ESTIMATES OF COMBINING ABILITY USING DIALLEL CROSSES AMONG EIGHT NEW MAIZE INBRED LINES

AMER E. A.
Maize Research Section, FCRI , Sakha ARS , ARC , Egypt

ABSTRAC

Eight white maize inbred lines were crossed in diallel cross system in 2003 season to obtain28 single crosses .The 28 single crosses were evaluated in 2004 season at three locations i.e.Sakha ,Gemmeiza and Sids Agricultural research station to estimate G.C.A. and S.C.A. effects for determining the most superior genotypes for grain yield and some desirable agronomic traits. Based on the combined data, significant differences among the three locations for all studied traits. Were obtained the variation of genotypes (G) and genotypes × location (G×L) were significant for all studied traits, except(G×L)for no.of rows/ear. Highly significant differences were obtained for the variances of G.C.A and S.C.A for all traits. The interactions between G.C.A and S.C.A with location were significant for all traits except G.C.A×L and S.C.A×Lfor no.of rows/ear. The ratio of G.C.A / S.C.A. was greater than unity for all studied traits indicated that the additive gene effects play an important role in the inheritance of these traits.G.C.A.×L/ S.C.A×L were more than unity for all traits except No.of rows/ear. The inbred lines Sk-6016/5,SK-6016/20 and Sk-9195 exhibited the highest positive and significant G.C.A effects for grain yield, ear length and weight of 100 kernels. While, the they showed negative and significant G.C.A effects for silking date indicate earliness. The best S.C.A for grain yield exhibited in crosses between parents with poor and good G.C.A. These crosses were (Sk- 5026 ×Sk–6016/20), (Sk–5026xSk–9195),(Sk–5027×Sk–9195 and (Sk–5036×Sk–9195) which yielded 36.85,36.37,38.30 and 36.10 ard/fed, respectively, showing insignificantly increase than check

variety S.C.122 (34.92 ard/fed) while these crosses differed significantly for ear length and no.of rows/ear than the check variety S.C 122.These crosses were defined as superior and promising genotype for grain yield and other agronomic traits .

INTRODUCTION

The high yielding maize hybrids is considered among the main objectives of The National Maize Research Program to cover the increasing consumption of maize rural , animal feeding and poultry industry . Combining ability are needed to select the best inbreds lines to produce high yielding single crosses and to supply the breeding program with important information concerning the inheritance of grain yield and other desirable traits.Hallawer and Miranda(1981) stated that both general and specific combining ability effects should be taken in consideration when planning the maize into breeding program to produce and release new inbreds and crosses.Shehata et al.(1997),Mosa (1997)and EL-Zeir et al.(2001), estimated general and specific combining ability and their roles in the inheritance of grain yield , yield components and agronomic traits. They found that both G.C.A and S.C.A. effects were important in the inheritance of the most studied traits.Numerous investigators suggested that the estimates of additive genetic variance played an important role in the inheritance of grain yield than non–additive genetic variance, Matzinger et al (1959), Mahmoud (1996), Soliman and Sadak (1999) and Amer et al (2003).On the contrary, Nawar et al (1981), Hoballah and Radwan (1996), Mostafa et al (1996), Gaber (1997) and Mosa and Amer (2004) reported that dominance effects were more important in condition grain yield.

The main objective of this investigation was to estimate general and specific combining ability effects and their interaction with three location for diallel cross among eight inbred lines of maize to develop superior single crosses to improve the yielding ability in maize breeding programs.

MATERIALS AND METHODS

Eight maize inbred lines developed from different sources by the National Maize Research Program, ARC. were used in this study. These lines were Sk-6025,Sk-5027,Sk-5033,Sk-5036,Sk-6016/5,Sk-6016/20,Sk-9151 and Sk-9195. In 2003 season,The eight lines were crossed at Sakha agricultural research station in all possible combination without reciprocal by using adiallel cross technique to form 28 single crosses. In 2004 season, The 28 single crosses were evaluated at three locations i.e Sakha,Gemmeiza and Sids agricultural research station. A randomized complete block design with four replications were used at each location . Plot size was one row 6m long 80 cm wide 25cm between hills. A population density was 21.000 plants/feddan (0.42 ha).

The recommended cultural practices were applied at each location in the proper time. Data were recorded for number of days to 50% silking, plant height, ear height, grain yield (ard/fed) adjusted to 15.5% moisture, ear length, number of rows/ear and 100 kernels weight. The analysis of variance for each location and their combined data was done according to Griffing (1956) method 4 model I .

RESULTS AND DSCUSSION

Analysis of variance for the studied traits for combined over three locations are presented in Table(1).Significant differences among the three locations were found for all studied traits. These would indicate the great influence of environment on the expression of these traits. The variation of genotypes(G) and genotypes × location (G×L)were significant for all studied traits, except (G×L) for No of rows / ear. These results indicated that the genotypes and genotypes×Location differed from one location to another in most traits. These results were in agreement with Balko and Russell (1980), Morshed et al.(1990) and EL-Zeir et al .(1999) G.C.A and S.C.A mean squares were highly significant for all traits . This would indicate that G.C.A (additive effects) and S.C.A (non-additive effects) are important for the studied traits. Ratio of G.C.A./ S.C.A.was greater than unity for the studied traits. These indicated that the additive gene effects play an important role in the inheritance of these traits. These results are in agreement with those of Mareno–Gonzalez and Dudly (1981), Mann et al. (1981), Nawar et al (1981), Dawood et al. (1994), Mosa (1996), Mosa (1997) and Amer et al (2003) . The interactions between G.C.A.and S.C.A.with locations were significant for all traits except G.C.A.×L

S.C.A.×L for no.of rows/ear, indicating that additive and non additive effects were affectd by environments(L).while the ratio of G.C.A×L / S.C.A×L were more than unity for all the studied traits except No.of rows/ear, indicating that the additive gene effects were more interacted with environments than non additive gene effects for all the studied traits except no.of rows/ear. These results are in agreement with Matzenger et al (1959) where they suggested that the additive effects were biased by interaction with environments than the non-additive effects.

The mean performance for 28 single crosses over the three locations are presented in Table (2). The crosses (Sk-5026×Sk-6016/20), (Sk-5026×sk-9195),(Sk-5027×Sk-9195),(Sk-5036×Sk-9195)and(Sk-6016/5×sk-9195)had the highest grain yield of (36.85,36.37,38.30,36.10 and 36.46 ard/fed) respectively, out yielding insignificantly than check S.C.122 (34.92 ard/fed). Moreover ,most of the five crosses did not differd significantly from the check variety S.C.122 for ear height and weight of 100 kernel, while, all the five crosses differed significantly for ear length and No.of rows/ear than the check variety S.C122 . These results indicated that these five crosses could be utilized in maize hybrid breeding programs.

Estimates of general combining ability effects of eight parental inbred lines are presented in Table (3) . The positive estimates effects were desirable for all the studied traits, except silking date because negative estimates indicate earliness for this trait. Breeder preferred shorter hybrids with low ear placement, consequently, negative G.C.A.effects is also preferable for plant and ear height. Estimates either positive or negative my be most desirable and would indicate that a given cultivar is much better than the average of the group involved with it in the diallel crossing system. The reported results in Table (3) showed that parental inbred lines Sk-6016/5,Sk-6016/20 and Sk-9195 exhibited the highest positive and significant G.C.A.effects for grain yield, while the inbred lines Sk-6016/5,Sk-6016/20,Sk-9151 and Sk-9151 and Sk-9195 had negative and significant G.C.A effects for silking date indicating earliness. Meanwhile the inbred lines Sk-5026,Sk-5027Sk-5033 and Sk-9151 exhibited negative and significant G.C.A.effects for plant and ear height. The inbred lines sk-

6016/5,sk-6016/20 and sk-9195 the highest positive and significant G.C.A for ear length and weight of 100 kernels. These inbred lines possess favorable genes for developing and improvehybrids with short plants and earliness.

Specific combining ability effects for the F_1 crosses are presented in table (4). Desirable and negative significant effects were obtained for (13,12 and 12) single crosses for silking date, plant height and ear height, respectively. While, desirable and positive significant S.C.A.effects were obtained for(14,8,5 and 10)single crosses for grain yield, ear length, No.of rows/ear and weight of 100 kernels, respectively. It is worth noting that a good S.C.A. may come from two parents possessing good G.C.A. or from one with good G.C.A. and the other with poor G.C.A. for example, the best S.C.A. for grain yield exhibited in crosses between parents with poor and good G.C.A. these crosses were (Sk - 5026×Sk – 6016 / 20), (Sk-5026×Sk–9195),(Sk-5027×Sk–9195) and (Sk-5036×Sk–9195) which yielded 36.85,36.37,38.30 and 36.10 ard /fed, respectively. Similar findings were obtained by stuber et al (1966), Nawar and EL-Hosary (1985), Gaber (1997) and EL-Zeir (1998). It is concluded that the crosses (Sk-5026×Sk–6016/20), (Sk- 5026×Sk–9195), (Sk-5027×Sk– 9195)and(Sk-5036×Sk – 9195) and (Sk- 6016/5 × Sk–9195) produced the highest grain yield of 36.85,36.37,38.30,36.10 and 36.46 respectively, with increse insignificantly than check S.C 122, while differed significantly for ear length and no.of rows/ear .These five single crosses would be prospective and more efficiency to be used in maize breeding program.

Table (1) : Mean squares for seven traits combined over three locations

S.O.V	d.f	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard / fad	Ear length (cm)	No.of Rows / ear	100 kernal weight
Location (L)	2	651.636**	72300.20**	37211.47**	1561.28**	296.34**	2.687*	3225.03**
Error	9	9.588	1059.75	624.04	12.51	4.38	0.417	41.18
Genoypes (G)	27	184.95**	3616.10**	1169.53**	607.35**	36.87**	5.041**	409.52**
G C A	7	596.25**	7522.65**	1827.91**	1208.72**	86.232**	12.38**	1348.27**
S C A	20	40.99**	2248.81**	939.09**	396.87**	19.59**	2.472**	80.96**
G × L	54	4.69**	341.54**	113.58**	56.89**	3.814**	0.615	27.4**
GCA × L	14	10.12**	775.92**	187.98**	92.15**	9.218**	0.605	62.21**
SCA × L	40	2.79**	189.51**	87.55**	44.55**	1.923*	0.619	15.22**
Error	243	1.615	80.79	57.61	13.08	1.32	0.449	8.50
GCA / SCA		14.546	3.345	1.946	3.045	4.401	5.008	16.653
GCA × L /SCA ×L		3.627	4.094	2.147	2.068	4.794	0.977	4.087

* ,** Significant differences at 0.05 and 0.01 levels of probability, respective

Table (2) : Mean performance of 28 single crosses over three locations.

Crosses		Silking date (days)	Plant height (cm)	Ear height	Grain yield Ard / fad	Ear length (cm)	No.of Rows / ear	100 kernal weight
Sk-5026×Sk-5027		77.25	195.25	122.83	11.87	16.88	13.15	26.26
Sk-5026×Sk-5033		76.41	214.00	130.41	15.49	19.16	13.13	27.68
Sk-5026×Sk-5036		74.00	237.75	142.25	23.24	19.03	13.80	33.06
Sk-5026×Sk-6016/5		69.75	262.16	155.58	31.93	23.06	14.13	41.89
Sk-5026×Sk-6016/20		69.25	258.00	154.58	36.85	21.71	13.40	36.89
Sk-5026×Sk-9151		69.00	252.66	149.41	27.60	21.38	14.03	31.42
Sk-5026×Sk-9195		66.50	252.33	144.83	36.37	22.36	15.13	41.82
Sk-5027×Sk-5033		76.50	210.25	122.58	14.15	17.83	12.90	30.45
Sk-5027×Sk-5036		74.58	230.41	134.00	20.69	18.95	13.13	31.92
Sk-5027×Sk-6016/5		68.66	253.08	149.91	33.84	23.10	13.83	43.68
Sk-5027×Sk-6016/20		68.58	264.75	152.50	32.32	21.71	12.86	37.45
Sk-5027×Sk-9151		68.33	237.66	136.41	27.09	20.51	14.03	30.48
Sk-5027×Sk-9195		66.75	251.33	145.50	38.30	22.86	14.36	40.55
Sk-5033×Sk-5036		71.83	236.58	141.25	20.16	19.26	13.56	33.17
Sk-5033×Sk-6016/5		68.91	255.75	156.50	29.71	22.33	13.10	44.40
Sk-5033×Sk-6016/20		68.08	257.00	156.66	32.97	21.46	12.86	39.17
Sk-5033×Sk-9151		68.08	253.08	148.50	26.16	20.01	14.10	31.21
Sk-5033×Sk-9195		64.66	255.25	146.16	33.51	22.35	14.43	43.25
Sk-5036×Sk-6016/5		66.75	254.75	146.83	32.13	21.86	13.56	46.00
Sk-5036×Sk-6016/20		66.41	266.83	160.00	32.22	22.16	13.00	39.89
Sk-5036×Sk-9151		67.83	254.33	148.41	26.36	18.81	13.90	35.05
Sk-5036×Sk-9151		64.91	267.08	157.41	36.10	22.33	14.23	44.92
Sk-6016/5×Sk-6016/20		69.58	257.16	148.58	22.24	20.40	12.00	45.44
Sk-6016/5×Sk-9151		65.00	246.66	139.41	31.46	21.33	13.70	40.30
Sk-6016/5×Sk-9195		63.00	260.83	149.16	36.46	23.96	14.20	45.70
Sk-6016/20×Sk-9151		64.25	240.08	134.00	28.27	20.71	13.20	35.89
Sk-6016/20×Sk-9195		64.50	259.25	148.16	32.82	22.33	13.63	39.24
Sk-9151×Sk-9195		64.91	245.58	139.00	31.33	21.70	13.40	38.52
S.C 122		64.16	253.16	150.16	34.92	20.26	13.50	39.74
L.S.D	0.05	1.245	8.808	7.438	3.544	1.086	0.656	2.857
L.S.D	0.01	1.639	11.592	9.791	4.665	1.430	0.864	3.760

Table (3) : Estimates of general combining ability for eight inbred lines over the three locations

Inbred line	Silking date (days)	Plant height (cm)	Ear height (cm)	Grain yield Ard / fad	Ear length (cm)	No.of Rows/ ear	100 kernal weight
Sk-5026	3.51**	-10.05**	-2.55**	-2.82**	-0.67**	0.28**	-4.15**
Sk-5027	3.26**	-14.95**	-8.57**	-3.71**	-0.93**	-0.17*	-3.84**
Sk-5033	2.23**	-8.42**	-2.19**	-4.68**	-0.84**	-0.15*	-2.45**
Sk-5036	0.87*	2.54*	2.48**	-1.57**	-0.79**	-0.03	-0.02
Sk-6016/5	-1.56**	9.65**	5.12**	2.91**	1.42**	-0.07	7.23**
Sk-6016/20	-1.73**	11.76**	6.54**	2.92**	0.45**	-0.75**	1.66**
Sk-9151	-2.27**	-0.39	-3.34**	-0.40	-0.43**	0.23**	-3.48**
Sk-9195	-4.30**	9.86**	2.50**	7.35**	1.81**	0.66**	5.06**
L.S.D gi 0.05	0.27	1.94	1.63	0.78	0.23	0.144	0.629
0.01	0.36	2.55	2.15	1.28	0.31	0.190	0.828

Table (4) : Estimates of specific conbining ability for 28 single crosses over three locations.

Crosses	Silking date (days)	Plant height (cm)	Ear height	Grain yield Ard / fad	Ear length (cm)	No.of Rows/ ear	100 kernal weight
Sk-5026×Sk-5027	1.74**	-27.24**	-11.07**	-10.18**	-2.59**	-0.47**	-3.40**
Sk-5026×Sk-5033	1.94**	-15.02**	-9.87**	-5.63**	-0.27	-0.57**	-3.46**
Sk-5026×Sk-5036	0.88**	-2.24	-2.72	-0.82	-0.56**	-0.03	-0.55
Sk-5026×Sk-6016/5	-0.92**	15.07**	7.97**	3.28**	1.29	0.25	1.09
Sk-5026×Sk-6016/20	-1.25**	8.79**	5.56**	8.18**	0.34	0.27	1.66*
Sk-5026×Sk-9151	-0.96**	15.62**	10.28**	2.10*	1.48**	-0.04	1.40*
Sk-5026×Sk-9195	-1.43**	5.02*	-0.15	3.03**	0.31	0.60**	3.26**
Sk-5027×Sk-5033	2.27**	-13.87**	-11.68**	-6.07**	-1.59**	-0.36*	-0.93
Sk-5027×Sk-5036	1.71**	-4.67*	-4.94	-2.77**	-0.30	-0.40*	-1.86**
Sk-5027×Sk-6016/5	-1.75**	10.88**	8.34**	6.00**	1.55**	0.55**	2.54**
Sk-5027×Sk-6016/20	-1.67**	20.44**	9.50**	4.57**	1.11**	0.23	1.85**
Sk-5027×Sk-9151	-1.37**	5.52*	3.31	2.57**	0.75**	0.32*	0.09
Sk-5027×Sk-9195	-0.93**	8.93**	6.54**	5.89**	1.083**	0.14	1.70*
Sk-5033×Sk-5036	-0.004	-5.03*	-4.08*	-2.13*	-0.23**	0.16	-2.16**
Sk-5033×Sk-6016/5	-0.47	7.02**	8.53**	2.80**	0.62*	-0.13	1.90**
Sk-5033×Sk-6016/20	-1.14**	6.16**	7.28**	6.21**	0.68*	0.13	2.30**
Sk-5033×Sk-9151	-0.60*	14.41**	9.00**	2.62**	0.40	0.39*	-0.54
Sk-5033×Sk-9195	-1.99**	6.32**	0.82	2.19*	0.40	0.38*	2.90**
Sk-5036×Sk-6016/5	-1.28**	-4.95*	-5.82**	2.11*	0.16	-0.006	0.97
Sk-5036×Sk-6016/20	-1.44**	5.02*	5.93**	2.26*	1.63**	0.09	0.54
Sk-5036×Sk-9151	0.51	4.69*	4.24*	-0.32	-0.97**	0.27	0.85
Sk-5036×Sk-9151	-0.37	7.18**	7.39*	1.66	0.27	-0.07	2.22**
Sk-6016/5×Sk-6016/20	4.16**	-11.75**	-8.12**	-12.06**	-2.50**	-0.78**	-1.14
Sk-6016/5×Sk-9151	0.12	-10.09**	-7.40**	0.28	-0.69**	0.06	-1.15
Sk-6016/5×Sk-9195	0.14	-6.18**	-3.50	-2.40**	-0.44	0.05	-4.21**
Sk-6016/20×Sk-9151	-0.46	-18.78**	-14.23**	-2.99**	-0.30	0.07	-0.002
Sk-6016/20×Sk-9195	1.81**	-9.88**	-5.91**	-6.17**	-0.97**	-0.02	-5.22**
Sk-9151×Sk-9195	2.77**	-11.38**	-5.19**	-4.25**	-0.66**	-1.08**	-0.65
L.S.D ig 0.05	0.60	4.29	3.62	1.72	0.53	0.32	1.39
0.01	0.79	5.65	4.77	2.27	0.69	0.42	1.83

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الملـــــخص العربي

تقدير القدرة على التألف عن طريق اجراء جميع الهجن الممكنة بين ثمانية سلالات جديدة من الذرة الشامية

عصام عبد الفتاح عامر

مركز البحوث الزراعية – معهد المحاصيل الحقلية – قسم بحوث الذرة الشامية

تم اجراء جميع الهجن الممكنة بين ٨ سلالات جديدة بيضاء من الذرة الشامية عام ٢٠٠٢م لانتاج حبوب ٢٨ هجين فردى فى الجيل الأول . وفى عام ٢٠٠٤م تم تقييم الهجن الناتجة فى محطة البحوث الزراعية بسخا والجميزة وسدس بهدف تقدير القدرة العامة والخاصة على التالف لصفة محصول الحبوب وبعض الصفات الزراعية الأخرى.

وقد أوضحت نتائج تحليل الثلاث مواقع معا مايلى :

١- وجدت اختلافات معنوية بين المواقع لكل الصفات المدروسة.

٢- كانت الاختلافات الوراثية وتفاعلاتها مع المواقع معنوية لكل الصفات المدروسة فيما عدا تفاعل التراكيب الوراثية مع المواقع لصفة عدد السطور بالكوز .

٣- كانت كل من القدرة العامة والخاصة على التالف عالية المعنوية لكل الصفات المدروسة وكذلك التفاعل بين القدرة العامة والخاصة على التألف مع المواقع معنويا لجميع الصفات المدروسة فيما عدا صفة عدد السطور بالكوز.

٤- أظهرت النسبة بين تباين القدرة العامة على التألف الى القدرة الخاصة على التألف دور سائد للقدرة العامة للتألف (التباين الوراثى المضيف) فى توريث الصفات المدروسة.

٥- كانت القدرة العامة للتألف للآباء الاتية: (Sk -9195,Sk-6016/20,Sk-6016/5) موجبة ومعنوية لصفة محصول الحبوب وطول الكوز ووزن ١٠٠ حبة وسالبة ومعنوية لصفة عدد الأيام لظهور ٥٠% حريرة أى فى اتجاه التبكير.

٦- الهجن الفردية:-

(SK-5026×SK-9195),(SK-5026×SK-6016/20),(SK-6016/5×SK-9195),(SK-5036×SK-9195),(SK-5027×SK-9195).

كانت متفوقة فى محصول الحبوب حيث أعطت:-

36.85و 36.37 و38.30 و 36.10 و 36.46 أردب / فدان على التوالى بالمقارنة بصنف المقارنةS.C.122(34.92) أردب/فدان هذا بالإضافة إلى تفوق هذه الهجن معنويا عن صنف المقارنة S.C.122

فى صفة طول الكوز وعدد السطور بالكوز ولهذا يمكن الاستفادة بهذه الهجن المبشرة فى برامج التربية.