HETEROSIS AND GENE ACTION FOR YIELD AND YIELD COMPONENTS AND Maize (*Zea mays* L.), USING HALF DIALLEL CROSSES.

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ABSTRACT

Experiment of half diallel cross among eight maize inbred lines was carried out during spring 2021.The varietal traits for F1 cross and parents with local hybrid were conducted during autumn 2021 Field of College of Agricultural Engineering Sciences , University of Duhok, using Randomized Complete Block Design with three replications .The results were revealed that the analysis of variance for genotypes and general and specific combining ability were significant effect on studied traits , also the ratio of degree of dominance is less then one for all traits . The cross 7x8 gave the heighest value (219.35g) for grain yield per plant and the same cross gave positive significant heterosis over mid parent , best parent and local hybrid .The heritability were high for number of ear per plant and ear diameter with value(0.55) and(0.45) respectively, the expected genetic advance was low for yield and yield components.

Key word: Line, half diallel, heterosis
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قوة الهجين والفعل الجيني لحاصل ومكوناته لذرة الصفراء باستعمال التهجين التبادلي النصف

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المستخلص

تجربة التهجين لثمانية سلالات من الذرة الصفراء زرعت في ربيع 2021 كما زرعت الهجن الناتجة منها مع هجن محلي في خريف 2021 في حقل كلية علوم الهندسة الزراعية جامعة دهوك بتصميم القطاعات العشوائية الكاملة وبثلاثة مكررات . اظهرت نتائج تحليل التباين ان التراكيب الوراثية وقابلية الائتلاف العامة والخاصة كانت معنوية التأثير على جميع الصفات ومعدل درجة السيادة اقل من واحد. اعطى الهجن 7 *8 اعلى حاصل بلغ (219.35) غرام للنبات الواحد كما اظهر نفس الهجن قوة هجين موجبة ومعنوية عبر متوسط الاباء وافضل الاباء والهجن المحلي. أما قوة التوريث فكانت عالية لصفتي عدد العرانيس في النبات وقطر العرنوس بلغت(0.55), (0.45) على التوالي كما كان التحصيل الوراثي واطئاً لحاصل ومكوناته.

كلمات مفتاحية: سلالات، التهجين النصفي، قوة الهجين.
جزء من اطروحة الدكتوراه للباحث الاول

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INTRODUCTION

Maize (*Zea mays L.*) is a multi purpose crop , plays an important role in cropping systems through out the world. Advance in genomics breeding and production had ignificant impact on the lives of a large proportion of the world's population (6, 21). Maize production in Iraq saw a sharp declines between the years of 2006 and 2020.Iraq requires approximately 300,000 metric tons of maize per year to satisfy the feed consumption of its growing poultry sector. One of the important things increasing the productivity of maize is to take advantage of the phenomenon of hybrid vigorous heterosis is an phenomenon where by hybrid of spring of genetically diverse individuals display improved physical and functional character is tics relative to their parents heterosis has been increasing applied in maize production for nearly a century with aim of developing more vigorous, higher yielding and better performing cultivars, heterosis can be visualized in term of increase in growth rate and total biomass. (7). There for the developed of hybrid of multi in developing countries is an urgent need ,and their success depends on the selection of parents that are distinguished in their performance to obtain from there hybrid, that are strong in their specification (15). Many studies have been conducted to the broaden the know the effect of heterosis , so that heterosis can be used more effectively and more consciously, Researcher have suggested three main hypothesis in order to explain the genetic basis of Heterosis ,dominance ,over dominance and epistasis. (8, 9, 13). Knowledge of the way genes action and interact will determine which breeding system optimizes gene action more efficiently and will elucidate the role of breeding system in the evolution of crop plants . also the gene action refers to the behavior or mode of expression of gene in a genetic population ,there are three types of gen action ,additive, dominance, and epistatic ,this is a type of gene action in which the genotypic values associated with genetic phase at one locus are influenced by genetic phase at the other locus. several researcher were important to know the kind of gene action and how estimation it , and determine the method to improve the crop. (19). The effect of general combining ability (GCA) and specific combining abilities (SCA) are important indicators of potential value for inbred lines in hybrid combinations. The concept of GCA and SCA has become increasingly important to plant breeder because of the widespread use of hybrid cultivar in many crops such maize many researcher estimation the general and specific combining ability are related to the type for gene action effects (4, 8, 13) Half diallel analysis provides a good information about the inheritance of traits among a set of genotype (4, 14) .Mohammed *et., al*(13) during their study of maize genotypes found that the values of heritability in broad sense were high for days to tasseling and skilling ,plant height, ear height number of row per ear ,number of grain per row , 300 grain weight and grain yield per plant(6, 13, 17, 18) The aim of the current study in which half diallel mating design was used between eight pure lines is to determine heterosis ,gene action ,combining ability and some genetic parameters for grain yield and its components.

MATERIALS AND METHODS

Eight maize pure lines intered in a half diallel crosses a ccording to the second method proposed by Grfting (11), Table 1 when sowing in at the field 12/ 3/ 2021 at the field of College of Agricultural Engineering Science, University of Duhok to produce 28 hybrids .The eight inbred lines and 28 hybrids were sowing in 10/ 7/ 2021 in the same location by using randomize complete bloke dosign with three replications. The experimental units contained one row 3 meter long , the distance between rows 0.75 cm and the plant inside the row 0.25 cm. N P K fertilizer (27,:27,: 72) was added by 100 kg per ha during the preparation of the law and urea by 200 kg per ha added into period the first after 3 week of plant and the second before the tasseling flowering , and five plants (randomly selected for each experimental unit) were to recorded the data about number of ear per plant ,ear diameter ,number of grain per row, number of row per ear , 300 grain weight and grain yield per plant .

Table 1. Genetic material used in the experiment

Genotypes		Sources
1	MA-F-53	Locally devised
2	SY-F-54	Locally devised
3	H-4	Locally devised
4	2P-SQ5	Locally devised
5	K58	Locally devised
6	HS	Locally devised
7	UN44052	Locally devised
8	DK-17	Locally devised

Genotypes(parents and hybrids) data were analyzed , for each trait according to the experiment design method used (3) and the sum of squares of genotypes was divided in to general and specific combining abilities according to method 2, fixed moder proposed by Griffing (11) and the following parameters were used.

1- Heterosis: Heterosis was determined for various characters for each hybrid from the replicates mean related to the differences of F1 hybrids generation from the mid parent value, better parent and local variety and the equation to estimate each heterosis as follows:

1- $(H) = \overline{F}1 - \frac{\overline{p}1 + \overline{p}2}{2}$

$2-(H) = \frac{F1-BP}{BP}$ ===== $3-(H) = \frac{F1-CC}{CC}$

where:
F'1: mean of hybrid
P1: parent one,
P2: parent two
BP**:** better parent
CC: local variety

The significance of heterosis was tested from calculation of **t** value for each hybrid according to the following equation:

$$t = \frac{H}{\sqrt{V(H)}}$$

Where the heterosis variance V (H) will be

$$V(H) = V(\overline{F}1) + (1/4)(V(\overline{pi}) + V(\overline{pj}))$$

$$V(H) = \sigma^2 e + (1/4)(\sigma^2 e + \sigma^2 e)$$

$$V(H) = (3/2)(Mse/r)$$

2- Estimation of component of variance and genetic interpretation: The Additive, Dominance and Environmental variances were estimated by using EMS from Griffing analysis. and their significance from zero were tested in the manner explained by (12).

$\sigma^2 A = 2\sigma^2 g$
$\sigma^2 D = \sigma^2 s$
$\sigma^2 E = \sigma^2 e$
$\sigma^2 G = \sigma^2 A + \sigma^2 D$
$\sigma^2 P = \sigma^2 G + \sigma^2 E$
$\sigma^2 P = \sigma^2 A + \sigma^2 D + \sigma^2 E$

where:
$\sigma^2 A$: Additive genetic variance,
$\sigma^2 D$: Non-additive (dominance and epistasis) genetic variance,
$\sigma^2 g$: Variance of general combining ability
$\sigma^2 s$: Variance of specific combining ability
σ^2 E: Variance of experimental error, i.e. environmental variance
$\sigma^2 G$: Total genetic variance,
and $\sigma^2 P$: Phenotypic variance (genetic and environmental variance).

3- Heritability: Heritability was calculated in broad sense (H^2) and narrow sense (h^2) concept and average Degree of Dominance for each characteristic were calculated as follows:

$$H.b.s = \frac{\sigma^2 G}{\sigma^2 p} \times 100$$

$$H.n.s = \frac{\sigma^2 A}{\sigma^2 p} \times 100$$

$$\overline{a} = \sqrt{\frac{2\sigma^2 D}{\sigma^2 A}}$$

where:
H b.s: heritability in broad sense,
H n.s: heritability in narrow sense,
If: ā = zero denote no dominance,
ā < 1 denote partial dominance
ā = 1 denote complete dominance,
ā > 1 denote over dominance

4- **Expected genetic advanced**
EGA = (I) (h_{ns})(σ P)
EGA% = (EGA/ȳ) x 100
Where:
EGA: Expected genetic advanced
i: intensity of selection (which equals 1.76 when 10% of plants are selected
$h_{n.s}$: narrow sense heritability
σ P : phenotypic deviation

RESULTS AND DISCUSSION

Table 2. shows the analysis of variance for genotypes (parents and hybrids), and general and specific combining ability for yield and yield components and its noted that the mean square of all these three sources was highly significant for studied traits with exception NEP^{-1}, EDcm and significant for significant for general combining ability in NEP^{-1}. The

highly significant of genotypes indicated that the differences in the genetic diversity between the strain inbred lines using in this study, which caused a greater divergence between the resulting hybrids. Also the ratio of the degree of dominance is less than one for all traits , indicating that the dominant gene action were more important than the additive in controlling the inheritance of the inbred lines traits. The results are generally supported by (2, 5) when study half mating diallel cross in maize.

Table2. Analysis of variance for genotypes and combining ability for yield and yield components in maize studied characters in maize

Source	d.f.	Ms Traits NEP-1	ED (cm)	NGR-1	NRE-1	300 GW (g)	GYP -1 (g)
Rep.	2	0.11	0.57**	21.64**	0.45	1.10	28.18
Genotypes	35	0.07	0.07	84.32**	6.59**	132.37**	2622.84
GCA	7	0.10*	0.06	26.41**	5.85**	230.14**	2339.80**
SCA	28	0.06	0.08	98.80**	6.78**	107.93**	2693.60**
Error	70	0.05	0.07	3.16	0.29	6.64	45.94
$\frac{\phi^2 g.c.a}{\phi^2 s.c.a}$		0.18	0.07	0.02	0.08	0.02	0.08

(**) and (*) Significant at 1% and 5% probability level respectively

Table (3a and 4) reveals, respectively the mean of the eight parental lines and their general combining ability effect for the various studied traits. The results show that the parental lines 2 gave the maximum NEP^{-1}(1.73)followed by the parental 1 (1.60)while the minimum value recorded by parental 7(1.0) and data the same table exhibited general combining ability ,positive and non- significant , so it is the considered the desirable general combining ability for this trait .For ED, line 5 gave the highest value(4.60), whilst the parental line 3 gave the lowest value (4.20) and gave the negative(undesirable) and non-significant so it is considered the had in general combining ability. From the resulting in the Table 3a and table 4 , for NGR^{-1} and NRE^{-1}, the parental line 8 had the highest mean 29.26 and 14.40 respectively and also the same line gave the positive value (0.17) for NGR^{-1} and highly significant for NRE^{-1}(0.73) so it is considered the best in its general combining ability for these traits.

Table 3a . Mean parents for studied traits in half diallel cross in maize

parents	NEP^{-1}	E D	NGR^{-1}	NRE^{-1}	300 GW (g)	GYP^{-1} (g)
1	1.60a-b	4.59a-c	25.00k	12.06o-p	68.51m	109.00s
2	1.73 a	4.23b-c	24.86k	11.46p	76.76h-k	118.33r-s
3	1.20b-d	4.20c	24.46k	14.60i-l	80.51e-h	120.66q-s
4	1.20b-d	4.56a-c	25.60k	13.60l-n	92.06a	110.00s
5	1.33a-d	4.60a-c	26.80j-k	12.86n-o	78.17h-j	132.33o-q
6	1.20b-d	4.16c	26.26j-k	12.73n-o	81.11e-h	120.66q-s
7	1.0 d	4.56a-c	27.20j-k	14.66i-k	84.01b-f	133.33n-p
8	1.26a-d	4.33a-c	29.26j	14.40a	67.19n	124.66p-r
X	1.20	4.51	34.73	15.17	80.52	160.94
C.V.%	20.94	6.12	5,25	3.60	3.16	4.19

Values followed by the same letter for each trait are not significantly different from each other

For 300 GW, the line 4 gave the highest was 92.06(g), while the parental 1 recorded the lowest value (109.0 g). For the general combining ability the parental line 4 recorded the highly significant value (2.28), its general combining ability desirable for this trait . Regarding to yield per plant GYP^{-1},the line 7 recorded the highest value 133.33 g , while the parental line 1 gave the lowest value 109.0 g . Concerning for the general combining ability for this traits , the line 7 had the highly significant effect and the value was 12.77. The present results are corroboration with the finding (10, 20). Table 3b revealed that ,the mean performance of single crosses for the yield and yield components, and its noted through Duncans Multiple Range Test that difference between Twenty nine cross were significant for yield and yield components indicated that a large genetic differences between them , as a results of genetic differences between eight lines used in this study .It is noted that the best NEP^{-1} were 1.33 cm and 1.26 cm in crosses 5x7 ,1x6 and 5x8,7x8,3x6,2x8 respectively, while the lowest value 1.06 cm recorded by 1x4 ,3x5 and 4x6 .

For ED the cross 1x4 and 1x7 had the highest value 4.80 cm ,4.76 respectively, whereas the lowest value obtained by 4.40 cm recorded by cross 3x6 .Regarding to NGR^{-1},the cross 2x4 and 2x5 had the highest value 43.06 and 42.40,while the lowest value 32.86 obtained by cross 1x4 .For NRE^{-1}, the largest value 17.26 was detected in cross 2x3 , whereas the cross 4x7 gave the lowest value 13.46 . Concerning the 300 GW , cross 5x7 showed highest value 88.70 g ,while the cross 1x4 gave the lowest value 63.26 g . For GYP^{-1} the cross 4x6 had the maximum value 220.15 g and the minimum value 137.90 g recorded by cross 1x4. The superior the cross may be due to superior the one parent in on or more yield components. These results are generally analogues to the finding of (13, 14).

Table 4. General combining ability for parents for studied traits in maize

parents	NEP-1	ED (cm)	NGR-1	NRE-1	300 GW(g)	GYP-1
1	0.05	0.03	-2.11**	-0.50**	-5.71**	-14.89**
2	0.08	-0.07	0.51*	-0.22*	-0.63	2.12*
3	-0.01	-0.03	0.17	0.73**	1.50**	-6.72**
4	-0.07	0.06	-0.23	-0.51**	2.38**	-1.60
5	0.03	0.004	0.12	-0.09	1.72**	-4.43**
6	0.02	-0.03	0.10	0.01	0.95	8.35**
7	-0.08*	0.06	0.34	0.12	2.06**	12.77**
8	0.01	-0.01	1.09**	0.46**	-2.18**	4.39**

(**) and (*) Significant at 1% and 5% probability level respectively

The results of special combining ability of crosses for yield and yield components were presented in Table 5 and it seem that some cross exhibited significant effect in desired direction for each trait , as the number of crosses with significant desirable effect was one for NEP^{-1} and ED cm 11 for GYP^{-1}. It is clear that the crosses 2x3, 2x4, 2x6 ,3x4 and 4x5 were characterized by significant and desirable effect for the most traits including GYP^{-1}. For the previous studied, (2, 8) obtained desirable significant effects of special combining ability exhibited by some crosses for yield and yield components.

Table 3b: Mean cross for studied traits in maize.

Parents	NEP^{-1}	E D (cm)	NGR^{-1}	NRE^{-1}	300 GW (g)	GYP^{--1} (g)
1x2	1.13b-d	4.20c	35.80e-i	15.53d-i	73.06k-l	160.03g-k
1x3	1.26a-d	4.56a-c	34.20f-i	14.53i-l	87.05b	157.23h-l
1x4	1.06 c-d	4.80a	32.86i	15.53d-i	63.26n	137.90m-o
1x5	1.20b-d	4.23c	36.40d-i	16.20c-f	69.77l-m	149.90j-l
1x6	1.33a-d	4.66a-c	35.00e-i	16.53a-d	83.74b-g	150.56j-l
1x7	1.00d	4.76a-b	33.40h-i	14.46j-m	80.41e-h	148.33k-m
1x8	1.06c-d	4.53a-c	33.60h-i	14.33j-m	75.04i-k	167.22d-h
2x3	1.13b-d	4.50a-c	37.26d-g	17.26a-b	73.72j-l	146.81l-n
2x4	1.06c-d	4.46a-c	43.06a	15.26f-j	88.20a-b	179.31c-d
2x5	1.40a-d	4.53a-c	42.40a-b	14.53i-l	86.43b	161.74f-j
2x6	1.06c-d	4.63a-c	38.26c-e	16.13c-f	79.00g-i	173.36c-f
2x7	1.06c-d	4.46a-c	36.46d-h	16.33b-e	85.83b-d	193.72b
2x8	1.26a-d	4.66a-c	34.86e-i	16.20c-f	80.43e-h	208.69a
3x4	1.13b-d	4.46a-c	39.66b-d	14.60i-l	86.17b-c	173.70c-f
3x5	1.06c-d	4.76a-b	33.73g-i	17.46a	83.70b-g	153.32i-l
3x6	1.26a-d	4.40a-c	37.53d-f	16.86a-c	79.76f-i	176.38c-e
3x7	1.13b-d	4.63a-c	40.96a-c	16.609a-d	88.56a-b	195.23b
3x8	1.20b-d	4.60a-c	41.33a-c	17.40a	81.46c-h	128.84o-r
4x5	1.13b-d	4.66a-c	35.80e-i	15.86c-g	85.50b-d	164.45e-i
4x6	1.06c-d	4.60a-c	33.93f-i	14.13k-m	79.10g-i	220.15a
4x7	1.00d	4.60a-c	36.20d-i	13.46m-n	78.47h-i	158.99g-l
4x8	1.13b-d	4.53a-c	36.66d-h	15.30e-j	85.50b-d	169.58c-h
5x6	1.06c-d	4.46a-c	36.80d-h	14.73h-k	88.26a-b	171.04c-g
5x7	1.33a-d	4.43a-c	38.20c-e	15.13g-j	88.70a-b	170.52c-g
5x8	1.26a-d	4.40a-c	36.73d-h	15.73d-f	84.93b-e	159.12g-l
6x7	1.13b-d	4.66a-c	36.66d-h	15.86c-g	78.50h-i	209.00a
6x8	1.20b-d	4.53a-c	42.06a-b	16.86a-c	84.36b-f	181.86c
7x8	1.26a-d	4.56a-c	39.53b-d	16.46a-d	78.50h-i	219.35a
Check	1.53a-c	4.56a-c	36.20d-i	15.70d-h	73.56j-l	195.58b
X	1.194	4.51	24.11	15.158	80.70	160.01
C.V.%	19.29	6.16	5.12	3.557	3.19	4.23

Values followed by the same letter for each trait are not significantly different from each other.

The results of heterosis according to mid parents , best parent and local hybrid were showen in Table 6 . From the results in the same Table, 4 crosses recorded positive heterosis and the maximum value 0.166 recorded by cross 5x7, for NEP^{-1} and the other cross gave negative hetrosis based and mid parent ,while the same cross had possite heterosis according to best parent with value 0.066, for local hybrid all cross recorded negative hetrosis for this trait. Regarding to ED cm, all cross had positive heterosis and the value range 0.066 to 0.43 for cross 1x8 and 2x6 respectively according to mid parent, for the best parent 15 crosses gave positive heterosis and the rest gave negative heterosis, according to the local hybrid 12 cross accorded positive hetrosis and the highest value recorded 0.23 by cross 1x4. Concering the NGR^{-1}, all cross had significant positive heterosis absed on mid perent and the highest value 17.833 produced by cross 2x4 allso the twenty eight crosses had significant positive heterosis a ccording to best pare, this mean the all crosses superior in this trait, seven crosses recorded significant positive heterosis according the local hybrid this mean these crosses were superior in this trait with local hybrid. For NRE^{-1}, all crosses had significant positive heterosis and the large value 4.1 recorded by cross 1x6 and only two ceosses recorded possitve hetrosis and the second had negative heterosis (4x7). The crosses 1x6 obtaind significant positive heterosis based on mid parend, best parent and local hybrid in NER, while the rest of cross gave positive or negative hetrosis but less them cross 1x6. For 300 GW, 6 crosses recorded significant positive heterosis according to mid parent, best parent and local hybrid, this mean these crosses were superior in this trait and this trait was the important components for yield. For GRP^{-1} the cross 2x8, 4x6 ,6x7 and 7x8 had significant positive heterosis and the cross 4x6 had the highest value 104.82 ,99.48 and 24.56 abased on mid parent, best parent and local hybrid, so that this cross considerd the best cross and cross 7x8 and 2x8 respectively .The results appeared that crosses had positive value were under over dominant effect ,while the crosses that had negative values are greatly supports by (1, 7, 16) Concering the NGR^{-1}, all cross had significant positive heterosis absed on mid perent and the highest value 17.833 produced by cross 2x4 allso the twenty eight crosses had significant positive heterosis a ccording to best pare, this mean the all crosses superior in this trait, seven crosses recorded significant positive heterosis according the local hybrid this mean these crosses were superior in this trait with local hybrid. For NRE^{-1}, all crosses had significant positive heterosis and the large value 4.1 recorded by cross 1x6 and only two ceosses recorded possitve hetrosis and the second had negative heterosis (4x7). The crosses 1x6 obtaind significant positive heterosis based on mid parend, best parent and local hybrid in NER, while the rest of cross gave positive or negative hetrosis but less them cross 1x6. For 300 GW, 6 crosses recorded significant positive heterosis according to mid parent, best parent and local hybrid, this mean these crosses were superior in this trait and this trait was the important components for yield. For GRP^{-1} the cross 2x8, 4x6 ,6x7 and 7x8 had significant positive heterosis and the cross 4x6 had the highest value 104.82 ,99.48 and 24.56 abased on mid parent, best parent and local hybrid, so that this cross considerd the best cross and cross 7x8 and 2x8 respectively .The results appeared that crosses had positive value were under over dominant effect ,while the crosses that had negative values are greatly supports by (1, 7, 16).

Table 6. Heteross based on mid parents,best parent and commerial hybrid for studied traits in maize.

Cross	NPE^{-1}			E D (cm)			NGR^{-}		
	mid par	B. P	LH	mid par	B. P	L H	mid par	B. P	L H
1x2	-0.53333**	-0.6**	-0.4*	-0.2167	-0.4	-0.3667	10.866**	10.8**	-0.4
1x3	-0.13333	-0.3333*	-0.2667	0.16667	-0.033	0	9.4666**	9.2**	-2
1x4	-0.3333**	-0.533**	-0.466**	0.21667	0.2	0.2333	7.5666**	7.266**	-3.333*
1x5	-0.26667	-0.4*	-0.3333*	-0.3667	-0.36667	-0.3333	10.5**	9.6**	0.2
1x6	-0.06667	-0.26667	-0.2	0.2833	0.0667	0.1	9.3667**	8.7333**	-1.2
1x7	-0.3**	-0.6**	-0.533**	0.1833	0.1667	0.2	7.3**	6.2**	-2.8*
1x8	-0.36667*	-0.533**	-0.467**	0.0667	-0.06667	-0.0333	6.4667**	4.333**	-2.6*
2x3	-0.33333*	-0.6**	-0.4	0.2833	0.3	-0.06667	12.6**	12.4**	1.06666
2x4	-0.4**	-0.666**	-0.467**	0.0667	-0.1	-0.1	17.833**	16.266**	6.8666**
2x5	-0.13333	-0.3333*	-0.1333	0.1167	-0.0667	-0.03333	16.567**	15.6**	6.2**
2x6	-0.4**	-0.666**	-0.467**	0.43333	0.4	0.0667	12.7**	12**	2.0667
2x7	-0.3*	-0.666**	-0.467**	0.0667	-0.1	-0.1	10.433**	9.2666**	0.2667
2x8	-0.23333	-0.466**	-0.26667	0.3833	0.3333	0.1	7.8**	5.6**	-1.33333
3x4	-0.06667	-0.06667	-0.4*	0.0833	-0.1	-0.1	14.633**	14.066**	3.4666**
3x5	-0.2	-0.26667	-0.467**	0.3667	0.166667	0.2	8.1**	6.9333**	-2.466*
3x6	0.0667	0.0667	-0.26667	0.2167	0.2	-0.16667	12.167**	11.266**	1.333333
3x7	0.033333	-0.06667	-0.4*	0.25	0.0667	0.066667	15.133**	13.766**	4.7666**
3x8	-0.1	-0.06667	-0.3333*	0.3667	0.266667	0.033333	14.1**	12.066**	5.1333**
4x5	-0.13333	-0.2	0	0.0833	0.066667	0.1	9.6**	9**	-0.4
4x6	-0.13333	-0.13333	-0.4*	0.2333	0.033333	0.033333	8**	7.6666**	-2.26667
4x7	-0.1	-0.4	-0.467**	0.0333	0.0333	0.0333	9.8**	9**	0
4x8	-0.1	-0.13333	-0.533**	0.0833	-0.03333	-0.03333	9.2333**	7.4**	0.466667
5x6	-0.2	-0.26667	-0.4*	0.0833	-0.13333	-0.1	10.267**	10.533**	0.6
5x7	0.1667	0	-0.467**	-0.15	-0.16667	-0.13333	11.2**	11**	2
5x8	-0.033	-0.06667	-0.2	-0.0667	-0.2	-0.16667	8.7**	7.4666**	0.53333
6x7	0.0333	-0.0667	-0.2667	0.3	0.1	0.1	9.9333**	9.4666**	0.466667
6x8	-0.03333	-0.0667	-0.4*	0.2833	0.2	-0.03333	14.3**	12.8**	5.8666**
7x8	0.133333	0	-0.333**	0.1167	0	0	11.3**	10.267**	3.333333*

	mid par	B. P	LH	mid par	B. P	LH	Mid p.	B.P	LH
1x2	3.7666**	3.4667**	-0.16667	0.423333	-3.7*	-0.50333	45.87**	41.703**	-35.55**
1x3	1.2**	-0.06667	-1.1667**	12.54**	6.54**	13.49**	41.9033**	36.57**	-38.35**
1x4	2.7**	1.9333**	-0.1667	-17.03**	-28.803**	-10.307**	27.9**	27.9**	-57.68**
1x5	3.8**	3.4**	0.566667	-3.56833*	-8.3967**	-3.79*	28.733**	17.567**	-45.6867**
1x6	4.1333**	3.8**	0.83333**	8.92333**	2.623333	10.1733**	35.2333**	29.9**	-45.02**
1x7	1.1**	-0.2	-1.2333**	4.15333*	-3.59333*	6.85**	25.1633**	11.9967*	-47.2567**
1x8	1.1**	-0.06667	-1.3667**	7.18333**	6.52333**	1.47333	49.8867**	42.553**	-28.3667**
2x3	4.2333**	2.6667**	1.5667**	-4.9167**	-6.7933**	0.156667	27.3133**	26.147**	-48.7733**
2x4	2.7333**	1.6667**	-0.43333	3.786667*	-3.86333*	14.6333**	65.1433**	60.97**	-16.277**
2x5	2.3666**	1.6667**	-1.1667**	8.965**	8.26**	12.8667**	36.4067**	29.407**	-33.87**
2x6	4.0333**	3.4**	0.433333	0.06	-2.11667	5.43333**	53.8633**	52.697**	-22.2233**
2x7	3.2666**	1.6667**	0.63333	5.44667**	1.8233	12.2667**	66.3867**	57.387**	-1.86667
2x8	3.2667**	1.8**	0.5	8.4533**	3.67*	6.86667**	87.1967**	84.03**	13.11*
3x4	0.5	0	-1.1**	-0.11667	-5.89**	12.6067**	58.37**	53.037**	-21.8833**
3x5	3.7333**	2.8667**	1.76667**	4.355**	3.183333	10.133**	26.8233**	20.99**	-42.263**
3x6	3.2**	2.2667**	1.1667**	-1.05	-1.35	6.2**	55.7133**	55.713**	-19.20**
3x7	1.96667**	1.9333**	0.9*	6.30333**	4.55667*	15**	66.7333**	58.9**	-0.3533
3x8	2.1**	2.8	1.7**	14.71**	0.95	7.9**	72.5667**	4.176667	-66.743**
4x5	2.63333**	2.2667**	0.166667	0.381667	-6.5633**	11.9333**	43.29**	32.123**	-31.13**
4x6	0.96667**	0.53333	-1.5667**	-7.49**	-12.963**	5.53333**	104.82**	99.487**	24.567**
4x7	-0.66667*	-1.2**	-2.2333**	-9.5633**	-13.59**	4.90667*	35.8233**	22.657**	-36.597**
4x8	1.3**	0.9*	-0.4	5.87**	-6.5633**	11.9333**	52.25**	44.917**	-26.03**
5x6	1.9333**	1.8667**	-0.96667*	8.62167**	7.15**	14.7**	44.54**	38.707**	-24.547**
5x7	1.3666**	0.466667	-0.56667	7.608333**	4.69*	15.13333**	36.19**	34.19**	-25.063**
5x8	2.1**	1.33333**	0.033333	12.24833**	6.76**	11.36667**	30.62667**	26.7933**	-36.46**
6x7	2.1666**	1.2**	0.166667	-4.06333*	-5.51**	4.933333*	80.50333**	72.67**	13.416**
6x8	3.3**	2.4666**	1.166667**	10.21**	3.25	10.8**	59.19333**	57.1933**	-13.727**
7x8	1.9333**	1.8**	0.766667*	2.896667		4.933333*	88.85**	83.0167**	23.763**

(**) and (*) Significant at 1% and 5% probability level respective
(**) and (*) Significant at 1% and 5% probability level respective

Teble 7. Shows the estimates of genetic parameters for yield and yield components, and its noted that the additive and dominance genetic variance were significant from zero for yield and yield componets, indicating their important in controlling the in heritence of these traits. It is clear that the value of additive variance were greather than those of dominance for NEP^{-1} and ED, while the value of dominance variance were greather than the additive variance for NRP^{-1}, 300 GW and GYP^{-1}. For this reason, it is clear that the values of heritability in narrow sense were much lower in the broad sense for these traits and the value of heritability narrow sense was 0.04, 0.14, 0.28 and 0.14 respectivly. Which means in appropriationess of selection for additive genetic influences between lines under study, while the value of broad sense heritability were high NEP^{-1} and ED and the values was 0.55 and 0.45 .finally ,it is clear from the same table that the expected genetic improvement in the next generation as a preset was low for yield and yield component , as it ranged between 0.51 for ED and 5.22% for GYP^{-1} It is concluded from foregoing that it is possible to benefit from the line 2,3,4,5 and due to their significant and disrable effect of general combining ability for the most studied traits. These result are a line with the finding by (2, 5, 18).

Table 7. Variance components and genetic parametrrs for yield and yield components in maize.

Genetic parameter	NEP^{-1}	E D (cm)	NGR^{-1}	NRE^{-1}	300 GW (g)	GYP^{-1}g
σ^2A	0.006	0.003	1.691	0.384	15.195	154.966
SEA	0.003	0.002	0.830	0.184	7.233	73.533
σ^2 D	0.016	0.019	32.585	2.229	35.240	892.763
SEA	0.006	0.007	8.504	0.584	9.291	231.830
σ^2E	0.0183	0.026	1.054	0.097	2.216	15.316
SEA	0.003	0.004	0.176	0.016	0.369	2.553
σ^2G	0.022	0.022	34.276	2.614	50.435	1047.73
σ^2P	0.039	0.048	35.329	2.711	52.652	1063.05
h^2_{BS}	0.5513	0.4561	0.9702	0.9642	0.9579	0.9856
h^2_{NS}	0.1489	0.0611	0.0479	0.1416	0.2886	0.1458
GA	0.052	0.023	0.501	0.410	3.686	8.365
GA%	4.357	0.519	1.442	2.706	4.567	5.228

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