21	1.14	1.05	0.16	0.77	2.54
0.01	2.18	14.47	10.81	1.50	1.38	0.21	1.02	3.35

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

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القدرة على الائتلاف لبعض السلالات الجديدة من الذرة الشامية البيضاء للمحصول وبعض الصفات الاخرى

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تم تهجين ١٩ سلالة بيضاء الحبوب ناتجة فى الجيل الخامس الذاتى مع اثنين من الكشافات بمحطة البحوث الزراعية بسخا موسم ٢٠١٤. تم تقييم الـ ٣٨ هجين الناتجة بمحطتى البحوث الزراعية سخا وملوى موسم ٢٠١٥ وتم اخذ ثمانية صفات وهى عدد الايام حتى ظهور ٥٠% حريرة وارتفاع النبات وارتفاع الكوز ومحصول الحبوب (طن/هكتار) وطول الكوز وقطر الكوز وعدد السطور/كوز وعدد الحبوب/سطر. أظهرت التباينات الراجعة الى السلالات والكشافات والتفاعل بينهما معنوية عالية لمعظم الصفات. بينما التباينات الراجعة للتفاعل بين السلالات والكشافات والمواقع كانت غير معنوية لمعظم الصفات. اظهر الهجين القمي سخا ٩/٥٠٠٢ × سخا١٣ اعلي محصول (١٤.٥ طن /هكتار) مقارنة بالهجين الفردى ١٢٨ (١٣.٢ طن /هكتار) كذلك يوجد ١٣ هجين قمى زادت زيادة معنوية فى المحصول عن هجين المقارنة هجين فردى ١٠ (١١ طن /هكتار). هذه الهجن هامة ويمكن ان تستخدم فى برنامج التربية فى المستقبل. أظهرت السلالات سخا ٢/٥٠٠١ وسخا ٩/٥٠٠٢ وسخا٢ ١٠/٥٠٠ وسخا٢ ١١/٥٠٠ وسخا ٣ ١٥/٥٠٠ قدرة ائتلافية خاصة عالية لصفة المحصول. وعلى العموم يمكن استخدام هذه الهجن والسلالات المتميزة فى برنامج الذرة الشامية فى المستقبل.