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Combining Ability of New Yellow Maize Inbred Lines and Superiority of their Hybrids to Check Cultivars

Cross Mark

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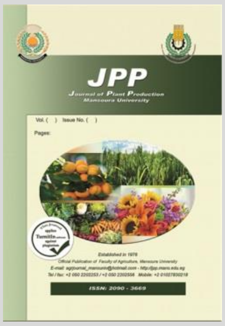

ABSTRACT

Twenty five new yellow maize inbred lines were top crossed with two testers, *i.e.* inbred lines; Sk11 and Gz658 during 2016 season at Sakha Agric. Res. Station of Agricultural Research center (ARC), Egypt. The resulting 50 crosses along with two commercial check hybrids (SC 162 and SC 168) were evaluated in yield trails using a randomized complete block design with four replications at Sakha and Mallawy Agric. Res. Stations (ARC) in 2017 growing season to study the combining ability of these new inbred lines and evaluated the superiority of crosses compered to commercial crosses. Mean squares due to hybrid (H), hybrid × location (H ×Loc.) were highly significant for days to 50% silking, ear position, number of ears/ plant and grain yield/ha. Also, mean squares due to line (L), tester (T) and their interaction (L × T) were significant for all studied traits except for L×T of ear position, number of ears/plant and grain yield. The best inbred line, that revealed desirable GCA effects were Sk5008/27 for earliness, Sk5010/57 for ear position, Sk5010/54 for No. of ears/plant, and Sk5008/31 for grain yield. The best hybrid superiority relative to checks was exhibited by Sk5007/27 × Sk11 for earliness, Sk5010/44 × Sk11 for ear position, Sk5010/58 × Sk11 for No. of ears/plant and Sk5008/31 × Gz658 for grain yield. The 25 inbred lines were classified into two different heterotic groups using HSGCA method for grain yield, group 1 (Sk11) included seven inbred lines and group 2 (Gz658) included seven inbred lines.

Keywords: Zea mays, Line × tester analysis, Heterotic group.

INTRODUCTION

Maize (*Zea mays* L.) is an important cereal crop in Egypt, which plays an important role in animal and human nutrition. It has assumed greater significance due to its demand for feed as forage crop, industrial utilization and food. Maize acreage and production have an increasing tendency with the introduction of hybrids due to its high yield potential. The nature and magnitude of gene action is an important factor in developing an effective breeding programme. Combining ability analysis is useful to assess the potential inbred lines and also helps to identify the nature of gene action involved in various quantitative traits. Liakcat and Teparo (1986), Mahgaub *et al*., (1996), Al-Nagger *et al*., (1997) and Mosa *et al*., (2007) mentioned that inbred lines tester can be effectively used for the evaluation of both general (GCA) and specific (SCA) combining ability. Fan *et al*., (2009) proposed the heterotic groups specific and general combining ability (HSGCA) method, as a combination of SCA and GCA effects to assign inbred lines into known heterotic group. This method has proved to be more reliable and effective than the use of SCA effects of yield and molecular markers. This information is helpful to plant breeders for formulating hybrid breeding program.

The objectives of this study were to determine general and specific combining ability effects, identify the best new single crosses in grain yield and classify the inbred lines into contrasting heterotic groups using the HSGCA method derived form line × tester analysis.

MATERIALS AND METHODS

The experiment was carried out in the summer seasons 2016 and 2017 at Sakha and Mallawy Agricultural Research Stations. In 2016 season, the two inbred lines Sk11 and Gz658 were used as testers and crossed with twenty-five female parents according to line x tester design to produce 50 F_1 crosses. The resulting 50 hybrids and two checks; SC162 and SC168 were evaluated at two locations; Sakha and Mallawy Agricultural Research Stations in 2017. The experimental design was a randomized complete block design with (RCBD) four replications. Each hybrid was grown in one row, 6 meter-long, 80 cm apart and 25 cm between hills and one plant were left per hill. Recorded data on; days to 50% silking (was recorded as the number of days from planting to 50% silking), ear position (was taken according ear placement to plant height as the percentage), number of ears/plant and grain yield per plot adjusted to 15.5% grain moisture content and transformed to tons per hectare (t/ha). Combined analysis across the two locations was done when homogeneity of error mean squares was detected for the trials according to Snedecor and Cochran (1967). The data for the combining ability analysis was done using line × tester procedure as suggested by Kempthorne (1957). The heterotic groups using specific and general combining abilities (HSGCA) were identified according to Fan *et al*., (2009).

RESULTS AND DISCUSSION

Results for variance for four studied traits across two locations are presented in Table 1. Mean squares due to locations (Loc.) were highly significant for all studied

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traits.This result indicated that the environmental conditions at the two locations were different for maize growing. These results are in agreement with Hassan et al. (2016) and Mosa et al., (2017). Mean squares due to hybrids (H) and hybrids × locations (H × loc.) were highly significant for all studied traits, indicating that these hybrids differed in their order from location to another for these traits. Similar results were reported by Aly (2013) and Abo El-Haress et al., (2016).

Table 1. Combined analysis of variance for four studied traits 0f 52 hybrids across two locations.

SOV	d.f	Days to 50% silking	Ear position%	Number of ears/plant	Grain yield (t/h)
Locations (Loc)	1	1235.79**	2846.11**	24808.22**	128.39**
Rep/Loc	6	10.06	41.46	189.69	0.803
Hybrids (H)	51	7.026**	14.233**	427.71**	4.202**
H×Loc	51	2.73**	18.834**	454.19**	2.899**
Error	306	1.12	3.95	90.93	1.03

****significant at 0.01 level of probability.**

Estimates of superiority for 50 hybrids relative to the checks SC 162 and SC 168 for four traits across two locations are presented in Table 2. The results revealed that 40 and 20 single crosses showed significant superior for days to 50% silking (earliness) over the two check hybrids SC162 and SC168, respectively. Also, 20 and 2 single crosses showed negative and significant superiority for ear position over the checks SC162 and SC168, respectively..

Table 2. Superiority percentage for 50 hybrids relative to two checks across two locations.

Hybrid	Days to 50% silking		Ear position%		Number of ears/plant		Grain yield (t/ha)	
	SC162	SC168	SC162	SC168	SC162	SC168	SC162	SC168
Sk5007/20 × Sk11	-3.40**	-2.03*	-2.93	2.24	13.27**	17.17**	-1.98	8.04
× Gz658	-2.20**	-0.81	-1.86	3.36	0.28	3.73	-0.20	9.99
Sk5007/22 × Sk11	-1.60	-0.20	-4.94**	0.12	8.66	12.40**	-1.54	8.51
× Gz658	-0.20	1.22	-1.81	3.41	2.35	5.88	2.37	12.83*
Sk5007/26 × Sk11	-6.00**	-4.67**	-2.38	2.81	-4.06	-0.75	-13.36**	-4.50
× Gz658	-5.40**	-4.06**	-2.11	3.10	-6.09	-2.86	-4.44	5.32
Sk5007/27 × Sk11	-6.60**	-5.27**	-7.03**	-2.09	4.71	8.32	-11.87**	-2.87
× Gz658	-5.40**	-4.06**	-3.28	1.86	0.07	3.51	-22.09**	-14.13*
Sk5008/29 × Sk11	-5.80**	-4.46**	-3.61*	1.51	19.11**	23.21**	2.80	13.30*
× Gz658	-1.20	0.20	-0.71	4.57**	-3.21	0.12	-0.09	10.12
Sk5008/30 × Sk11	-3.00**	-1.62	-5.48**	-0.45	2.36	5.88	-4.44	5.32
× Gz658	-2.60**	-1.22	-1.84	3.38	-4.59	-1.31	6.69	17.59*
Sk5008//31× Sk11	-4.40**	-3.04**	-4.58*	0.49	3.67	7.23	4.33	14.99*
× Gz658	-3.80**	-2.43**	-3.00	2.16	-0.33	3.10	13.64**	25.25**
Sk5008/33× Sk11	-2.80**	-1.42	-4.79**	0.27	2.01	5.52	-1.14	8.96
× Gz658	-2.60**	-1.22	-1.99	3.22	-5.67	-2.43	8.75	19.86**
Sk5009/34× Sk11	-5.40**	-4.06**	-4.13*	0.97	7.83	11.54*	-16.70**	-8.19
× Gz658	-3.80**	-2.43**	-0.31	4.99**	0.85	4.32	-17.73**	-9.33
Sk5009/35× Sk11	-5.00**	-3.65**	-2.84	2.32	11.84**	15.69**	-0.91	9.22
× Gz658	-3.20**	-1.83	-1.67	3.56	0.55	4.01	-2.89	7.04
Sk5009/37× Sk11	-5.40**	-4.06**	-0.01	5.31**	5.68	9.32**	-8.72	0.61
× Gz658	-4.20**	-2.84**	0.02	5.34**	-4.38	-1.09	-12.78**	-3.87
Sk5009/38× Sk11	-5.80**	-4.46**	-4.09*	1.01	-4.50	-1.21	-13.82**	-5.01
× Gz658	-3.80**	-2.43**	-1.38	3.86*	-3.53	-0.21	-6.09	3.50
Sk5009/39× Sk11	-1.60	-0.20	-2.15	3.05	10.94*	14.76**	-3.98	5.83
× Gz658	-2.40**	-1.01	-1.37	3.87*	-0.66	2.76	-1.54	8.51
Sk5009/40× Sk11	-4.40**	-3.04**	-1.64	3.59*	3.60	7.17	-0.93	9.19
× Gz658	-2.40**	-1.01	0.48	5.82**	-4.62	-1.34	-2.07	7.94
Sk5009/43× Sk11	-4.60**	-3.25**	-2.71	2.47	3.09	6.64	-3.73	6.11
× Gz658	-3.00**	-1.62	-0.39	4.90**	-3.84	-0.53	-10.76*	-1.65
Sk5010/44× Sk11	-3.20**	-1.83	-9.65**	- 4.85*	7.21	10.90*	-9.97	-0.77
× Gz658	-3.40**	-2.03	-3.29	1.85	-7.34	-4.15	-10.88*	-1.77
Sk5010/45 × Sk11	-3.00**	-1.62	-7.78**	-2.87	17.89**	21.95**	5.04	15.78**
× Gz658	-1.80	-0.41	-3.40	1.74	-1.11	2.29	12.86*	24.39**
Sk5010/46 × Sk11	-3.60**	-2.23**	-6.78**	-1.82	0.44	3.90	-9.72	-0.49
× Gz658	-1.60	-0.20	-3.48	1.66	0.60	4.06	-2.91	7.01
Sk5010/47× Sk11	-2.40**	-1.01	-7.38**	-2.46	2.54	6.07	-9.56	-0.32
× Gz658	-2.20**	-0.81	-4.21*	0.88	2.44	5.97	-6.45	3.11
Sk5010/51× Sk11	-3.00**	-1.62	-6.69**	-1.72	-0.02	3.43	-5.77	3.86
× Gz658	-3.20**	-1.83	-3.99*	1.11	-3.27	0.06	-1.51	8.56
Sk5010/54× Sk11	-4.20**	-2.84**	-3.40	1.73	15.09**	19.05**	-5.66	3.98
× Gz658	-1.20	0.20	-0.32	4.98**	5.59	9.22*	-8.16	1.22
Sk5010/55× Sk11	-0.60	0.81	-5.68**	-0.66	-3.47	-0.15	-14.68**	-5.97
× Gz658	-2.20**	-0.81	-1.67	3.56	-4.73	-1.45	-4.00	5.81
Sk5010/57× Sk11	-4.00**	-2.64**	-8.85**	-4.01*	2.57	6.10	-6.87	2.65
× Gz658	-3.00**	-1.62	-5.27**	-0.24	-6.20	-2.97	-3.51	6.35
Sk5010/58× Sk11	-3.00**	-1.62	-5.48**	-0.46	19.38**	23.48**	-1.51	8.56
× Gz658	-1.60	-0.20	-2.14	3.07	0.05	3.50	1.24	11.58
Sk5011/59× Sk11	-1.60	-0.20	-7.03**	-2.08	9.76*	13.53**	-10.05	-0.86
× Gz658	-2.00*	-0.61	-3.36	1.77	-0.84	2.57	3.24	13.79*
L.S.D.0.05	1.037		1.946		9.344		0.993	
0.01	1.365		2.562		12.3		1.307	

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

Meanwhile, 8 and 13 single crosses exhibited significant and positive superiority for number of ears/plant over the checks SC162 and SC168, respectively Also, 2 and 9 single crosses showed positive and significant superiority for grain yield over the checks SC162 and SC168, respectively. The best crosses from them were Sk5008/31×Gz658 and Sk5010/45×Gz658

The results for mean squares due to lines (L), testers (T), L × T and their interactions with locations (Loc.) for four traits across two locations are presented in Table 3. The results showed that mean squares due to L, T and L × T interaction were significant for all studied traits, except L × T for ear position, number of ears/plant and grain yield, indicating that the inbred lines behaved differently in their respective top crosses and that big diversity exists between testers. These results are in agreement with Amin *et al*., (2014), Mosa *et al*., (2017) and Abd El-Aty *et al*., (2018). Mean squares due to L x Loc. and T x Loc. were significant for all studied traits, except T × Loc for days to 50% silking. Meanwhile, mean squares due to L × T × Loc. Interaction was not significant for all studied traits. The results are in agreement with those reported by EL-Hosary (2014), Motawei *et al*., (2016) and Noelle *et al*., (2017).

Table 3. Line × tester analysis for four studied traits of 50 hybrids across two locations.

SOV	d.f	Days to 50% silking	Ear position%	Number of ears/plant	Grain yield t/ha
Lines (L)	24	10.073**	16.71**	366.58**	6.808**
Testers (T)	1	42.25**	238.162**	7967.79**	8.723**
L x T	24	2.51*	2.115	174.717	1.408
L x Loc	24	2.835*	18.831**	394.82**	2.632*
T x Loc	1	0.045	323.25**	8476.24**	24.88**
L x T x Loc	24	1.805	6.155	179.33	2.251
Error	294	1.109	4.020	92.98	1.022

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

Estimates of general combining ability effects of 25 inbred lines and two testers for four studied traits across two locations are presented in Table 4. A wide range of variability for general combining ability effects was observed among the inbred lines for different traits.

Table 4. General combining ability effects (GCA) of 25 inbred lines and two testers for four studied traits across two locations.

Inbred lines/testers	Days to 50% silking	Ear position %	Number of ears/ plants	Grain yield (t/ha)
Sk5007/20	0.285	0.606	4.886*	0.312
Sk5007/22	1.473**	0.063	3.519	0.460
Sk5007/26	-1.528**	0.688	-7.874**	-0.452
Sk5008/27	-1.715**	-0.924	0.162	-1.243**
Sk5008/29	-0.153	0.735	6.148*	0.552*
Sk5008/30	0.285	-0.095	-3.615	0.529**
Sk5008/31	-0.528*	-0.166	-0.616	1.299**
Sk5009/33	0.348	0.053	-4.385	0.792**
Sk5009/34	-0.840**	0.703	2.260	-1.267**
Sk5009/35	-0.528*	0.682	4.257	0.234
Sk5009/37	-0.965**	1.935**	-1.708	-0.633*
Sk5009/38	-0.965**	0.416	-6.733**	-0.555*
Sk5009/39	0.785**	0.956	3.125	0.149
Sk5009/40	-0.090	1.608**	-2.959	0.272
Sk5010/43	-0.340	1.073*	-2.816	-0.290
Sk5010/44	-0.028	-1.653**	-2.482	-0.602*
Sk5010/45	0.535*	-1.162**	6.622**	1.295**
Sk5010/46	0.410	-0.909	-1.851	-0.199
Sk5010/47	0.598*	-1.277*	0.272	-0.365
Sk5010/51	0.098	-1.025*	-4.181	0.063
Sk5010/54	0.348	0.901	8.721**	-0.257
Sk5010/55	1.160**	-0.104	-6.825**	-0.495*
Sk5010/57	-0.153	-1.980**	-4.365	-0.089
Sk5010/58	0.598*	-0.179	8.047**	0.406
Sk5011/59	0.910**	-0.946	2.387	0.086
Tester SK11	-0.325**	-0.772**	4.463**	-0.148*
Tester GZ658	0.325**	0.772**	-4.463**	0.148*
L.S.D g_i :(L) 0.05	0.516	0.982	4.724	0.495
0.01	0.679	1.293	6.219	0.652
L.S.D. g_i:(L)g_j 0.05	0.728	1.389	6.681	0.700
0.01	0.959	1.828	8.795	0.922
L.S.D. g_i:(T)g_i 0.05	0.145	0.277	1.336	0.140
0.01	0.192	0.365	1.759	0.184
L.S.D g_i- g_j 0.05	0.206	0.392	1.889	0.198
0.01	0.271	0.517	2.487	0.260

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

The favorable GCA effects for earliness were shown in the inbred lines Sk5007/26, Sk5008/2, Sk5008/3, Sk5009/34, Sk5009/35, Sk5009/37 and Sk5009/38. The inbred lines Sk5010/44, Sk5010/45, Sk5010/51 and Sk5010/57 had desirable GCA effects for ear position. Also, the inbred lines Sk5010/45, Sk5010/54 and Sk5010/58 gave desirable GCA effects for number of ears/plant. Meanwhile, the inbred lines Sk5008/29, Sk5008/30, Sk5008/31, Sk5009/33 and Sk5010/45 had desirable GCA effectsfor grain yield. Meanwhile, the good general combiner tester for GCA effects was Sk11 for days to 50% silking, ear position and number of ears/plant and Gz658 for grain yield.

Estimates of specific combining ability effects for four studied traits of 50 crosses across two locations are presented in Table 5. The best hybrids for SCA effects were Sk5008/29 × Sk11 and Sk5010/55 × Gz658 for days to 50% silking, Sk5010/44 × Gz658 for ear position SK5008/29× Sk11 for number of ears/plant and Sk5007/27 × Sk11 for grain yield. These new single crosses could be useful in maize breeding hybrids.

Table 5. Specific combining ability effects (SCA) of 50 top crosses for four studied traits across two locations.

crosses	Days to 50% silking	Ear position%	Number of ears/plant	Grain yield t/ha
Sk5007/20 × Sk11	-0.050	0.477	2.530	0.061
× Gz658	0.050	-0.477	-2.530	-0.061
Sk5007/22 × Sk11	-0.113	-0.095	-1.066	-0.044
× Gz658	0.113	0.095	1.066	0.044
Sk5007/26 × Sk11	0.138	0.695	-3.368	-0.289
× Gz658	-0.138	-0.695	3.368	0.289
Sk5007/27 × Sk11	-0.050	-0.267	-1.961	0.748*
× Gz658	0.050	0.267	1.961	-0.748*
Sk5008/29 × Sk11	-1.113**	-0.033	7.553*	0.289
× Gz658	1.113**	0.033	-7.553*	-0.289
Sk5008/30 × Sk11	0.200	-0.235	-0.720	-0.397
× Gz658	-0.200	0.235	0.720	0.397
Sk5008//31× Sk11	0.138	0.334	-2.311	-0.308
× Gz658	-0.138	-0.334	2.311	0.308
Sk5008/33× Sk11	0.263	-0.003	-0.326	-0.336
× Gz658	-0.263	0.003	0.326	0.336
Sk5009/34× Sk11	-0.175	-0.286	-0.706	0.198
× Gz658	0.175	0.286	0.706	-0.198
Sk5009/35× Sk11	-0.238	0.445	1.618	0.245
× Gz658	0.238	-0.445	-1.618	-0.245
Sk5009/37× Sk11	-0.050	0.764	0.954	0.346
× Gz658	0.050	-0.764	-0.954	-0.346
Sk5009/38× Sk11	-0.300	0.022	-4.986	-0.230
× Gz658	0.300	-0.022	4.986	0.230
Sk5009/39× Sk11	0.575	0.556	1.782	0.028
× Gz658	-0.575	-0.556	-1.782	-0.028
Sk5009/40× Sk11	-0.300	0.184	-0.038	0.203
× Gz658	0.300	-0.184	0.038	-0.203
Sk5009/43× Sk11	-0.175	0.131	-0.732	0.492
× Gz658	0.175	-0.131	0.732	-0.492
Sk5010/44× Sk11	0.388	-0.990	3.373	0.192
× Gz658	-0.388	0.990	-3.373	-0.192
Sk5010/45 × Sk11	-0.050	-0.440	5.766	-0.235
× Gz658	0.050	0.440	-5.766	0.235
Sk5010/46 × Sk11	-0.300	-0.143	-4.551	-0.185
× Gz658	0.300	0.143	4.551	0.185
Sk5010/47× Sk11	0.263	-0.107	-4.410	-0.005
× Gz658	-0.263	0.107	4.410	0.005
Sk5010/51× Sk11	0.388	0.026	-2.710	-0.061
× Gz658	-0.388	-0.026	2.710	0.061
Sk5010/54× Sk11	-0.613	-0.083	0.654	0.270
× Gz658	0.613	0.083	-0.654	-0.270
Sk5010/55× Sk11	0.825*	-0.337	-3.784	-0.375
× Gz658	-0.825*	0.337	3.784	0.375
Sk5010/57× Sk11	0.013	-0.219	0.258	-0.017
× Gz658	-0.013	0.219	-0.258	0.017
Sk5010/58× Sk11	-0.113	-0.155	5.939	0.013
× Gz658	0.113	0.155	-5.939	-0.013
Sk5011/59× Sk11	0.450	-0.242	1.243	-0.503
× Gz658	-0.450	0.242	-1.243	0.503
L.S.D. S_{ij} : 0. 05	0.729	1.389	6.681	0.700
0.01	0.960	1.828	8.795	0.922
L.S.D. S_{ij}: Sk_l 0.05	1.032	1.964	9.449	0.990
0.01	1.358	2.586	12.438	1.304

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

Estimates of heterotic groups using specific and general combining abilities (HSGCA) method for grain yield across two locations are presented in Table 6. According to Fan *et al.*, (2009), the inbred lines were divided into groups as the following;1) place all inbred lines (25) in the same heterotic group as their tester. 2) keep the inbred lines with the heterotic group, where it's HSGCA effects had the smallest value (or largest negative value) and remove it from other heterotic groups .3) if the inbred line had positive HSGCA effects with all testers, it will be cautious to assign that line to any heterotic group because the line might belong to a heterotic group different from the testers used in the investigation. Hence, for grain yield, there were two groups as follows. In the group 1 (tester Sk11): which contained seven inbred lines (Sk 5007/26, Sk5009/38, Sk5010/46, Sk5010/47, Sk5010/55, Sk5010/57 and Sk 5011/59). Group 2 (tester Gz658): which contained seven inbred lines (Sk 5008/27, Sk5009/34, Sk5009/35, Sk5009/37, Sk5010/43, Sk5010/44 and Sk 5010/54), meanwhile this method was not able to divide eleven inbred lines. These results could be used in breeding programs to identify the best for making crosses. A heterotic group is a collection of closely related inbred lines which tend to related in vigorous hybrids when crossed with inbred lines from a different heterotic group, but not when crossed to other lines of same group by (Lee, 1995). In selection followed by hybridization, GCA and SCA effects are important; because GCA effects impact are due to preponderance of genes with additive effects and SCA effects indicate predominance of gene with no additive effects (Kanga *et al*., 2004 and Abrha *et al*., 2013).

Table 6. Heterotic groups using specific and general combining ability (HSGCA) for grain yield across two locations.

Inbred lines	Testers	
	Sk11	**Gz 658**
Sk 5007/20	0.372	0.252
Sk5007/22	0.415	0.503
Sk5007/26	- 0. 74 #	- 0.166
Sk5008/27	0.596	- 1.89 #
Sk5008/29	0.839	0.263
Sk5008/30	0.132	0.926
Sk5008/31	0.991	1.605
Sk5009/33	0.455	1.127
Sk5009/34	-1.068	- 1.464 #
Sk5009/35	0.477	- 0.011 #
Sk5009/37	- 0.287	- 1.279 #
Sk5009/38	- 0.785 #	- 0.325
Sk5009/39	0.176	0.12
Sk5009/40	0.475	0.069
Sk5010/43	0.202	- 0.782 #
Sk5010/44	- 0.409	- 0.793 #
Sk5010/45	1.061	1.529
Sk5010/46	- 0.383 #	- 0.015
Sk5010/47	- 0.368 #	0.36
Sk5010/51	0.001	0.123
Sk5010/54	0.013	- 0.527 #
Sk5010/55	- 0.87 #	- 0.12
Sk5010/57	- 0.105 #	- 0.073
Sk5010/58	0.419	0.393
Sk5011/59	- 0.416 #	0.588

#means that this inbred line belongs to tester group.

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القدرة الإئتلافية لسلالات صفراء جديدة من الذرة الشامية وتفوق هجنها على أصناف المقارنة

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تم إجراء التهجينات بين 25 سلالة صفراء جديدة من الذرة الشامية مع إثنان من الكشافات (السلالة سخا 11 وجيزة 658) في موسم 2016 بمحطة البحوث الزراعية بسخا. ثم تقييم ال 50 هجين الناتجة مع اثنين من هجن المقارنة (هجين فردي 162 وهجين فردي 168) فى تصميم القطاعات الكاملة العشوائية في أربع مكرارات بمحطتي سخا وملوى خلال موسم 2017 وذلك بهدف دراسة القدرة علي التآلف لبعض سلالات الذرة الشامية الصفراء الجديدة وتقييم نسبة تفوق الهجن الجديدة الناتجة علي الهجن التجارية. كان التباين الراجع للهجن وكذلك التفاعل بين الهجن والمواقع عالي المعنوية لكلا من عدد الأيام حتى ظهور حراير 50% من النباتات وموقع الكوز وعدد الكيزان/نبات وصفة المحصول (طن/هكتار). أيضا كان التباين الراجع إلى كلاً من السلالات والكشافات وتفاعل السلالات× الكشافات معنوياً فى كل الصفات المدروسة ماعدا التباين الراجع إلى تفاعل السلالات × الكشافات لصفات موضع الكوز وعدد الكيزان/نبات والمحصول. كانت أفضل سلالة في القدرة العامة المرغوبة هي سلالة 27/5008 لصفة التبكير وسلالة 57/5010 لموضع الكوز ، وسلالة 54/5010 لصفة عدد الكيزان/نبات ، وسلالة 31/5008 لصفة المحصول. وكانت أفضل الهجن نسبة هجن المقارنة هو سخا 27/5007 × سخا11 للتبكير وهجين44/5010 × سخا11 لموضع الكوز و هجين58/5010 × سخا11 لعدد الكيزان/للنبات والهجين 31/5008 × جيزة 658 لصفة المحصول. تم تقسيم الـ 25 سلالة الجديدة إلى مجموعتين مختلفتين باستخدام طريقة (HSGCA) لصفة المحصول حيث المجموعة الهجينية الأولى للكشاف (سخا 11) تضم 7 سلالات والمجموعة الهجينية الثانية للكشاف (جيزة 658) تشتمل على 7 سلالات أيضاً.