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Combining Ability and Heterotic Groups of New White Maize Inbred Lines

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ABSTRACT: A field experiment was conducted during two seasons. In 2022 summer season, sixteen new white maize inbred lines were crossed with three testers using (Line x Tester) method. The result for 48 F_1 crosses plus two standard check were evaluated in 2023 summer season at three Research Stations, Sakha, Gemmiza and Mallawi. The recorded data were days to 50% silking, plant height (cm), ear height (cm) and grain yield (ard/fad). Mean squares due to locations (Loc), lines (L), testers (T), (L × T), (L × Loc), (T x Loc) and (L × T × Loc) interactions were significant, except Loc for grain yield and (L × T × Loc) for plant height. Single crosses (Sk.5009/40 × Sd.7), (Sk.5009/41 × Sd.7) and (Sk.5009/42 × Sd.7) were significantly outyielded the check. Five inbred lines (Sk.5009/40), (Sk.5009/41), (Sk.5009/42), (Sk.5009/43) and (Sk.5009/44) showed desirable General Combining Ability (GCA) effects for grain yield. Also, inbred lines (Sk.5006/34) and (Sk.5006/35) showed desirable GCA effects for earliness, plant height and ear height. Ten crosses showed positive Specific Combining Ability (SCA) for grain yield. The cross (Sk.5009/42xSd.7) showed desirable SCA effects for all traits. The tested inbred lines based on heterotic groups were classified to three heterotic groups. Group-1 (Tester Sd.7) included inbred lines (Sk.5006/34), (Sk.5006/36), (Sk.5006/38), (Sk.5009/45), (Sk.5010/47), (Sk.5010/48) and (Sk.5010/49) while group-2 (Tester Sd.63) included only inbred lines (Sk.5006/35). Group-3 (Tester Sc.131) included (Sk.5006/37), (Sk.5008/39), (Sk.5009/43) and (Sk.5009/46). These groups help breeder to choose best parents to create superior crosses.

Keywords: *Maize, Zea mays, Line x tester, General combining ability, Specific combining ability.*

INTRODUCTION

In hybrid maize breeding programs, information on genetic diversity and heterotic group is very useful in inbred line development and evaluation for planning crosses for hybrid cultivar development. The classification of elite germplasm and inbred lines into different heterotic groups is an important task in any breeding program (**Hallauer *et al.* 1998**). In Egypt, efforts are being made to develop hybrids with high yield potential to increase production of maize. Most efficient use of such materials would be possible only when adequate information on the amount and type of genetic variation and combining ability effects in the materials is available. Combining ability analysis is useful to assess the potential inbred lines and superior hybrids, which is dissected in two parts general combining ability (GCA) and specific combining ability (SCA). Both GCA and SCA variances have been determined and related to the possible types of gene action involved. GCA is a good estimate of additive gene action, whereas SCA is a measure of non-additive gene action (**Sharief *et al.* 2009**). Identification of high yielding hybrid needs development and careful selection of parents based on their combining ability and genetic structure (**Ceyhan 2003, Hallauer and Miranda 1988 and Karim *et al.* 2018**). Additionally, information on combining abilities can be used to classify inbred lines into distinct heterotic groups. Heterotic groups comprise related or unrelated genotypes that exhibit similar combining ability effects when crossed with genotypes from other germplasm groups (**Warburton *et al.* 2002**). This classification is pivotal for effective hybrid breeding programs, as it enables breeders to strategically select parental lines from specific heterotic groups to maximize heterosis and develop hybrids with superior performance (**Akinwale 2021**). The parents having contrasting but complementary heterotic groups are essential in hybrid maize breeding (**Reif *et al.* 2003 and Xingming *et al.* 2009**). This assigning of maize genotypes into heterotic groups is helpful to exploit heterosis or hybrid vigor (**Flint *et al.* 2009**), particularly for grain yield and other attributes (**Osorno and Carena 2008**). Line X tester mating scheme is an effective method to estimate general (GCA) and specific (SCA), combining ability effects and recognizing the appropriate parents (**Kamara *et al.* 2021**). The objectives of this study were to estimate combining ability, determine the heterotic groups for inbred lines and identify the superior hybrids.

MATERIALS AND METHODS

Sixteen new white maize inbred lines *i.e.* Sk.5006/34, Sk.5006/35, Sk.5006/36, Sk.5006/37, Sk.5006/38, Sk.5008/39, Sk.5009/40, Sk.5009/41, Sk.5009/42, Sk.5009/43, Sk.5009/44, Sk.5009/45, Sk.5009/46, Sk.5010/47, Sk.5010/48 and Sk.5010/49 were obtained from different genetic sources at Sakha Agricultural Research Station. These inbred lines were crossed with three testers; Sd.7, Sd.63 and Sc.131 during 2022 summer season. In 2023, thirty-two single crosses (Sc.), sixteen three-way crosses (Twc.) and two checks i.e. Sc.2031 and Twc.321 were evaluated at Sakha, Gemmiza and Mallawi Agricultural Research Stations. Randomized complete block design (RCBD) with three replications was used. The plot size was one row, 6m long, 80 cm apart and 25 cm between hills. All agricultural recommended practices were applied in the proper time. The data were recorded on; days to 50% silking, plant height (cm), ear height (cm) and grain yield (ardab/faddan) which was adjusted to 15.5% grain moisture (one ardab (ard) =140 kg and one feddan (fed) =4200 m^2).Combined analysis was done across three locations, after homogeneity test according to **Siendecor and Cochran (1989)** using computer application of Statistical Analysis System (**SAS, 2008**). Line × tester analysis was applied as described by **Kempthorne (1957)**. The comparative importance of GCA and SCA was computed by the procedure of **Baker (1978)** which was modified by **Hung and Holland (2012):** $2K^2$ GCA/ ($2K^2$ GCA + K^2 SCA). Grouping to test inbred lines to heterotic groups was carried out using specific and general combining ability (HSGCA) method according to **Fan *et al.* (2009)**.

RESULTS AND DISCUSSION

Combined analysis of variance for days to 50% silking, plant height, ear height and grain yield across the three locations is presented in Table (1). Highly significant differences were detected between the three locations (Loc.) for days to 50% silking, plant height and ear height, indicating that these traits were affected by changing locations. Mean squares due to hybrids (H) and their interactions with locations (H × Loc)were highly significant for all studied traits. Traits indicating that hybrids differed in their genetic background and greatly affected by changing locations.

Table(1). Combined analysis of variance for days to 50% silking, plant height, ear height and grain yield across the three locations.

S.O.V	d.f	Days to 50% silking	Plant height	Ear height	Grain yield
Location (Loc)	2	961.5**	191515.8**	100467.7**	5.2 ns
Rep/Loc	6	4.2	1794.0	641.4	40.1
Hybrids (H)	49	15.5**	407.0**	124.0**	77.2**
Loc×H	98	2.8**	274.5**	85.7**	22.2**
Error	294	1.3	60.0	37.9	8.3

**** Significantly differences of variance at the 0.01 level of probability.**
NS: Insignificant variances f differences.

Line × tester analysis for days to 50% silking, plant height, ear height and grain yield across the three locations is presented in Table (2). Mean squares due to lines (L), testers (T), (L × T) interactions were significant and highly significant for all traits, indicating the presence of wide diversity among inbred lines and among testers for these traits and that inbred lines differed in their performance when crossed with the two testers. Mean squares due to (L × Loc),(T x Loc) and (L × T × Loc) interactions were significant and highly significant for all traits, except (L × T × Loc) for plant height. These results are in agreement with those reported by **Singh *et al.* (2017) and Motawei *et al.* (2019).** Results also showed that GSR ratio were 0.85 and 0.92 for days to 50% silking and plant height, respectively. So, the additive gene effects were more important than non-additive gene effects in the inheritance of these traits and selection is a good tool to improve these traits. Meanwhile, GSR ratios for ear height was 0.51 indicating that, additive or non-additive gene effects had equal role in the inheritance of this trait. While GSR was 0.4 for grain yield, meaning that non-additive gene effects were more important than additive gene effects in controlling this trait. These results in agreement with **Motawei *et al.* (2019) and Galal *et al.* (2025).**

Table (2). Mean squares of line x tester analysis of 48 hybrids for days to 50% silking, plant height, ear height and grain yield across the three locations.

S.O.V	d.f	Days to 50% silking	Plant height	Ear height	Grain yield
Line (L)	15	17.3**	577.8**	220.1**	153.7**
Tester (T)	2	164.0**	2881.3**	198.1**	54.3**
Line × Tester (L x T)	30	4.6**	93.0*	72.2**	38.8**
L × Loc	30	3.3**	472.5**	138.6**	28.8**
T × Loc	4	8.2**	1410.2**	132.8**	133.8**
L ×T × Loc	60	2.3**	73.5	59.0**	11.9*
Error	282	1.3	60.7	38.0	8.4
$2K^2$ GCA/$2K^2$ GCA+K^2 SCA (GSR)		0.85	0.92	0.51	0.40

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

Mean performances of 48 hybrids as well as the two checks for days to 50% silking, plant height, ear height and grain yield across the three locations are presented in Table (3). For days to 50% silking, single crosses ranged from 62.8 days for single cross (Sk.5006/35 X Sd.63) to 67.1 days for single cross (Sk.5009/42 X Sd.63) with 17 single crosses were significantly earlier than the check hybrid Sc.2031. The best hybrids of them were (Sk.5006/35 X Sd. 63) followed by (Sk.5006/34 X Sd. 63) and (Sk.5009/43 X Sd. 7). Meanwhile, new three-way crosses ranged from 61.8 days for the three-way cross (Sk.5006/35 × Sc.131) to 64.8 days for the three-way cross (Sk.5009/41 × Sc.131). Most of three-way crosses were significantly earlier than the check Twc. 321, the best three-way crosses of them were (Sk.5006/35 × Sc.131) followed by (Sk.5006/34 × Sc.131) and (Sk.5010/48 × Sc.131). For plant height, single crosses ranged from 240.0 cm for (Sk.5010/47 X Sd. 63) to 266.4 cm for (Sk.5010/48 X Sd. 7), with 29 single crosses were significantly shorter than the check hybrid Sc.2031. Three-way crosses ranged from 242.6 cm (Sk.5006/34 × Sc.131) to 257.9 cm for (Sk.5010/48 × Sc.131), with eight three way crosses were significantly shorter than the check Twc. 321, the shortest of them were (Sk.5006/34 × Sc.131) and (Sk.5006/38 × Sc.131). As for ear height, single crosses ranged from 126.8 cm for (Sk.5006/38 × Sd. 63) to 141.9 cm for (Sk.5009/44 × Sd.63), with nine single crosses showed significantly lower ear position than the check Sc. 2031. While three-way crosses ranged from 127.4 cm for (Sk.5006/34 × Sc.131) to 139.3 cm for (Sk.5010/48 × Sc.131), four three-way crosses showed significantly lower ear position than the check Twc. 321, grain yield of single crosses ranged from 25.5 (ard/fed) for (Sk.5010/47 x Sd.7) to 38.5 (ard/fed) for (Sk.5009/40 x Sd.7), with three single crosses *i.e.* (Sk. 5009/40 x Sd.7) followed by (Sk.5009/42 x Sd.7) and (Sk.5009/41 x Sd.7) significantly out yielded the check Sc. 2031. While three-way crosses ranged from 25.7 (ard/fed) for (Sk.5006/37 x Sc.131) to 34.7 (ard/fed) for (Sk.5009/40 x Sc.131). Six three-way crosses were not significantly different for grain yield from the check Twc. 321, the best crosses of them were (Sk.5009/40 x Sc.131) and (Sk.5010/49 x Sc.131).

General combining ability effects of 16 inbred lines and three testers for days to 50% silking, plant height, ear height and grain yield across the three locations are presented in Table (4). Three inbred lines (Sk.5006/34), (Sk.5006/35), (Sk.5009/43) and one tester (Sc.131) exhibited desirable values (negative and significant) of GCA effects for earliness. For plant height, five inbred lines (Sk.5006/34), (Sk.5006/35), (Sk.5006/36), (Sk.5006/38) and (Sk.5010/47) and two testers (Sd.63) and (Sc.131) showed desirable values (negative and significant) of GCA effects for shorter plant height. For ear height, four inbred lines (Sk.5006/34), (Sk.5006/35), (Sk.5006/38) and (Sk.5009/45) exhibited desirable GCA effects for lower ear position. Meanwhile five inbred lines (Sk.5009/40), (Sk.5009/41), (Sk.5009/42), (Sk.5009/43, Sk.5009/44) and one tester (Sd.7) showed desirable GCA effects (positive and significant) for high grain yield. These inbreds could be utilized in maize improvement programs.

Table (3). Mean performance of 32 new single crosses, 16 new three way crosses and two checks for days to 50% silking, plant height, ear height and grain yield across the three locations.

Hybrid	Days to 50% silking	Plant height (cm)	Ear height (cm)	Grain yield (ard/fed)
Sk.5006/34 × Sd.7	64.2	249.0	129.2	28.0
Sk.5006/34 × Sd.63	63.0	241.6	127.9	27.1
Sk.5006/34 × Sc.131	62.0	242.6	127.4	30.4
Sk.5006/35 × Sd.7	64.1	257.0	133.1	29.7
Sk.5006/35 × Sd.63	62.8	245.6	129.9	26.5
Sk.5006/35 × Sc.131	61.8	243.8	128.9	31.2
Sk.5006/36 × Sd.7	65.6	251.3	134.2	28.3
Sk.5006/36 × Sd.63	65.9	246.1	129.0	28.0
Sk.5006/36 × Sc.131	62.8	246.2	131.2	30.0
Sk.5006/37 × Sd.7	65.9	261.3	138.7	30.9
Sk.5006/37 × Sd.63	65.2	251.8	134.2	28.5
Sk.5006/37 × Sc.131	64.0	246.1	130.2	25.7
Sk.5006/38 × Sd.7	66.7	261.2	136.2	26.8
Sk.5006/38 × Sd.63	65.1	241.7	126.8	28.9
Sk.5006/38 × Sc.131	63.0	243.7	128.4	31.0
Sk.5008/39 × Sd.7	66.1	260.3	133.1	31.4
Sk.5008/39 × Sd.63	65.0	255.7	133.6	32.3
Sk.5008/39 × Sc.131	64.3	254.1	133.3	29.9
Sk.5009/40 × Sd.7	65.6	259.6	132.7	38.5
Sk.5009/40 × Sd.63	66.1	247.8	127.8	34.5
Sk.5009/40 × Sc.131	63.4	252.4	133.1	34.7
Sk.5009/41 × Sd.7	66.9	255.8	131.6	36.7
Sk.5009/41 × Sd.63	65.3	253.3	132.1	33.6
Sk.5009/41 × Sc.131	64.8	253.0	130.1	31.4
Sk.5009/42× Sd.7	64.8	253.1	130.7	36.8
Sk.5009/42× Sd.63	67.1	257.8	137.3	31.3
Sk.5009/42× Sc.131	63.4	251.9	134.1	32.2
Sk.5009/43 × Sd.7	63.4	253.8	135.3	34.7
Sk.5009/43 × Sd.63	63.6	248.1	136.6	30.8
Sk.5009/43 × Sc.131	62.6	247.0	131.7	30.7
Sk.5009/44 × Sd.7	63.9	262.1	137.7	34.2
Sk.5009/44 × Sd.63	65.3	259.8	141.9	33.2
Sk.5009/44 × Sc.131	63.3	255.0	136.4	31.3
Sk.5009/45 × Sd.7	65.6	255.4	129.4	29.2
Sk.5009/45× Sd.63	64.1	250.7	132.3	30.1
Sk.5009/45× Sc.131	64.0	245.9	127.6	30.0
Sk.5009/46 × Sd.7	64.6	262.6	132.0	31.9
Sk.5009/46 × Sd.63	65.0	254.2	132.0	28.8
Sk.5009/46 × Sc.131	63.2	256.9	134.9	29.4
Sk.5010/47 × Sd.7	65.1	254.3	138.6	25.5
Sk.5010/47 × Sd.63	65.4	240.0	128.7	27.4
Sk.5010/47 × Sc.131	63.9	244.6	131.9	29.9
Sk.5010/48 × Sd.7	65.8	266.4	139.9	28.1
Sk.5010/48 × Sd.63	64.4	255.6	134.3	28.9
Sk.5010/48 × Sc.131	62.5	257.9	139.3	31.7
Sk.5010/49 × Sd.7	65.8	258.8	136.8	26.6
Sk.5010/49 × Sd.63	64.8	252.0	132.6	28.2
Sk.5010/49 × Sc.131	62.8	254.0	137.7	32.4
Check Sc.2031	66.3	269.1	137.1	34.0
Check Twc.321	65.2	258.4	135.7	34.0
$LSD._{0.05}$	1.1	7.2	5.7	2.6
$LSD._{0.01}$	1.4	9.4	7.5	3.5

Table (4). General combining ability effects of 16 inbred lines and three testers for studied traits across the three locations.

Inbred	Days to 50% silking	Plant height(cm)	Ear height(cm)	Grain yield (ard/fed)
Sk.5006/34	-1.38**	-8.10**	-4.78**	-2.05**
Sk.5006/35	-1.57**	-3.69*	-2.34*	-1.44**
Sk.5006/36	0.28	-4.58**	-1.48	-1.81**
Sk.5006/37	0.58**	0.60	1.41	-2.21**
Sk.5006/38	0.47*	-3.62*	-2.48*	-1.66**
Sk.5008/39	0.69**	4.23**	0.37	0.63
Sk.5009/40	0.58**	0.79	-1.78	5.32**
Sk.5009/41	1.21**	1.56	-1.71	3.31**
Sk.5009/42	0.65**	1.79	1.07	2.85**
Sk.5009/43	-1.27**	-2.84	1.55	1.50**
Sk.5009/44	-0.27	6.49**	5.70**	2.32**
Sk.5009/45	0.10	-1.81	-3.19**	-0.78
Sk.5009/46	-0.20	5.42**	0.01	-0.54
Sk.5010/47	0.36	-6.18**	0.07	-2.95**
Sk.5010/48	-0.20	7.49**	4.89**	-0.99
Sk.5010/49	-0.01	2.45	2.70*	-1.49**
Tester Sd.7	0.78**	5.16**	1.35**	0.51*
Tester Sd.63	0.43**	-2.38**	-0.66	-0.68**
Tester Sc.131	-1.22**	-2.78**	-0.69	0.17
LSD g_i L $_{0.05}$	0.43	2.94	2.33	1.09
LSD g_i L $_{0.01}$	0.57	3.87	3.06	1.44
LSD g_i T $_{0.05}$	0.19	1.27	1.01	0.47
LSD g_i T $_{0.01}$	0.25	1.68	1.33	0.62

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

Specific combining ability effects of the 48 crosses for all studied traits are presented in Table (5). For days to 50% silking, five crosses; (Sk.5009/42 **x** Sd.7), (Sk.5009/44 x Sd.7), (Sk.5009/41 x Sd.63), (Sk.5009/45 x Sd.63) and (Sk.5006/36 x Sc.131) exhibited desirable SCA effects for earliness. One cross; (Sk.5009/42 x Sd.7) exhibited desirable SCA effect for short plant height and ear height. Ten crosses (Sk.5006/37 x Sd.7), (Sk.5009/40 **x** Sd.7), (Sk.5009/41 **x** Sd.7), (Sk.5009/42 **x** Sd.7), (Sk.5009/43 **x** Sd.7), (Sk.5006/35 **x** Sc.131), (Sk.5006/38 **x** Sc.131), (Sk.5010/47 **x** Sc.131), (Sk.5010/48 **x** Sc.131) and (Sk.5010/49 **x** Sc.131) showed desirable SCA effect for high grain yield. From the above results, the cross (Sk.5009/42 **x** Sd.7) showed desirable SCA effects for all studied traits.

Table (5). Specific combining ability effects of 48crosses for days to 50% silking, plant height, ear height and grain yield across the three locations.

Inbred line	Days to 50% silking			Plant height			Ear height			Grain yield		
	Testers			Testers			Testers			Testers		
	Sd7	Sd63	SC 131	Sd7	Sd63	SC 131	Sd7	Sd63	SC 131	Sd7	Sd63	SC 131
Sk.5006/34	0.36	-0.50	0.14	-0.53	-0.44	0.97	-0.32	0.36	-0.05	-1.00	-0.74	1.74
Sk.5006/35	0.44	-0.54	0.10	3.06	-0.85	-2.22	1.13	-0.08	-1.05	0.03	-1.97*	1.94*
Sk.5006/36	0.03	0.72	-0.75*	-1.72	0.60	1.12	1.39	-1.82	0.44	-0.97	-0.12	1.09
Sk.5006/37	0.07	-0.25	0.18	3.10	1.08	-4.18	2.94	0.51	-3.45	2.03*	0.78	-2.81**
Sk.5006/38	0.96*	-0.25	-0.71	7.21**	-4.81	-2.40	4.39*	-3.04	-1.34	-2.60**	0.70	1.89*
Sk.5008/39	0.18	-0.58	0.40	-1.53	1.34	0.19	-1.58	0.88	0.69	-0.27	1.77	-1.50
Sk.5009/40	-0.27	0.64	-0.38	1.14	-3.11	1.97	0.13	-2.75	2.62	2.10*	-0.68	-1.42
Sk.5009/41	0.44	-0.76*	0.33	-3.42	1.67	1.75	-1.06	1.51	-0.45	2.25*	0.39	-2.64**
Sk.5009/42	-1.12**	1.57**	-0.45	-6.31*	5.89*	0.41	-4.72*	3.96	0.77	2.85**	-1.42	-1.43
Sk.5009/43	-0.53	-0.06	0.59	-1.01	0.86	0.16	-0.54	2.70	-2.16	2.12*	-0.54	-1.58
Sk.5009/44	-1.08**	0.72	0.36	-2.01	3.19	-1.18	-2.35	3.88	-1.53	0.78	0.99	-1.77
Sk.5009/45	0.22	-0.88*	0.66	-0.38	2.38	-1.99	-1.69	3.22	-1.53	-1.09	1.03	0.06
Sk.5009/46	-0.49	0.31	0.18	-0.49	-1.29	1.78	-2.32	-0.30	2.62	1.32	-0.57	-0.75
Sk.5010/47	-0.49	0.20	0.29	2.88	-3.92	1.04	4.16*	-3.71	-0.45	-2.64**	0.51	2.13*
Sk.5010/48	0.73	-0.25	-0.49	1.32	-2.03	0.71	0.68	-2.86	2.18	-1.95*	0.02	1.93*
Sk.5010/49	0.55	-0.10	-0.45	-1.31	-0.55	1.86	-0.24	-2.45	2.69	-2.97**	-0.16	3.12**
LSD $S_{ij0.05}$		0.74			5.09			4.03			1.89	
LSD $S_{ij0.01}$		0.98			6.70			5.30			2.49	

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

Estimates of heterotic groups using specific and general combining ability effects (HSGCA) method of 16 inbred lines for grain yield across three locations are presented in Table (6). According to **Fan *et al.* (2009),** heterotic group depended on specific and general combining ability effects (HSGCA), inbred lines were divided into groups as follows: Step-1 placed tested lines in the same heterotic groups as their testers. Step-2, the inbred line which has the smallest HSGCA effects values or the largest negative values will be included in this heterotic group and removed from others. Step-3, the inbred lines which have positive HSGCA effects with all testers, it means that these inbred could not be assigned to any tester group and need to be tested with other testers. Group-1 (tester Sd.7) included inbred lines Sk.5006/34, Sk.5006/36, Sk.5006/38, Sk.5009/45, Sk.5010/47, Sk.5010/48 and Sk.5010/49 while group-2 (tester Sd.63) included only inbred line Sk5006/35. Group-3 (tester Sc.131) included lines Sk.5006/37, Sk.5008/39, Sk.5009/43 and Sk.5009/46. However, the method was not able to classify the inbred lines Sk.5009/40, Sk.5009/41, Sk.5009/42 and Sk.5009/44. Heterotic group method could be recommend to breeders to select best parents to create crosses. **Lee (1995) and Mosa *et al.* (2016)** illustrated that the heterotic group is a collection of related inbred lines which results in vigorous hybrids when crossed with inbred lines from a different heterotic groups but not when crossed with inbred lines in the same heterotic group.**Mahato *et al.* (2021)**stated that, evaluation of large nomber of parental lines and their all possible cross combinations will be imprectical without identifying heterotic grouping.

Table (6). Estimates of heterotic groups using specific and general combining ability (HSGCA) method for 16 inbred lines of grain yield across the three locations.

Inbred line	Tester		
	Sd7	Sd63	SC131
Sk.5006/34	-3.05#	-2.79	-0.31
Sk.5006/35	-1.41	-3.41#	0.50
Sk.5006/36	-2.78#	-1.93	-0.72
Sk.5006/37	-0.18	-1.43	-5.02#
Sk.5006/38	-4.26#	-0.96	0.23
Sk.5008/39	0.36	2.40	-0.87#
Sk.5009/40	7.42	4.64	3.90
Sk.5009/41	5.56	3.70	0.67
Sk.5009/42	5.70	1.43	1.42
Sk.5009/43	3.62	0.96	-0.08#
Sk.5009/44	3.10	3.31	0.55
Sk.5009/45	-1.87#	0.25	-0.72
Sk.5009/46	0.78	-1.11	-1.29#
Sk.5010/47	-5.59#	-2.44	-0.82
Sk.5010/48	-2.94#	-0.97	0.94
Sk.5010/49	-4.46#	-1.65	1.63

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الملخص العربى

القدرة على الائتلاف والمجاميع الهجينية لسلالات ذرة شامية بيضاء جديدة

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تم تكوين 32 هجين فردى ابيض و16 هجين ثلاثى ابيض من التهجين بين 16 سلاله بيضاء جديدة من الذرة الشامية مع ثلاثة كشافات من خلال نظام السلالة x الكشاف. وتم تقيم الهجن الناتجة (48 هجين) بالإضافة الى اثنين من هجن المقارنة خلال موسم 2023 في ثلاث محطات بحثية هي محطة بحوث سخا ومحطة بحوث الجميزة ومحطة بحوث ملوى) . وتم حساب عدد الأيام حتى ظهور 50% من الحرائر للنورات المؤنثة وارتفاع النبات وارتفاع الكوز من سطح التربة ومحصول الحبوب . وقد اظهر تحليل التباين وجود معنوية للسلالات والكشافات و تفاعل السلالات مع الكشافات وأيضا تفاعلاتها مع البيئة لكل الصفات محل الدراسة ماعدا تفاعل الثلاثي بين البيئة والسلالات والكشافات لصفة ارتفاع النبات .وكان افضل الهجن المتفوقة معنويا عن هجن المقارنة (هـ ف 2031) لصفة المحصول هي (سخا 5009/40 x سدس7) و(سخا 5009/41 x سدس 7) و(سخا5009/42 x سدس 7) بينما لم يختلف الهجين ثلاثى (سخا5009/40 x هـ ف131) عن هجين المقارنة (هـ ث 321). وقد أظهرت الخمسة سلالات الجديدة (سخا 5009/40 و سخا 5009/41 و سخا 5009/42 وسخا 5009/43 سخا 5009/44) قدرة عامة على الائتلاف لمحصول الحبوب العالى كذلك أظهرت السلالات (سخا 5006/34 والسلالة سخا 5006/35) قدرة عامة على الائتلاف مرغوبة للتبكير وانخفاض إرتفاع النبات والكوز. وقد أظهرت 10 هجن قدرة خاصة على الائتلاف للمحصول العالى بينما أظهر الهجين (سخا 5009/42 x سدس 7) قدرة خاصة على الائتلاف مرغوبة لجميع صفات تحت الدراسة. وتم تقسيم السلالات لصفة المحصول تبعا لطريقة HSGCA الى ثلاث مجاميع مختلفة تساعد المربى لاختيار افضل الإباء لتكوين هجن متفوقة وهذة المجاميع هي :

1- المجموعة الأولى (سدس 7) ضمت سلالات سخا 5006/34 و سخا 5006/36 و سخا 5006/38 و سخا 5006/45 و سخا 5006/47 و سخا 5006/48 و سخا 5006/49
2- المجموعة الثانية (سدس 63) ضمت السلالة سخا 5006/35 .
3- المجموعة الثالثة (هـ ف 131) ضمت السلالات سخا 5006/37 و سخا 5006/39 و سخا 5006/43 و سخا 5006/46.