GENERAL AND SPECIFIC COMBINING ABILITY OF MAIZE TRAITS STUDIED IN SINGLE CROSS HYBRIDS

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ABSTRACT

The study was carried out using full diallel cross between six inbred lines of maize, parents and their F_1 including reciprocals were planted in 19th march 2014 at field of agriculture college, Duhok University. All treatments arranged in randomized complete block design (RCBD) with three replications to estimate the general and specific combining ability of maize traits in single cross hybrids. According to the mean square values of The results showed that the general combining ability, specific combining ability, and reciprocal combining ability, the general combining ability exhibited significant variance for all traits except days to 75% tasseling and number of kernels row^{-1}, whereas, specific combining ability was non significant for leaf area though its prerogative for all other traits. The reciprocal combining ability was remarkable for days to 75% tasseling, plant and ear height, leaf area, ear diameter, ear length, number of rows ear^{-1}, number of kernels row^{-1}, 300- kernel weight and yield plant^{-1}. The hybrid IK8xTH613 displayed the best value for yield plant^{-1} and IK58XTH613 for days to 75% tasseling, while the reciprocal HSxIK8 was the best for yield plant-^{1}.

Keywords: Single cross, Maize, combining ability, Hybrid

قابلية الائتلاف العامة والخاصة في الهجن الفردية لصفات الذرة الصفراء

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المستخلص

نفذت الدراسة باستعمال التهجين التبادلي الكامل بين ست سلالات من الذرة الصفراء زرعت الاباء والهجن والهجن العكسية في 19 اذار 2014 في حقل بحوث كلية الزراعة جامعة دهوك . رتبت التراكيب الوراثية في تصميم القطاعات العشوائية الكاملة وبثلاثة مكررات لتقدير قابلية الائتلاف العامة والخاصة لصفات الذرة في الهجن الفردية وبينت االنتائج وجود فروقات معنوية بينها حيث اظهرت قابلية الائتلاف العامة فروقات معنوية لجميع الصفات ماعدا صفتي 75% تزهير ذكري وعدد البذور بالصف بينما لم تظهر قابلية الائتلاف الخاصة اي فروقات معنوية لصفة المساحة الورقية وكانت معنوية لبقية الصفات وكانت قابلية الائتلاف للهجن العكسية معنوية للصفات التالية 75% تزهير ذكري وارتفاع النبات والعرنوص والمساحة الورقية وقطر وطول العرنوص وعدد الصفوف بالعرنوص و وزن 300 بذرة وحاصل النبات . اظهر الهجينIK8Xth613 افضل قيم لحاصل النبات واظهر الهجين IK58XTH613 افضل قيم ل75% تزهير ذكري بينما اظهر الهجين العكسي IK8XHS افضل قيم لحاصل النبات.

كلمات مفتاحية: هجين فردي، الذرة الصفراء، قابلية الائتلاف، هجين

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INTRODUCTION

Knowledge on combining ability among maize genotypes is the key in augmenting the efficiency of hybrid improvement ,since combining ability analysis is the most important means to recognize the best combiners that can be used in the crosses for utilizing the accumulation of productive genes, Melkamu *et al*. (14), and , Legesse *et al*.(24) found that the combining ability consisted from GCA and SCA,and subsequently the combining ability could help to give a clue for choosing the best strains. The concept of general and specific combining ability was introduced by Sprague and Tatum (24) and mathematical model was set by Griffing (10). Amiruzzaman *et al*. (5) and Pablo *et al*. (28) found during studying ear length, ear diameter, 1000 - kernel weight and kernel weight that some parents were best combiners showing significant positive GCA effects for grain yield and all other traits. Mohammed *et al*. (17) evaluated the combining ability, the results confirmed that the mean squares of GCA were highly significant for these traits the number of grains row^{-1}, number of row ear^{-1}, ear and plant height, number of days to tasseling and silking, 300-grain weight, leaf area and yield plant^{-1}.In this reqard Ali (3) revealed that the GCA effects were more connected to grain yield and yield component traits in an inbred line ,thus the significant positive GCA effects for yield were highly related. Kanagarasu *et al*. (12) and Muna *et al*. (19) reported that the variance due to SCA was higher than the variance of GCA in maize for plant height, ear height, grain yield plant^{-1}, cob diameter, cob length, leaf length, 100- grain weight, grain rows cob^{-1}, day to 50% tasseling and silking. Mohammed (15) noticed that the effect of SCA was more than GCA effects in two kinds of crosses of maize indicating the importance of dominant and dominant x dominant gene action in the inheritance of 300- grain weight. The main objective of current work was to estimate the general combining ability (GCA) and specific combining ability (SCA) among six maize inbred lines to identify superior single - cross hybrid developed from them.

MATERIALS AND METHODS

Plant and experimental material The material under study consisted of six inbred lines shown in (Table 1) which were selected based on different agronomic traits. This study was carried out at the field of college of Agriculture, Duhok University. In the spring season, 15th of March, 2013, grains of six inbred lines were sown to perform full diallel crosses between them (all possible crosses including reciprocals). 2-4 grains per hole were sown in a row, 3 m long for each experimental unit, 0.80 m between rows and 0.25 m between plants at two different sowing dates to get compatibility among inbred lines pollen grain, because of the differences in the flowering dates among inbred lines, 2-3 ears were pollinated for each cross for more precise results, then getting 30 hybrids

Table 1. Genetic material used in the experiment

No.	Name	Sources
1	OH40	IPA
2	IK8	IPA
3	IK58	IPA
4	TH613	USA
5	HS	IPA
6	UN44052	Greece

In spring season, 19th of March, 2014 the F_1 hybrids with their parental lines and the check variety (Sangria) were grown in Randomized Complete Block Design (RCBD) with three replications, each replication consisted of 37 genotypes (30 F_1 , 6 parental lines and check variety). One row for each genotype with 3m long 0.80 m between rows and 0.25 m between plants. Field was fertilized at planting date with (N. P. K.; 27: 27: 0) at rate 400 kg /ha. and 200 kg/ha of urea (46%N) were added. Weed control and other practices were performed according to plant requirements. Data were collected from five consecutive plants row^{-1}and studied traits were days to 75% tasseling, plant height (cm), ear height (cm), leaf area (cm^2), No. of rows ear^{-1}, No. of kernels row^{-1}, ear length (cm), ear diameter (cm), 300- kernel weight (g) and kernel yield plant^{-1}

Statistical analysis

Combining ability analysis: It was carried out according to the procedure of Griffing(10) using method model (1); the linear mode

utilized for the combined analysis was as follows:

$Yijk = \mu + gi + gj + sij + Rij + rk + \frac{1}{bc}\sum\sum eijk$

Where Yijk*:* observed value of the experimental unit;

μ: population means;

gi :general combining ability effect due to i^{th}genotype;

gj:generalcombining ability effect due to the j^{th} genotype;

sij:specific combining ability for the diallel crosses involving parent*i* and*j;*

Rij: specific combining ability for the reciprocal crosses involving parent *i* and *j;*

Rk:replication (block) effect, and

eijk: means error effect.

Estimation of general and specific combining ability effect

$\hat{g}ii = \frac{1}{2p}(Yi. + Y.j) - \frac{1}{p2}Y$

$\hat{s}ij = \frac{1}{2}(Yij + Yji) - \frac{1}{2p}(Yi. + Y.i + Yj. + Y.j) + \frac{1}{p2}Y..$

$\hat{r}ij = \frac{1}{2}(Yij - Yji)$

Where ĝii: effect of expected general combining ability for parent i;

ŝij: effect of expected specific combining ability for single reciprocalcrosses ij when i=j ;

Yij: F_1's mean as a result of crossing parent i with parent j;

Y..: sum of the means of all parents and F_1's hybrids, and

P: parents'number.

Estimation of components of variance for both general and specific combining ability

$\sigma^2\hat{g}ii = (\hat{g}ii)^2 - \frac{MS\bar{e}}{p^2}$ $\sigma^2\hat{s}ij = \frac{1}{p^{-2}}\sum \hat{s}ij^2 - \frac{MS\bar{e}\,(p2-2p+2)}{2p^2}$

$\sigma^2\hat{r}ij = \frac{1}{p^{-2}}\sum\hat{r}ij - \frac{MS\bar{e}}{2}$

where $\sigma^2\hat{g}ii$: variance of expected effect of general combining ability for parent i;

$\sigma^2\hat{s}ij$: variance of expected effect of specific combining ability for diallel crosses of parent i

$\sigma^2\hat{r}ij$: variance of expected effect of specific combining ability for reciprocal crosses of parent i

RESULTS AND DISCUSSION

Analysis of variance: Table (2) showed that the analysis of variance of genotypes (parents + hybrids) were highly significant for all of the studied traits. General combining ability (GCA) was substantially significant for plant and ear height, ear diameter, ear length, number of rows ear^{-1}, 300-kernel weight and yield $plant^{-1}$. It was significant for leaf area and non - significant for days to 75% tasseling. The specific combining ability (SCA) was worthy significant for all of the traits except leaf area, while reciprocal combining ability (REC) was highly significant for days to 75% tasseling, ear height, leaf area, ear diameter, ear length, number of rows ear^{-1}, 300- kernel weight and yield $plant^{-1}$, it was significant for plant height and non-significant for number of kernels ear^{-1}.The significance of reciprocal combining for all traits , indicating that there was enough variation for successful selection of desirable traits, therefore the genotypes could be used in breeding program, Similar results were revealed by several authors like (2, 8, 27, 28)

Table 2. Mean square of variance analysis for G.C.A and S.C.A for parents F_1 diallel crosses and reciprocals for studied traits in maize.

S.O.V	d.f	Days to 75% tasseling	Plant height Cm	Ear height Cm	Leaf area cm^2	Ear diameter cm	Ear length cm	NO. of rows ear^{-1}	NO. of kernels row^{-1}	300 kernel weight g	Yield $plant^{-1}$ G
Rep.	2	2.39	1241.09**	195.02**	10590.36	0.02	3.65	0.18	3.56	292.03**	343.75
Genotype	35	7.09**	547.54**	390.98**	9454.09**	0.07**	4.80**	4.37**	26.66**	158.19**	2516.22**
GCA	5	3.82	860.75**	511.84**	13169.61*	0.14**	8.64**	5.87**	17.95	236.86**	3633.70**
S.C.A	15	7.38**	720.86**	465.41**	7247.22	0.06**	4.75**	4.77**	47.33**	139.73**	2697.72**
REC.	15	7.88**	269.82*	276.25**	10422.4**	0.05**	3.58**	3.47**	8.98	150.42**	1962.23**
Error	70	1.68	113.60	19.75	3244.46	0.01	1.09	0.55	6.98	23.25	115.72

***and** Indicating significance at level 0.05 and 0.01 respectively**

Estimation of general combining ability (GCA) effect: Table (3) clarified the estimation of GCA for all of the examined traits. From this table we can notice the highest positive value (0.39) for parent 5 which predicts the contribution of this parent

in increasing the number of days to 75% tasseling in its hybrids, while, parent 2 exhibited the highest negative value reaching (-0.29) that indicates the contribution of this parent in decreasing the number of days to 75% tasseling in its hybrids. In this manner, the right choice of parental pairs based on their GCA might be of great importance in reducing the flowering period of male inflorescences. The highest effect of positive general combining ability for plant height was recorded for parent 2 with 7.46 cm, while parent 6 had the maximum negative general combining ability effects with -5.40 cm. Considering GCA effect for ear height, parent 3 showed the highest positive value 6.51cm, whereas the minimum negative value for GCA effect was recorded for parent 4 with -4.26 cm. Similar results were found by Faheem *et al*. (8) and Amino *et al*. (2) while studying these traits. For leaf area, the largest value was shown by parent 5 with 27.33 cm^2 and followed by parent 3 with 18.88cm,while the the s mallest negative GCA effect was for parent 6 with -21.77 cm^2. Based on these data we conclude that the parent 5 may significantly contribute in increasing the yield of the hybrids depending on their photosynthetic ability, as clarified in table (5-A). The estimation of GCA effect as presented in the same table showed positive effects for ear diameter and ear length in parent 2 with 0.09 cm and 0.47 cm respectively, while the parent 4 gave negative effect for these traits due to values -0.08 cm and -0.64 cm . The values for GCA effects of ear diameter were also negative for all other parents except parent 6. Amiruzzaman *et al*. (5) and Pablo *et al*. (20) obtained the same results when studied these traits. Regarding the GCA effects for the number of rows ear^{-1}, the maximum value was exhibited by parent 3 with 0.52, whereas the maximum negative GCA effect was for parent 4 with -0.58. Based on these data we conclude that parent 3 may significantly contributed in increasing the yield of their hybrids. The estimated effect of GCA on number of kernels row^1, the parent 1 had the highest positive effect with 0.73 and followed by parent 3 with 0.64, nevertheless parent 6 gave the negative effect with -1.10. Concerning 300 - kernel weight, parent 5 recorded positive effects with 2.02 followed by parent 6 with 1.87 and parent 3 showed negative effect with -1.29. For yield $plant^{-1}$ the parent 2 had the maximum positive value with 14.39, while parent 4 gave the maximum negative effect with -14.39, and other two parents gave positive effects with 4.56 and 3.47 for parent 1 and parent 5, respectively, whist parent 3 and 6 had negative effects -0.47 and -7.55, respectively. The results of yield components for parents demonstrated that, parent 2 had superior positive effect for traits ear diameter, ear length, number of rows ear^{-1}, and 300-kernel weight. Based on the results obtained from parent 2, we can say that this parent significantly contribute in increasing the yield of its hybrids. Comparable results were showed by Mohammed *et al*. (17), Ali (3) and Mohammed *et al*. (18). Table (6) revealed that parent 2 (IK8) showed highly significant GCA effect for plant height, ear diameter and yield $plant^{-1}$, and showed cosiderable effect for ear length. Parent 1 (OH40) showed moral GCA effect for yield $plant^{-1}$. These results were in agreement with Shams *et al*. (23) Zare *et al*., and Bocanski *et al*. (28).

Table 3. Estimation of G.C.A effects of parents for studied traits

Traits / Parents	Days to 75% tasseling	Plant height (cm)	Ear height (cm)	Leaf area (cm^2)	Ear diameter (cm)	Ear length (cm)	No. of rows ear^{-1}	No. of kernels ear^{-1}	300 kernel weight (g)	Yield $plant^{-1}$ (g)
1-OH40	0.34	-1.14	0.84	6.64	-0.003	0.39	0.15	0.73	1.17	4.56*
2-IK8	-0.29	7.46**	0.45	-6.26	0.09**	0.47*	0.29	-0.30	0.85	14.39**
3-IK58	0.01	3.97	6.51**	18.88	-0.01	-0.51*	0.52**	0.64	-1.29	-0.47
4-TH613	-0.04	-4.11	4.26**	12.94	-0.08**	-0.64**	-0.58**	-0.32	-4.63**	-14.39**
5-HS	0.39	-0.77	-0.51	27.33*	-0.03	0.36	-0.23	0.35	2.02*	3.47
6-UN44052	-0.4	-5.40*	3.04**	-21.77	0.03	-0.05	-0.15	-1.10*	1.87	-7.55**
s.e.(gi)	1.62	9.19	0.67	8.6	0.01	0.15	0.11	0.40	0.73	1.63

and ** Indicating significance at level 0.05 and 0.01 respectively.

Estimation of specific combining ability effect of hybrids (SCA): The data in table (4) described the estimation of SCA of hybrids for studied traits; for the longest period to 75% tasseling it was observed for the cross 5x6 (1.51), followed by cross 2x3 with (1.29), indicating its ability to increase the required days to tasseling, while the shortest period with negative SCA effect value (-1.62) was noticed from the cross 3x4, and followed by the cross 1x5 with (-1.39), demonstrates the ability of this hybrid in decreasing the number of days to 75% tasseling compared with its parents. Table (4) explained the SCA effect for plant height, the maximum positive value was remarked by the cross 5x6, while the maximum negative effect was -10.24 showed by the cross 1x6, the data in the same table revealed the estimation of SCA for ear height, the highest positive SCA effect value was exhibited by the crosses 5x6, 2x6 and 2x3 with respective values 16.25, 8.95 and 8.72. The lowest negative effect was -6.33 recognized by cross 3x5 and followed by the cross 1x6 with -5.93. Regarding leaf area the largest effect for SCA was realized by cross 2x3, 5x6 , 1x3,and 3x5 with 39.38, 33.98, 28.99 and 28.95, respectively, the lowest value for SCA effect for leaf area was recorded by the cross 3x4 with -20.55. Previous studies by Zare *et al.* (28) showed similar results. Considering to the estimates of SCA effects for ear diameter the cross 1x3 showed the maximum positive value with 0.19 followed by cross 4x6 with 0.14, whereas the cross 1x4 revealed the maximum negative effect with -0.17 followed by the crosses 1x6, 3x5, and 3x6 with value of (-0.11). For ear length the highest positive value was noticed in cross 4x6 with 1.47, followed by crosses 5x6 and 2x5 with 1.13, 1.01 respectively, and the cross 2x6 had the highest negative value with -0.81. Value of the estimated SCA effect of hybrids for number of rows ear^{-1} in the table indicated that the SCA effect for this trait 1.28 was the maximum positive value noticed by the cross 2x4, followed by the crosses 2x3 and 5x6 with respective values 0.97 and 0.85, whereas maximum negative value was -1.33 and -1.32 for the combination 1x4 and 2x5, respectively. The data in the same table revealed that the highest SCA effect for number of kernels row^{-1} were 2.91 and 2.75 exhibited by the crosses 5x6 and 3x6 respectively, while the maximum negative value was -1.03 for the cross 1x2.Regarding to the SCA effect for 300-kernel weight, maximum positive SCA effect value was 7.32 recorded by the cross 2x6 and followed by the cross 3x5 and 1x6 with 5.68 and 5.62 respectively, whereas the maximum negative value was recorded by cross 3x6 with -4.37. For the yield palnt^{-1}, the same table pointed out that the highest positive SCA effect showed in crosses 4x6, 2x4, 5x6 and 1x5 with (29.52, 17.73, 17.30 and 16.48), respectively, beside these crosses the crosses (3x4 and 1x6) showed significant SCA with 10.98 and 10 .41 respectively, Per contra the highest negative value was -21.64 exhibited in the cross 1x4. From this table we also notice that the cross 3x4 showed substantial and significant SCA effect for days to 75% tasseling , positive highly significant and significant for ear height and yield plant^{-1}, the cross 2x4 appeared with highly significant SCA effect for number of rows ear^{-1} and yield plant^{-1}. The cross 1x6 showed significant SCA for 300 - kernel weight and yield plant^{-1}, whereas the cross 4x6 exhibited highly significant SCA for ear diameter and length and yield plant^{-1}, and it was significant for number of kernels row^{-1}. Finally the cross 5x6 had highly significant SCA for each of plant and ear height, ear length and yield plant^{-1}, and had significant SCA for number of rows ear^{-1} and number of kernels row^{-1}. These results were in agreement with the results proved by Surinder et al. (25), Saad et al. (21), Muna et al. (19), and Mohamed et al. (18).

Table 4. Estimation of specific combining ability effect of hybrids for studied traits

Traits / Hybrids	Days to 75% tasseling	Plant height (cm)	Ear height (cm)	Leaf area (cm^2)	Ear diameter (cm)	Ear length (cm)	No. of rows ear^{-1}	No. of kernel $srow^{-1}$	300 kernel weight (g)	Yield $plant^{-1}$ (g)
1x2	0.29	6.05	4.59*	26.87	-0.04	0.23	0.67	-1.03	-1.17	-0.03
1x3	0.99	2.61	4.60*	28.79	0.19**	0.39	-0.42	0.14	2.18	8.80
1x4	-0.62	6.33	1.21	-0.33	-0.17**	-0.27	-1.33**	-0.19	-2.66	-21.64**
1x5	-1.39*	-4.09	-1.33	2.50	0.06	0.37	0.14	0.93	3.88	16.48**
1x6	-0.59	-10.24*	-5.93**	14.93	-0.11*	0.05	-0.14	2.03	5.62*	10.41*
2x3	1.29*	6.93	8.72**	39.38	-0.04	0.56	0.97**	1.54	-2.98	6.13
2x4	-0.64	0.62	-2.76	4.17	0.03	-0.65	1.28**	2.01	-1.00	17.73**
2x5	0.40	3.22	3.31	7.53	-0.05	1.01*	-1.32**	-0.72	4.31	-0.82
2x6	-0.95	9.44	8.95**	19.76	0.04	-0.81	-0.15	-0.66	7.32**	6.36
3x4	-1.62**	7.07	7.37**	-20.55	-0.002	-0.06	0.38	0.63	-2.26	10.98*
3x5	-0.39	-2.32	-6.33**	28.45	-0.11*	-0.70	-0.82*	-0.50	5.68*	-0.10
3x6	-0.59	9.60	-1.90	-8.53	-0.11*	0.42	-0.31	2.75*	-4.37	-5.64
4x5	-0.67	-1.86	-2.22	5.69	0.03	-0.06	0.62	0.62	1.79	5.89
4x6	0.76	-1.57	0.24	11.75	0.14**	1.47**	0.20	2.62*	1.54	29.52**
5x6	1.51*	16.32**	16.25**	33.98	-0.01	1.13**	0.85*	2.91*	-2.73	17.30**
s.e.(si)	0.45	3.6	1.5	19.7	0.03	0.36	0.25	0.92	1.67	3.7

* and ** Indicating significance at level 0.05 and 0.01 respectively.

Estimation of specific combining ability of reciprocal crosses (RCA): Table (5) demonstrates the estimation of specific combining ability of reciprocal crosses for studied traits, the reciprocal crosses 4x1 and 6x3 had the highest positive RCA effect with 2.66 for days to 75% tasseling, while the maximum negative effect was recoded in the reciprocal cross 4x3 with -1.33 for days to 75% tasseling and the highest negative value was showed by the reciprocal 3x1 with -0.66 for days to 75% silking, indicating it's ability to decrease the days to tasseling. Concerning plant and ear height, the highest negative effect for RCA was recorded by the reciprocal cross 5x1 with -12.60 and -11.76, in sequence, and the highest positive effect was recognized in the reciprocal 6x3 with 18.20 and 12.80 for both traits respectively. The RCA effect for leaf area was significantly positive for the crosses 4x3 with 66.1and 5x4 with 65.45, and the reciprocal cross 6x2 gave negative effect with -55.86. Positive and negative RCA was found by Kanagarasu *et al.* (12) and Muna *et al.* (19). In the same table the RCA effect estimates for ear diameter and ear length, the reciprocal cross 3x1 had negative effect with respective values -0.19 and -1.33, whereas the highest positive effect was reported in the reciprocal 6x5 with 0.12 for ear diameter, The highest positive value for ear length was noticed in reciprocal cross 5x3 with 1.20, the results were in agreement with Abdel-Moneam *et al.*(1) and Haochuan *et al*,(18). Data presented in table (5) referred to the effect of RCA, for the number of rows ear^{-1}, the maximum positive RCA effect was recorded for the reciprocal cross 6x5 followed by the reciprocal cross 5x3 with 1.33 and 0.86 respectively, and regarding the negative effect the reciprocal 5x1 had maximum value with 1.46. Concerning the number of kernels row^{-1}, six reciprocal crosses gave negative effect for this trait. For 300 kernel weight the reciprocal cross 4x1 showed the highest positive RCA value with 6.78,while the highest negative RCA effect values -12.62 and -8.17 were viewed for the crosses 2x1 and 3x1 in sequence. Regarding the yield $plant^{-1}$, the highest positive RCA effect value 16.82 was obtained by the reciprocal 5x3, whereas the maximum negative value due to RCA (-40.91, -31.02, -25.87 and -25.42) were shown by the crosses 5x2, 2x1, 5x1 and 3x1, three crosses gave negative RCA effect. The researchers Vasal *et al.* (26), Bidhendi *et al.* (8) and Mohammed and Ismail (2014) demonstrated similar results for the same traits. The final conclusion of this table is that the reciprocal cross 5x3 was better than other reciprocals because it was highly significant for yield $plant^{-1}$ and oil percent and it was significant for ear length, number of rows ear^{-1} and protein percent, followed by the reciprocal cross 6x5 which was highly significant for protein and oil percent and number of rows ear^{-1} and significant for ear diameter. These results were in agreement with those ones Bidhendi *et al.* (7) and Zare *et al.* (28).

Table 5. Estimation of specific combining ability effect of reciprocals for studied traits

Traits / Reciprocals	Days to 75% tasseling	Plant height (cm)	Ear height (cm)	Leaf area (cm^2)	Ear diameter (cm)	Ear length (cm)	No. of rows ear^{-1}	No. of kernels row^{-1}	300 kernel weight (g)	Yield $plant^{-1}$ (g)
2x1	0.00	-0.06	-1.40	-3.56	0.03	1.00	0.53	0.53	-12.62**	-31.02**
3x1	-0.33	-1.60	2.60	-41.83	-0.19**	-1.33*	-0.20	-2.40	-8.17**	-25.42**
4x1	2.66**	2.96	3.43	51.03	0.09	-0.20	-0.50	-2.03	6.78*	5.39
5x1	0.33	-12.60*	-11.76**	-25.63	-0.09	-0.03	-1.46**	-1.23	1.11	-25.87**
6x1	0.00	3.23	-2.36	-23.78	-0.07	0.29	-1.00*	1.73	-0.82	3.02
3x2	0.00	-3.33	-2.73	-21.71	0.07	-0.91	0.00	-1.10	2.26	-14.44*
4x2	0.00	-3.40	-1.4	33.36	-0.01	-0.50	-0.13	-1.80	-2.98	3.93
5x2	1.16	6.80	12.50**	-4.08	-0.10	-0.91	-0.66	0.66	-0.87	-40.91**
6x2	0.00	4.06	9.13**	-55.86	-0.05	0.00	0.33	0.53	-5.99	0.51
4x3	-1.33	-5.43	-3.06	66.11*	-0.06	-0.66	-0.40	-0.50	0.49	-9.07
5x3	-1.00	5.23	-2.36	7.65	0.10	1.20*	0.86*	-0.56	2.66	16.82**
6x3	2.66**	18.20**	12.8**	54.55	0.003	0.91	-0.93	-0.23	0.08	-0.30
5x4	0.66	2.13	-0.63	65.45*	0.11	0.08	-0.53	0.55	4.62	11.53
6x4	-0.66	1.06	-9.23**	33.33	-0.07	-1.16*	-0.73	0.40	-1.95	-13.01
6x5	-0.50	3.83	3.53	-54.25	0.12*	-0.16	1.33**	-1.23	4.34	4.71
s.e. (ri)	0.52	4.3	1.8	23.2	0.04	0.42	0.03	1.07	1.9	4.3

* and ** Indicating significant at level 0.05 and 0.01 respectively

CONCLUSIONS

The results of indicate significantly different combining abilities of days to 75% tasseling, plant height, ear height, leaf area, ear diameter, ear length, no. of rows ear^{-1}, no. of kernels row^{-1}, 300- kernel weight and yield $plant^{-1}$. The inbred line with highest value for GCA was the maize line IK8, while for SCA was the combination 2x4, 1x6, 4x6, 5x6. The investigation suggests that some of the inbreds represent a highly valuable genetic material that could be successfully used for future breeding.

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