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COMPARISON BETWEEN TWO TYPES OF TESTERS FOR EVALUATING NEW WHITE INBRED LINES OF MAIZE.

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ABCTRACT

New white twenty-seven inbred lines of maize were top crossed to the two testers i.e. homozygous inbred line Gm-4 and heterozygous promising single cross Sakha-1 during the 2002 season at Sakha Experimental Station. The resulting 54 top crosses and the two checks SC10 and TWC 324 were evaluated during the 2003 season at two locations, Sakha and Mallawy. The studied traits were silking date, plant and ear heights, grain yield, ear length, ear diameter, number of rows/ear, number of kernels/row and 100 kernel weight. Combining ability analysis was computed via line x tester procedure as proposed by Kempthorne (1957). The results of the present study combined over two locations could be summarized as follows:

The mean squares of locations were highly significant for all traits except number of rows/ear.

Significant mean squares due to lines, testers and lines x testers interaction were detected for all studied traits except testers for number of kernels/row. A lines x locations interaction was significant for all traits except number of rows/ear and 100 kernel weight. While testers x locations and lines x testers x locations interactions were not significant for most traits.

The non-additive type of gene action were important in controlling the behavior of silking date, plant height, grain yield, ear length, number of kernels/row and 100 kernel weight. While the additive type of gene action played the major contribution in the inheritance of ear height, ear diameter and number of rows/ear. The non-additive types of gene action were more sensitive to environmental differences than additive types of gene action for most traits.

Top crosses involving heterozygous SC Sk-1 as a common tester showed the highest means for all traits and the widest range for all traits except plant height compared with top crosses involving homozygous inbred line Gm-4 as a common tester. Consequently, the heterozygous SC Sk-1 was the best tester for evaluating the inbred lines in top crosses.

The parental inbred lines that revealed the best desirable GCA effects were Sk-5016/12 for silking date Sk-5016/9 for plant height, Sk-Y-17 for ear height, Sk-5016/14 for grain yield, Sk-5014/3 for ear length, Sk-5015/4 for ear diameter, Sk-Y-13 for number of rows/ear, Sk-Y-11 for number of kernels/row and Sk-5016/8 for 100 kernel weight. Again, the heterozygous SC Sk-1 as tester was the best general combiner for grain yield, ear length, number of rows/ear, number of kernels/row and 100 kernel weight. While the homozygous inbred line Gm-4 as tester was the best combiner for silking date, plant and ear heights and ear diameter.

The mean performance of top crosses for grain yield of the single crosses Sk-5015/7 x Gm-4 was 34.38 Ard/Fad, Sk-5017/19 x Gm-4 was 34.75 Ard/Fad, Sk-5015/4 x Gm-4 was 32.98 Ard/Fad and Sk-5016/14 x Gm-4 was 32.82 Ard/Fad and three way crosses Sk-N-2 x SC Sk-1 was 35.37 Ard/Fad, Sk-5016/8 x SC Sk-1 was 34.01 Ard/Fad, Sk-5016/14 x SC Sk-1 was 33.99 Ard/Fad, Sk-N-1 x SC Sk-1 33.93 was Ard/Fad and Sk-5016/12 x SC Sk-1 was 33.37 Ard/Fad were superior for grain yield compared with two checks SC10 was 32.68 Ard/Fad and TWC 324 was 32.59 Ard/Fad, respectively. These results suggest use of these crosses as good crosses in maize breeding programs.

INTRODUCTION

The national maize breeding program in Egypt is adopting a new policy to cover all the area devoted to high- yielding maize cultivars with single and three way cross hybrids in the next few years. Hybrids are developed by crossing two or more inbred lines (Allard, 1960). The evaluation of new inbred lines can be accomplished through top cross test. However, the effectiveness of this test depends mainly upon the type of tester to be used in the evaluation program, Grogan and Zuber (1957), El-Ghawas (1963), Sokolov and Kostyuchenco (1978), Sedhom (1992) and Mosa (2001) indicated the superiority of maize heterozygous single cross as tester for the evaluation of inbred line. On the other hand, Rawlings and Thompson (1962), Darrah and Hallauer (1972), Horner *et al.*, (1973), Liakat and Tepora (1986), Mahmoud (1996), Al-Naggar *et al.*, (1997) and Mosa *et al.*, (2004) indicated the importance of using maize homozygous inbred line as tester in the evaluation process. Thus, the objectives of the present study were:

1- Compare the efficiency of homozygous and heterozygous testers for evaluating the homozygous inbred lines.
2- To estimates combining ability for some new inbred lines.
3- Identify superior top crosses to improve the yielding ability in maize breeding program.

MATERIALS AND METHODS

New twenty-seven white maize inbred lines(developed at Sakha Agricultural Research Station) were top crossed to each of two testers i.e. inbred line Gm-4 and promising single cross Sakha-1 in 2002 growing season at Sakha Station. In 2003 growing season, the resulting 54 top crosses and the two commercial checks i.e. S.C10 and TWC 324 were evaluated at Sakha and Mallawy Experimental Stations. A randomized complete block design with 4 replications was used. The experimental unit was one row, 6m long and 80cm apart. Planting was in hills 25cm distance. All cultural practices were applied as usual. Data were taken on silking date (number of days from planting to 50% emergence silking), Plant and ear heights (cm), grain yield Ard/Fad adjusted based on shelling percent at 15.5% moisture content, ear length cm, ear diameter cm, number of rows/ear, number of kernels/row and 100 kernel weight (g). Before calculating the combined analysis, test of homogeneity of error mean squares for the two locations was done as outline by Snedecor and Cochran (1980). When differences among top crosses were found significant, line x tester analysis according to Kempthorne (1957) was done for each location and combined over the two locations.

RESULTS AND DISCUSSION

Mean performance of top crosses for all the studied traits are presented in Table 1. The best top crosses were Sk-5016/12 x SC Sk-1 for earliness, Sk-5016/9 x Gm-4 for short plant height, Sk-Y-17 x Gm-4 for short ear height, Sk-5014/3 x SC Sk-1 for ear length, Sk-5015/4 x Gm-4 for ear diameter, Sk-Y-13 x SC Sk-1 for number of rows/ear, Sk-Y-11 x SC Sk-1 for number of kernels/row and Sk-5016/8 x SC Sk-1 for 100 kernels weight. The mean performance of top crosses for grain yield of the single cross Sk-5015/7 x Gm-4 was 34.38 Ard/Fad, Sk-5017/19 x Gm-4 was 34.75 Ard/Fad, Sk-5015/4 x Gm-4 was 32.98 Ard/Fad and Sk-5016/14 x Gm-4 was 32.82 Ard/Fad and three way crosses Sk-N-2 x SC Sk-1 (35.37 Ard/Fad), Sk-5016/8 x SCSk-1 (34.01Ard/Fad), Sk-5016/14 x SC Sk-1 (33.99 Ard/Fad), Sk-N-1 x SCSk-1 (33.93 Ard/Fad)and Sk-5016/12 x SCSk-1 (33.37 Ard/Fad) were superior for grain yield compared with the two checks SC10 was 32.68 Ard/Fad and TWC 324 was 32.59 Ard/Fad. These results suggest the use of these crosses as good hybrids in maize breeding programs. Means and ranges of nine traits for tester crosses sets in combined over the two locations are presented in Table 2. Top crosses involving promising SCSk-1 as a common tester showed the highest means for all traits. Moreover, top crosses involved inbred lines x tester SCSk-1 showed the widest ranges for all traits except plant height. Also the tester SCSk-1 was capable to best the mean of the top cross for all traits except plant and ear heights and ear diameter.Thus, the best tester for evaluating the inbred lines in top crosses for all traits was the heterozygous single cross Sakha-1.These results are in harmony with those of Allison and Curnow (1966) defined the best tester as one that is capable of giving higher maximum grain yield of its top cross hybrids, and Moentono (1989) stated that an efficient tester is a tester that is capable of showing a greater range of variability of top cross hybrids performance. Such tester would give most precise and accurate classification among entries for a given amount of testing.

Analysis of variance of top crosses for nine traits of maize over the two locations are presented in Table 3. The mean squares of locations (Loc) were highly significant for all traits except number of rows/ear, indicating over all differences between two locations. Data shown in table 4, exhibited that the mean values of plant and ear height, grain yield, ear length, number of kernels/row and 100 kernel weight at Sakha location were higher than Mallawy location while the reverse were obtained for silking date, ear diameter and number of rows/ear. Amer *et al.*, (2002), Kedlubiec *et al.*, (2003) and Mosa *et al.*, (2004) found that significant differences among locations for growth, yield and yield components. Regarding to Table 3,the mean squares due to lines (L), testers (T) and (L x T) interaction were highly significant for all traits except (T) for number of kernels/row. This indicates that the inbred lines behaved significantly different in their respective top crosses. Also, greater diversity among the two testers for evaluation the inbred lines. While, significant (L x T) interaction suggesting that inbred line may perform differently in yielding crosses depending on the type of tester used. These results are in agreement with conclusions reached by, Ashish and Singh (2002), Dodiya *et al.*, (2002), El-Shenawy (2003) and Duarte *et al.*, (2003). The mean square due to (Lx Loc) interaction was significant for all traits except number of rows/ear and 100 kernel weight. While the mean squares for (T x Loc) and (L x T x Loc) interactions were not significant for all traits except (T x Loc) interaction for silking date and ear diameter and (L x T x Loc) interaction for grain yield, ear length and ear diameter.

The estimates of the variance due to general combining ability GCA, specific combining ability SCA and their interaction with locations are shown in Table 5.Results indicated that σ^2SCA was the dominant and the important component for silking date, plant height, grain yield, ear length, number of kernels/row and 100 kernel weight. Consequently, the non-additive type of gene action was important in controlling the behavior of these traits. These results are in agreement with those obtained by Nawar and El-Hosary (1984) for silking date and plant height, Mosa (2001) for grain yield, Abd-Alla (1995) for 100 kernel weight and El-Kielany (1999) for ear length and number of kernels. While the σ^2 GCA or the additive types of gene action played the major contribution in the inheritance of ear height, ear diameter and number of rows/ear. Similar results were reported by Nawar and El-Hosary (1984) for ear diameter and number of rows/ear, El-Shenawy (2003) for ear height. The magnitude of the interactions for σ^2 SCA x locations were markedly higher than those of σ^2 GCA x locations for plant height, grain yield, ear length, ear diameter and number of rows/ear. While it was vice versa for silking date, ear height, number of kernels/row and 100 kernel weight. Meaning that the non-additive genetic variance was more sensitive to environmental differences than additive genetic variance for plant height, grain yield, ear length, ear diameter and number of rows/ear and it was the opposite for silking date, ear height, number of kernels and 100 kernel weight. The same conclusion was reached by Nawar and El-Hosary (1984), Mahmoud (1996), El-Kielany (1999), El-Shenawy (2003) and Mosa *et al.*, (2004).

Estimates of general combining ability effects for twenty-seven inbred lines and two testers over the two locations are presented in Table 6. The GCA effects, for silking date ranged from –3.213 for the line Sk-5016/12 to 2.787 for the line Sk-N-2, with the eight desirable values negative significant, for plant height ranged from –24.312 for the line Sk-5016/9 to 24.125 for the line Sk-5017/19, with the nine desirable values negative significant, for ear height ranged from –21.231 for the line Sk-Y-17 to 16.268 for the line Sk-5016/14, with the nine desirable values negative significant, for grain yield ranged from –2.863 for the line Sk-5016/16 to 4.136 for the line Sk-5016/14, with the six desirable values positive significant, for ear length ranged from –2.52 for the line Sk-5015/4 to 2.166 for the line Sk-5014/3, with the ten desirable values positive significant, for ear diameter ranged from –0.292 for the line Sk-5015/4 to 0.209 for the line Sk-5016/8, with the seven desirable values negative significant, for number of rows/ear ranged from –0.944 for the line Sk-5014/1 to 1.555 for the line Sk-Y-13, with the eight desirable values positive significant, for number of kernels/row ranged from –3.303 for the line Sk-5016/9 to 4.259 for the line Sk-Y-11, with the five desirable values positive significant, for 100 kernel weight ranged from –4.613 for the line Sk-5015/4 to 4.199 for the line Sk-5016/8, with the three desirable values positive significant. On the other hand, the heterozygous SC Sk-1 as tester was the best general combiner for grain yield, ear length, number of rows/ear,number of kernels/row and 100 kernel weight. While the homozygous inbred line Gm-4 as tester was the best combiner for silking date, plant and ear heights and ear diameter. The superiority of the heterozygous crosses as desirable tester were noticed by Grogan and Zuber (1957), El-Ghawas (1963) and Sokolov and Kostyuchence (1978) and Mosa (2001). The superiority of homozygous inbred line as good tester was noticed by several investigators among them Liakat and Teparo (1986), Al-Naggar *et al.*, (1997) and Mosa *et al.*, (2004)

Estimates of specific combining ability effects of the top crosses for nine traits over the two locations are presented in Table 7. The significant desirable SCA effect was detected for the inbred lines; Sk-5015/4, Sk-5015/7, Sk-5016/11, and Sk-5016/15 with the tester Gm-4, line Sk-Y-17 with the tester SC Sk-1 for silking date, Sk-5014/1, Sk-5016/15 and Sk-N-1 with the tester Gm-4, Sk-5016/14, Sk-5017/19 and Sk-5018/22 with the tester SC Sk-1 for plant height, Sk-5014/1 and Sk-5018/21 with the tester Gm-4, Sk-5017/19 with the tester SC Sk-1 for ear height, Sk-5015/4, Sk-5015/6, Sk-5015/7 and Sk-5017/19 with the tester Gm-4,Sk-5016/13 and Sk-N-2 with the tester SC Sk-1 for grain yield, Sk-5015/4, Sk-5015/7 and Sk-5017/19 with the tester Gm-4 for ear length, Sk-5014/3 and Sk-5016/9 with the tester Gm-4,Sk-5015/6, Sk-5015/7 and Sk-5016/11 with the tester SC Sk-1 for ear diameter, Sk-5015/4 and Sk-5016/8 with the tester Gm-4, Sk-Y-11 with the tester SC Sk-1 for number of rows/ear, Sk-5015/4 and Sk-5015/7 with the tester Gm-4 for number of kernels/row and Sk-5014/1 with the tester SC Sk-1. This may suggests use of these top crosses in maize breeding program to produce inbred lines.

Table (1): Mean performance of 54 top crosses between 27 inbred lines and each of two testers for nine traits of maize over two locations.

Top cross	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard /Fad	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels /row	100 kernel weight
Sk-5014/1xGm-4	60.00	234.0	127.62	25.33	22.20	4.78	11.50	42.55	40.58
Sk-5014/1xSCSk-1	59.37	257.25	143.87	29.07	24.07	5.16	12.95	45.65	51.28
Sk-5014/2xGm-4	61.12	241.62	134.5	25.95	22.30	4.86	11.60	46.77	42.41
Sk-5014/2xSCSk-1	61.37	249.25	143.25	28.98	23.55	5.22	13.20	46.07	46.75
Sk-5014/3xGm-4	60.25	256.5	137.75	28.19	23.85	4.86	11.87	48.0	42.35
Sk-5014/3xSCSk-1	60.50	265.75	146.37	32.18	25.10	5.38	13.55	47.22	48.96
Sk-5015/4xGm-4	61.25	248.37	134.87	32.98	20.62	4.76	12.65	44.35	39.82
Sk-5015/4xSCSk-1	64.62	240.62	137.0	20.50	18.67	4.82	12.75	38.75	37.93
Sk-5015/6xGm-4	60.50	239.37	128.70	29.70	22.15	5.27	13.70	45.57	42.11
Sk-5015/6xSCSk-1	60.75	241.0	128.87	25.75	23.05	5.22	13.57	42.95	42.87
Sk-5015/7xGm-4	61.37	264.75	139.25	34.38	22.70	5.15	13.45	46.12	44.0
Sk-5015/7xSCSk-1	64.00	256.62	141.5	23.24	20.80	5.12	14.05	41.60	40.87
Sk-5016/8xGm-4	62.87	268.62	147.37	30.38	21.82	5.35	13.35	43.17	44.31
Sk-5016/8xSCSk-1	62.37	273.75	157.75	34.01	23.25	5.46	13.20	44.15	51.72
Sk-5016/9xGm-4	60.62	229.37	124.25	27.98	19.50	4.95	12.25	40.40	44.20
Sk-5016/9xSCSk-1	61.12	238.87	130.37	29.53	20.57	5.42	13.85	42.22	43.07
Sk-5016/10xGm-4	60.5	262.75	143.37	27.76	23.20	5.02	12.05	44.90	45.37
Sk-5016/10xSCSk-1	59.87	262.5	143.25	29.0	24.22	5.30	13.35	45.32	42.17
Sk-5016/11xGm-4	60.5	241.5	135.75	29.72	20.80	5.12	12.30	42.80	43.81
Sk-5016/11xSCSk-1	62.5	258.87	149.75	28.53	21.10	5.28	13.10	42.67	42.56
Sk-5016/12xGm-4	58.0	243.37	136.87	29.52	22.12	5.15	13.45	46.02	39.70
Sk-5016/12xSCSk-1	57.87	242.62	136.5	33.37	21.97	5.48	14.80	43.87	45.17
Sk-5016/13xGm-4	62.12	267.37	151.37	25.24	21.0	4.91	12.15	42.62	42.95
Sk-5016/13xSCSk-1	61.75	278.87	158.75	31.49	22.57	5.28	13.45	45.47	44.88
Sk-5016/14xGm-4	61.37	273.12	160.12	32.82	20.70	4.90	12.95	41.85	40.72
Sk-5016/14xSCSk-1	61.37	256.57	157.37	33.99	22.40	5.35	12.95	44.97	47.91
Sk-5016/15xGm-4	59.62	239.5	134.37	28.48	21.17	4.90	12.20	43.90	41.76
Sk-5016/15xSCSk-1	61.87	261.25	145.0	31.59	22.22	5.31	13.45	44.0	44.68
Sk-5016/16xGm-4	62.00	264.62	150.5	25.66	21.45	4.92	11.85	41.65	43.90
Sk-5016/16xSCSk-1	62.62	277.37	154.75	27.40	22.35	5.26	13.30	45.52	46.17
Sk-5016/17xGm-4	61.00	259.87	142.0	27.53	20.67	4.98	13.30	42.15	38.90
Sk-5016/17xSCSk-1	61.37	261.25	150.12	30.27	22.35	5.36	14.60	44.70	38.96
Sk-5017/18xGm-4	62.25	270.0	142.0	27.96	21.0	4.90	12.20	42.25	42.02
Sk-5017/18xSCSk-1	63.25	271.12	150.5	28.29	21.37	5.15	13.32	42.17	45.23
Sk-5017/19xGm-4	61.0	290.62	157.37	34.75	23.40	5.02	12.45	44.60	41.78
Sk-5017/19xSCSk-1	61.25	274.50	152.5	25.55	22.70	5.20	12.65	45.60	49.13
Sk-5018/20xGm-4	60.37	252.37	135.25	26.52	20.70	5.17	12.90	43.25	40.96
Sk-5018/20xSCSk-1	60.25	255.12	139.12	27.92	22.05	5.35	13.05	46.02	44.50
Sk-5018/21xGm-4	61.50	258.87	134.12	29.58	22.77	5.01	12.20	46.80	41.78
Sk-5018/21xSCSk-1	62.50	279.25	150.12	31.25	23.17	5.38	13.0	45.75	45.85
Sk-5018/22xGm-4	58.87	268.12	141.0	30.22	22.32	5.17	12.55	45.25	47.18
Sk-5018/22xSCSk-1	59.0	254.87	144.37	30.59	23.47	5.32	13.20	44.30	45.91
Sk-Y-11xGm-4	59.62	257.0	133.0	24.58	23.50	4.90	12.05	48.22	43.26
Sk-Y-11xSCSk-1	59.62	264.0	136.12	28.71	24.22	5.22	13.95	49.30	45.75
Sk-Y-13xGm-4	59.87	253.50	133.5	30.63	21.85	5.41	13.85	46.70	41.21
Sk-Y-13xSCSk-1	60.12	265.62	142.0	31.87	21.87	5.48	15.35	44.92	42.28
Sk-Y-17xGm-4	59.62	238.62	118.87	30.24	22.02	5.30	13.55	44.0	40.27
Sk-Y-17xSCSk-1	58.50	241.37	123.62	30.38	21.62	5.26	14.35	44.90	42.90
Sk-N-1xGm-4	64.0	263.37	146.62	29.72	23.0	4.93	12.02	46.5	46.92
Sk-N-1xSCSk-1	63.0	288.37	160.13	33.93	23.95	5.27	12.80	45.62	43.65
Sk-N-2xGm-4	63.75	257.62	146.62	27.21	22.40	4.96	13.0	44.42	40.85
Sk-N-2xSCSk-1	64.12	275.62	153.87	35.37	23.72	5.35	14.5	49.22	41.86
Sk-N-4xGm-4	62.0	259.25	151.75	27.94	21.57	5.08	13.6	43.15	42.40
Sk-N-4xSCSk-1	61.12	258.87	148.25	28.13	22.40	5.28	13.8	44.65	39.57
Checla S.C.10	63.00	278.25	157.75	32.68	21.92	5.51	13.20	47.20	47.28
TWC-324	63.87	287.87	157.37	32.59	22.50	5.42	13.20	46.60	45.81
L.S.D. 0.05	1.07	11.18	7.26	2.90	1.11	0.21	0.87	3.49	4.55
0.01	1.41	14.72	9.56	3.81	1.47	0.28	1.15	4.60	5.99

Table (2): Means and ranges of nine traits of maize for tester crosses sets in combind over the two locations.

Tester	Estimate	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard/Fad	Ear length (cm)	Ear diameter (cm)	No. of rows/ ear	No. of kernels /row	100 kernel weight
Gm-4	Mean of top crosses	60.96	255.7	139.60	28.92	21.90	5.02	12.63	44.37	42.43
	Range	5.75	61.25	35.87	10.17	4.35	0.65	2.35	6.57	8.28
	Best top cross	58.00	229.37	118.87	34.75	23.85	4.76	13.85	48.22	47.18
S.C.Sk-1	Mean of top crosses	62.37	261.44	145.37	29.30	22.55	5.29	13.56	44.73	44.54
	Range	6.75	49.5	36.5	14.87	6.43	0.66	2.7	7.70	12.76
	Best top cross	57.87	238.87	123.62	35.37	25.10	4.82	15.35	49.3	51.72

Table (3): Analysis of variance for nine traits of maize over the two locations.

S.O.V.	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard/Fad	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels /row	100 kernel weight (gm)
Locations (loc)	2635.39**	214980.94**	127102.08**	12917.37**	308.39**	34.56**	4.32	1251.20**	6344.16**
Rep/Loc	54.61	4096.56	1185.37	169.82	8.02	0.29	1.21	27.46	71.28
Crosses C	19.15**	1538.48**	788.77**	74.20**	13.04**	0.31**	5.74**	35.98**	70.99**
Lines L	33.68**	2477.96**	1337.90**	56.44**	20.38**	0.28**	6.54**	48.36**	69.69**
Testers T	15.18**	3217.68**	3616.89**	58.6*	50.70**	4.28**	94.45**	12.33	481.33**
L x T	4.77**	534.41**	130.87**	92.49**	4.26**	0.17**	1.53**	24.50**	56.51**
C x Loc	1.64*	171.19*	100.83**	30.42**	2.35**	0.2**	0.91	19.06*	23.37
L x Loc	2.080*	212.06*	172.67**	41.56**	2.57**	0.18**	0.96	27.92**	27.14
T x Loc	8.00*	14.44	85.33	0.93	3.0	2.22**	0.92	19.16	13.0
L x T x Loc	0.95	136.34	29.58	20.42*	2.12**	0.16**	0.90	10.18	20.00
Error	1.2	130.30	55.0	8.76	1.30	0.05	0.60	12.74	21.58
C.V. %	1.79	4.41	5.22	10.10	5.15	4.65	5.93	8.01	10.68

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

Table (4): Mean for nine traits at Sakha and Mallawy locations.

Location	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard/ Fad	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels /row	100 kernel weight
Sakha	58.68	280.74	159.63	34.78	23.06	4.96	13.0	46.24	47.37
Mallawy	63.62	236.13	125.32	23.81	21.35	5.49	13.14	42.86	39.72
Mean over locations	61.15	258.43	142.47	29.29	22.20	5.22	13.07	44.55	43.54
L.S.D. 0.05	1.73	15.02	8.08	3.05	0.66	0.12	0.25	1.23	1.98
0.01	2.63	22.78	12.25	4.63	1.01	0.19	0.39	1.86	3.01

Table (5): Estimates values of the variance due to general combining ability GCA, specific combining ability SCA and their interaction with locations.

Genetic parameters	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard/Fad	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels /row	100 kernel weight
σ^2 GCA	0.134	20.14	19.37	-0.30	0.263	0.009	0.42	-0.064	1.88
σ^2 SCA	0.470	49.75	12.66	9.00	0.267	0.001	0.061	1.79	4.56
σ^2 GCA/ σ^2SCA	0.285	0.40	1.52	9.00	0.98	7.2	6.85	1.79	0.41
σ^2 GCA x Loc	0.070	-0.39	1.71	0.014	0.011	0.017	-0.001	0.230	0.001
σ^2 SCA x Loc	-0.062	1.51	-6.35	2.91	0.20	0.027	0.06	-0.64	-0.395
σ^2 GCA x Loc/ σ^2 SCA x Loc	0.07	1.51	1.71	0.004	0.05	0.618	0.06	0.23	0.001

Table (6): Estimates of general combining ability effects for twenty seven inbred lines and two testers over two locations.

Line	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard /Fad	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No.of kernels /row	100 kernel weight
Sk-5014/1	-1.463	-12.812**	-6.731**	-1.988**	0.979**	-0.291**	-0.944**	-0.428	2.636*
Sk-5014/2	0.099	-13.0**	-3.606	-1.863*	0.729**	-0.104*	-0.631**	1.884*	1.074
Sk-5014/3	-0.775**	2.687	-0.419	0.949	2.166**	-0.166**	-0.444*	3.071**	2.199
Sk-5015/4	1.787**	-13.937**	-6.544**	-2.550**	-2.52**	-0.292**	-0.381*	-2.928**	-4.613**
Sk-5015/6	-0.525	-18.25**	-13.669**	-1.675*	0.291	0.020	0.680**	-0.24	-1.050
Sk-5015/7	1.537**	2.25	-2.106	-0.550	-0.395	-0.041	0.618**	-0.678	-1.113
Sk-5016/8	1.474**	12.75**	10.081**	2.949**	0.229	0.209**	0.243	-0.928	4.199**
Sk-5016/9	-0.275	-24.312**	-15.169**	-0.488	-2.333**	0.020	-0.069	-3.303**	0.074
Sk-5016/10	-0.963**	4.187	0.831	-0.925	1.604**	0.083	-0.319	0.509	0.324
Sk-5016/11	0.349	-8.25**	0.268	-0.238	-1.270**	0.020	-0.444*	-1.74*	-0.238
Sk-5016/12	-3.213**	-15.437**	-5.794**	2.136**	-0.083	0.145**	1.055**	0.384	-0.988
Sk-5016/13	0.787**	14.687**	12.581**	-0.863	-0.520	-0.041	-0.256	-0.428	0.449
Sk-5016/14	0.224	6.562*	16.268**	4.136**	-0.645*	-0.041	-0.131	-1.115	0.824
Sk-5016/15	-0.400	-8.062**	-2.794	0.824	-0.520	-0.104*	-0.194	-0.553	-0.175
Sk-5016/16	1.162**	12.562**	10.143**	-2.863**	-0.458	-0.041	-0.506*	-1.053	1.511
Sk-5016/17	0.037	2.125	3.581	-0.363	-0.645*	0.020	0.868**	-1.115	-4.425**
Sk-5017/18	1.599**	12.125**	3.768*	-1.175	-1.083**	-0.041	-0.381*	-2.428**	0.261
Sk-5017/19	-0.025	24.125**	12.456**	0.886	0.979**	-0.104*	-0.694**	0.509	2.011
Sk-5018/20	-0.838**	-4.687	-5.294*	-2.113*	-0.770**	0.083	-0.28	0.071	-0.738
Sk-5018/21	0.849**	10.625**	-0.356	1.074	0.791**	0.145**	-0.569*	1.821*	0.199
Sk-5018/22	-2.213**	3.062	0.206	1.136	0.791**	0.208**	-0.256	0.196	3.074**
Sk-Y-11	-1.525**	2.062	-7.919**	-2.613**	1.541**	-0.041	-0.069	4.259**	1.011
Sk-Y-13	-1.15**	1.125	-4.731*	1.949**	-0.395	0.208**	1.555**	1.259	-1.738
Sk-Y-17	-2.088**	-18.437**	-21.231**	0.949	-0.395	0.145**	0.930**	-0.178	-1.988
Sk-N-1	2.349**	17.437**	10.893**	2.511**	1.229**	0.020	-0.631**	1.509	1.699
Sk-N-2	2.787**	8.187*	7.768**	2.011**	0.916*	0.083	0.618**	2.259*	-2.050
Sk-N-4	0.412	0.625	7.518**	-1.238	-0.208	-0.104*	0.618**	-0.615	-2.425*
Tester Gm-4	-0.19**	-2.729**	-2.893**	-0.39*	-0.342**	-0.099**	-0.467**	-0.169	-1.055**
Tester SC Sk-1	0.19**	2.729**	2.893**	0.39*	0.342**	0.099**	0.467**	0.169	1.055**
L.S.D g_L 0.05	0.53	5.59	3.63	1.45	0.55	0.10	0.37	1.74	2.27
0.01	0.70	7.36	4.78	1.90	0.73	0.14	0.49	2.30	2.99
L.S.D g_T 0.05	0.14	1.52	0.98	0.39	0.15	0.02	0.10	0.47	0.61
0.01	0.19	2.00	1.30	0.51	0.2	0.03	0.13	0.62	0.81

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

Table (7): Estimates of specific combining ability effects of top crosses for nine traits over th e two locations.

Top cross	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard /Fad	Ear length (cm)	Ear diamete r (cm)	No. of rows /ear	No. of kernels /row	100 kernel weight
Sk-5014/1xGm-4	0.500	-8.895	-5.231	-1.692	-0.719	-0.087	-0.282	-1.331	-4.506
Sk-5014/1xSCSk-1	-0.500	8.895	5.231	1.692	0.719	0.087	0.282	1.331	4.506
Sk-5014/2xGm-4	0.062	-1.083	-1.481	-1.192	-0.469	-0.025	-0.344	0.606	-1.069
Sk-5014/2xSCSk-1	-0.062	1.083	1.481	1.192	0.469	0.025	0.344	-0.606	1.069
Sk-5014/3xGm-4	0.062	-1.895	-1.418	-1.754	-0.282	-0.212	-0.407	0.543	-2.194
Sk-5014/3xSCSk-1	-0.062	1.895	1.418	1.754	0.282	0.212	0.407	-0.543	2.194
Sk-5015/4xGm-4	-1.50	6.604	1.831	6.495	1.405	0.037	0.53	2.918	1.993
Sk-5015/4xSCSk-1	1.50	-6.604	-1.831	-6.495	-1.405	-0.037	-0.53	-2.918	-1.993
Sk-5015/6xGm-4	0.062	1.916	2.831	2.495	-0.032	0.224	0.467	1.606	0.555
Sk-5015/6xSCSk-1	-0.062	-1.916	-2.831	-2.495	0.032	-0.224	-0.467	-1.606	-0.555
Sk-5015/7xGm-4	-1.125	6.791	1.768	5.870	1.28	0.162	0.155	2.418	2.743
Sk-5015/7xSCSk-1	1.125	-6.791	-1.768	-5.87	-1.28	-0.162	-0.155	-2.418	-2.743
Sk-5016/8xGm-4	0.437	0.166	-2.293	-1.504	-0.344	0.037	0.530	-0.206	-2.444
Sk-5016/8xSCSk-1	-0.437	-0.166	2.293	1.504	0.344	-0.037	-0.53	0.206	2.444
Sk-5016/9xGm-4	-0.062	-2.020	-0.168	-0.317	-0.157	-0.150	-0.282	-0.581	1.680
Sk-5016/9xSCSk-1	0.062	2.020	0.168	0.317	0.157	0.150	0.282	0.581	-1.680
Sk-5016/10xGm-4	0.500	2.854	2.956	-0.129	-0.219	-0.087	-0.157	-0.018	2.680
Sk-5016/10xSCSk-1	-0.500	-2.854	-2.956	0.129	0.219	0.087	0.157	0.018	-2.680
Sk-5016/11xGm-4	-0.812	-5.958	-4.106	1.057	0.155	0.224	0.0925	0.231	1.618
Sk-5016/11xSCSk-1	0.812	5.958	4.106	-1.057	-0.155	-0.224	-0.0925	-0.231	-1.618
Sk-5016/12xGm-4	0.250	3.104	3.081	-1.567	0.467	-0.025	-0.157	1.356	-1.756
Sk-5016/12xSCSk-1	-0.250	-3.104	-3.081	1.567	-0.467	0.025	0.157	-1.356	1.756
Sk-5016/13xGm-4	0.375	-3.020	-0.793	-2.692	-0.344	0.037	-0.219	-1.331	0.055
Sk-5016/13xSCSk-1	-0.375	3.020	0.793	2.692	0.344	-0.037	0.219	1.331	-0.055
Sk-5016/14xGm-4	0.187	10.854	4.268	-0.192	-0.469	-0.087	0.405	-1.393	-2.444
Sk-5016/14xSCSk-1	-0.187	-10.854	-4.268	0.192	0.469	0.087	-0.405	1.393	2.444
Sk-5016/15xGm-4	-0.937	-8.145	-2.418	-1.129	-0.219	-0.025	-0.157	0.168	-0.319
Sk-5016/15xSCSk-1	0.937	8.145	2.418	1.129	0.219	0.025	0.157	-0.168	0.319
Sk-5016/16xGm-4	-0.125	-3.645	0.768	-0.442	-0.157	-0.087	-0.219	-1.706	-0.131
Sk-5016/16xSCSk-1	0.125	3.645	-0.768	0.442	0.157	0.087	0.219	1.706	0.131
Sk-5016/17xGm-4	-0.001	2.041	-1.168	-1.067	-0.594	-0.025	-0.219	-1.143	0.930
Sk-5016/17xSCSk-1	0.001	-2.041	1.168	1.067	0.594	0.025	0.219	1.143	-0.930
Sk-5017/18xGm-4	-0.312	2.166	-1.356	0.245	0.092	0.037	-0.094	0.168	-0.506
Sk-5017/18xSCSk-1	0.312	-2.166	1.356	-0.245	-0.092	-0.037	0.094	-0.168	0.506
Sk-5017/19xGm-4	0.0625	10.791	5.331	4.932	0.780	0.099	0.342	-0.268	-2.631
Sk-5017/19xSCSk-1	-0.0625	-10.791	-5.331	-4.932	-0.780	-0.099	-0.342	0.268	2.631
Sk-5018/20xGm-4	0.250	1.354	0.956	-0.317	-0.344	0.037	0.280	-1.206	-0.631
Sk-5018/20xSCSk-1	-0.250	-1.354	-0.956	0.317	0.344	-0.037	-0.280	1.206	0.631
Sk-5018/21xGm-4	-0.312	-7.458	-5.106	-0.379	0.092	-0.025	0.092	0.668	-0.944
[illegible]018/21xSCSk-1	0.312	7.458	5.106	0.379	-0.092	0.025	-0.092	-0.668	0.944
[illegible]018/22xGm-4	0.125	9.354	1.260	0.182	-0.282	0.037	0.155	0.543	1.680
[illegible]8/22xSCSk-1	-0.125	-9.354	-1.260	-0.182	0.282	-0.037	-0.155	-0.543	-1.680
[illegible]41xGm-4	0.187	-0.770	1.331	-1.692	0.092	-0.087	-0.532	-0.393	-0.131
[illegible]41xSCSk-1	-0.187	0.770	-1.331	1.692	-0.092	0.087	0.532	0.393	0.131
[illegible]Gm-4	0.062	-3.333	-1.356	-0.254	0.280	0.037	-0.157	0.981	0.493
[illegible]CSk-1	-0.062	3.333	1.356	0.254	-0.280	-0.037	0.157	-0.981	-0.493
[illegible]Gm-4	0.750	1.354	0.518	0.120	0.530	0.099	-0.032	-0.331	-0.381
[illegible]SCSk-1	-0.75	-1.354	-0.518	-0.120	-0.530	-0.099	0.032	0.331	0.381
[illegible]xGm-4	0.687	-9.77	-3.856	-1.692	-0.219	-0.025	0.155	0.731	2.680
[illegible]xSCSk-1	-0.687	9.77	3.856	1.692	0.219	0.025	-0.155	-0.731	-2.680
[illegible]Gm-4	-0.001	-6.270	-0.731	-3.692	-0.157	-0.087	-0.344	-2.393	0.555
[illegible]SCSk-1	0.001	6.270	0.731	3.692	0.157	0.087	0.344	2.393	-0.555
[illegible]Gm-4	0.625	2.916	4.643	0.307	-0.157	-0.025	0.405	-0.643	2.430
[illegible]SCSk-1	-0.625	-2.916	-4.643	-0.307	0.157	0.025	-0.405	0.643	-2.430
LSD S_{ij} 0.05	0.75	7.91	5.10	2.05	0.78	0.15	0.53	2.41	3.21
0.01	0.99	10.41	6.76	2.69	1.04	0.20	0.70	3.25	4.23

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

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المقارنة بين اثنين من الكشافات لتقييم سلالات بيضاء جديدة من الذرة الشامية

حاتم الحمادى موسى
مركز البحوث الزراعية – معهد المحاصيل الحقلية– قسم بحوث الذرة الشامية

استخدم في هذا البحث٢٧ سلاله بيضاء جديدة من الذرة الشامية تم تهجينها مع اثنين من الكشافات هي سلالة جميزة-٤ و هـ.ف مبشر سخا-١ وذلك بمحطة البحوث الزراعية بسخا عام ٢٠٠٢. قيمت الهجن القمية الناتجة (٥٤) مع اثنين من الأصناف التجارية هـ.ف ١٠ ،هـ.ث ٣٢٤ وذلك في محطات بحوث سخا و ملاوى عام ٢٠٠٣ تم التحليل الوراثي للقدرة علي الائتلاف باستخدام تصميم (السلالة× الكشاف) طبقا لما اقترحة Kempthorne (1957) لصفات تاريخ ظهور ٥٠% من النورات المؤنثة، ارتفاع النبات والكوز، محصول الحبوب، طول الكوز، قطر الكوز، عدد الصفوف بالكوز، عدد الحبوب بالصف و وزن ١٠٠ حبة. يمكن تلخيص أهم النتائج للتحليل المشترك للموقعين فيما يلي:-

- كانت الاختلافات بين الموقعين عالية المعنوية لجميع الصفات المدروسة عدا صفة عدد الصفوف بالكوز.

- كان تباين السلالات والكشافات وتفاعلهما معنويا في جميع الصفات ما عدا تباين الكشافات لصفة عدد الحبوب بالصف. تفاعل السلالات x المواقع معنويا في جميع الصفات ما عدا صفة عدد الصفوف بالكوز و وزن ١٠٠ حبة بينما تفاعل كل من السلالات x الكشافات x المواقع غير معنويا في معظم الصفات.
- كان التباين الوراثي غير المضيف اكثر أهمية في وراثة صفات تاريخ ظهور ٥٠ % من النورات المؤنثة، ارتفاع النبات، محصول الحبوب ، طول الكوز، عدد الحبوب بالصف و وزن ١٠٠ حبة بينما التباين الوراثي المضيف هو الاكثر اهمية في وراثة ارتفاع الكوز، قطر الكوز وعدد الصفوف بالكوز كذلك كان التباين الوراثي غير المضيف اكثر تأثرا بالبيئة لمعظم الصفات.
- كان للكشاف الخليط وراثيا هجين فردى سخا-١ القدرة علي تعظيم متوسط جميع الصفات للهجن القمية الداخل فيها كما اظهر مدى اوسع بين الهجن القمية المختبرة لجميع الصفات ما عدا صفة ارتفاع النبات مقارنة بالكشاف الأصيل وراثيا سلالة جميزة-٤ بما يجعلنا نقترح أفضلية هذا الكشاف الخليط وراثيا عن الكشاف الأصيل وراثيا.
- أفضل السلالات في القدرة علي الائتلاف كانت السلالة سخا ٥٠١٦/ ١٢ لصفة تاريخ ظهور ٥٠% من النورات المؤنثة،سخا٥٠١٦/٩ لصفة ارتفاع النبات، سخا – ى ١٧ لصفة ارتفاع الكوز، سخا-٥٠١٦/١٤المحصول الحبوب، سخا ٥٠١٤/٣ لطول الكوز،سخا ٥٠١٥/٤ لقطر الكوز، سخا – ى ١٣ لعدد الصفوف في الكوز، سخا – ى١١ لعدد الحبوب بالصف و سخا ٥٠١٦/٨ لصفة وزن ١٠٠ حبة، كذلك أظهر الكشاف الخليط وراثيا هجين فردى سخا -١ أفضل قدرة علي الائتلاف لصفات محصول الحبوب، طول الكوز، عدد الصفوف بالكوز، عدد الحبوب بالصف و وزن ١٠٠ حبة. بينما الكشاف الاصيل وراثيا سلالة جميزة-٤ هو الأفضل في القدرة علي الائتلاف لصفات تاريخ ظهور ٥٠% من النورات المؤنثة، ارتفاع النبات و الكوز و قطر الكوز.
- أظهرت متوسطات الهجن القمية لصفة محصول الحبوب ان: الهجن الفردية التالية سخا ٥٠١٥/x٧ جميزة-٤ (٣٤,٣٨ اردب/فدان) ، سخا ٥٠١٧/١٩ x جميزة-٤ (٣٤,٧٥ اردب /فدان) ، سخا ٥٠١٥/٤ x جميزة-٤ (٣٢,٩٨ اردب/فدان) و سخا ٥٠١٦/٤ x جميزة-٤(٣٢,٨٢ اردب/فدان) و كذلك الهجن الثلاثية التالية سخا-ن-٢ x هـ.ف سخا-١(٣٥,٣٧ اردب /فدان) ، سخا ٥٠١٦/٨ x هـ.ف سخا-١ (٣٤,٠١ اردب/فدان) ، سخا ٥٠١٦/١٤ x هـ.ف سخا-١ (٣٣,٩٩ اردب/فدان) ، سخا- ن-١ x هـ.ف سخا-١ (٣٣,٩٣ اردب/فدان) و سخا ٥٠١٦/١٢ x هـ.ف سخا-١ (٣٣,٣٧ اردب/فدان) تتفوق فى محصولها عن هجينى المقارنة هـ.ف ١٠ (٣٢,٦٨ اردب /فدان) وهـ.ث ٣٢٤ (٣٢,٥٩ اردب/فدان) ولذلك يمكن استخدام هذة الهجن الفردية والثلاثية فى برنامج التربية كهجن عالية المحصول.