GENERAL AND SPECIFIC COMBINING ABILITIES AND THEIR INTERACTIONS WITH YEARS FOR EIGHT YELLOW INBRED LINES OF MAIZE (*ZEA MAYS* L.).

Ahmed L. Abdel-Mawgood[1], Mostafa S. F. El-Ashmooney[1], Bushra N. Ayaad[2] and Hesham T. Othman[2]

Received on: 5/8/2006 *Accepted on: 19/8/2006*

ABSTRACT

A diallel cross among eight selected yellow maize (Zea mays L.) inbred lines was made in 2002. The resulted 28 single crosses, in addition to two recommended commercial single crosses, were evaluated in 2003 and 2004 seasons at the Experimental Farm of Egaseed Company, Minia, Egypt. Four agronomic characters and grain yield and its components were recorded on ten competitive plants with each plot for four replications for each year. Combined analysis of variance was calculated and the variation among single crosses were partitioned into GCA and SCA, using Griffing's method 4 model I (fixed), while the year effect was assumed random. The GCA effects were significant for all characters and the SCA effects also, were, significant, except for number of days to mid-silking. The interactions between GCA and years were significant for eight out of the ten characters under study, while SCA x year interaction was significant only for six characters. Calculating the relative contribution of general and specific combining abilities and the environmental interaction with years showed that both interactions of GCA and SCA with years had a small source of variation among single crosses. Both the GCA and SCA were important components, with the GCA as a major component and SCA as a minor component for the studied characters, except for grain yield and number of kernels/row, where both types of combining ability were important. Six new single crosses were identified and they were recommended for extensive evaluation.

Keywords: *Diallel crosses, genetic x year interaction, general and specific combining abilities.*

INTRODUCTION

Maize is one of the major cereal crops for providing raw materials for the food industry and animal feed. The production area of maize, in Egypt, has been greatly increased, thus, the need for newly developed hybrids is needed to meet the demand of maize growers.

Information about the relative importance of general and specific combining abilities is playing an important role in maize improvement and in the development of commercial maize hybrids. Combining ability of inbred lines is the ultimate factor in determining the inbred lines suitable for developing commercial hybrids.

Heterosis has been used in maize breeding since Shull (1909) who described the concept of single-cross hybrids. The development of new hybrids depends on the combining ability of the lines involved in the production of these hybrids. Hence, since the introduction of double crosses for maize hybrid production (Jones, 1918), the evaluation of inbred lines to be used in crosses has been an important task in hybrid breeding programs.

The assessment of genetic variation of lines, proposed by Griffing (1956), is based on the concepts of general (GCA) and specific (SCA) combining abilities, established by Sprague and Tatum (1942), who presented detailed methods for analyzing fixed sets of lines or varieties in diallel crosses. Gardner and Eberhart (1966) suggested a model for analyses of fixed variety sets, in which the mean of an inter-varietal hybrid is determined by the value of the varieties *per se* and by heterosis and its components.

Sughroue and Hallauer (1997) concluded that the diallel mating design should only be used to estimate genetic parameters when the parents of the diallel have been randomly selected from a population in linkage equilibrium. However, when sets of lines or genotypes were available, the partial diallel cross (Geraldi and Miranda, 1988) has been suggested and crosses were made only among sets. The mating scheme is structurally similar to Design-II (Comstock and Robinson, 1948) and was designated "two-factor design" by Cockerham (1963). Although Design-II has been primarily suggested for estimating parameters in random samples from one reference population, it has, also, been used for the evaluation of combining ability of fixed or random sets of inbred *lines* (Hoegemeyer and Hallauer, 1976; Stangland *et al.*, 1983; Lamkey and Hallauer, 1986).

Significant GCA and SCA effects were estimated by El-Hosary and Sedhom (1990) for grain yield and some agronomic traits and that the magnitude of their ratio indicated the importance of additive and additive x additive effects. Interaction was higher for GCA than SCA in most traits. Mathur and Bhatnagar (1995) indicated that combining ability analysis played a major role for additive gene effects for number of days to tasseling and silking. On the other hand, Dehghanpour *et al.* (1996), estimated GCA and SCA means squares and were found to be significant for all studied characters. This indicates that additive and non-additive gene actions were involved in the genetic variability of the characters examined. However, non-additive (dominance) effects

1, Agronomy Department, Faculty of Agriculture, Minia University, Minia, Egypt.
2, Egaseed Company, Minia, Egypt
*, email address:mawgood9@yahoo.com

appeared to be more important in the expression of these traits.

The main objective of this work was to use diallel cross mating, without reciprocals, to estimate the general and specific combining abilities and their interactions with year for newly developed inbred lines of yellow maize. These data might be used to design and develop single crosses of yellow maize.

MATERIALS AND METHODS

The present investigation was undertaken during the summer of 2002, 2003 and 2004 seasons at Maghagha Agricultural Research Station, Egaseed Company, Minia, Egypt. Eight yellow inbred lines of maize were used in a diallel cross mating without reciprocals. The parental inbred lines were developed by the maize breeding program at Egaseed Company through self pollination for at least ten generations. The pedigree and origin of these parental lines are presented in Table 1.

In e 2002 summer season, diallel cross was made producing 28 F1 single crosses. The 28 F1 in addition to two commercial yellow varieties as checks (S.C. 3062 and S.C. 155) were evaluated in two consecutive seasons, (summer of 2003 and 2004 seasons). The experimental design was a randomized complete block (RCBD), with four replications. The plot size in each experiment consisted of two guarded rows, 6 m long and 0.70 m apart.

The following characters were recorded on plants chosen at random from each plot:

1- Number of days to 50 % pollen shedding measured as the number of days from sowing to the day when 50 % of plants shed their pollen.
2-Number of days to 50 % silking measured as the number of days from sowing to the day on which 50 % of the plants showed up visible silks,
3-Plant height (cm) determined as the distance from the soil surface to the base of the flag leaf,
4-Ear height (cm), was determined as the distance between soil surface and the base of upper- most ear,
5- Ear length (cm),
6- Ear diameter (cm),
7- Number of rows/ear,
8- Number of kernels /row,
9- 1000-kernel weight (g),
10- Grain yield, (kg/plot).

The percentage of the various components to the variance among single crosses also, was, calculated. The analysis of variance was performed for the F_1 diallel crosses for each year, separately, as well as for the combined. The effects of both blocks and years were assumed to be random, while the line effect was fixed (Hallauer and Miranda, 1981).

Estimates of general and specific combining ability effects were calculated, as given by Griffing (1956), using method 4 Model I. The estimates of variance components and constants were calculated, according to the EMS given in Table 2.

The variance among the 28 single crosses was calculated as:

$\sigma^2_e/8 + \sigma^2_{sy}/2 + \sigma^2_{gy}/2 + K^2_s + K^2_g$

Where σ^2_e= estimates of experimental error variance,
σ^2_{sy} = SCA x year variance components,
σ^2_{gy} = GCA x year variance components,
and K^2_S and K^2_g = constant components of EMS for GCA and SCA means squares.

RESULTS AND DISCUSSION

Combined analysis of variance for the diallel crosses for agronomic characters is given in Table 2. Difference between the two years was not significant for the two flowering characters, number of days to 50 % pollen shedding and mid-silking, indicating that the two flowering characters were stable with respect to the environmental conditions. On the other hand, the difference between the two years was significant for plant and ear heights. The genetic differences, among the 28 single crosses, were partitioned into GCA and SCA effects and their interaction with years. The two components were highly significant for the four agronomic characters under study. Also, the GCA x years was highly significant for the flowering characters only. The SCA x yeas interaction was not significant for either plant or ear heights.

The combined ANOVA for grain yield and its components is given in Table 3. Significant differences, due to years, were detected for grain yield, ear length, no. of rows/ear and number of kernels/row, while it was not significant for ear width and 1000-kernel weight. Both the GCA and SCA were significant for the six characters, except for SCA for 1000-kernel weight. Both year interactions with GCA and SCA were significant for grain yield, ear width and number of rows/ear.

GCA x year interaction was significant for ear length, and SCA was significant for 1000-kernel weight. Both types of interaction with years was not significant for number of kernels/row, indicating that both GCA and SCA effects were consistent across the two years. Hallauer and Mirinda (1981) summarized the results from different diallel crosses and showed that the magnitude of GCA and SCA would depend on the lines under evaluation, as well as the environmental conditions of the experiments.

The relative importance of GCA and SCA varied from one study to another. Sprague and Tatum (1942) showed that GCA was more important for non-selected lines, while the reverse was true for selected lines, as shown by Matzinger *et al.*, (1959). However, this conclusion is not consistently true. In general, the amount of GCA and SCA would depend upon the line under evaluation.

Estimates of GCA effects, for the eight lines under study, are given in Table 4. Estimates of GCA for both characters of flowering were almost similar. The early group consisted of lines, 5, 6 and 7, while the late group included 2 and 4 lines. Similarly, both plant and ear heights had similar effects. The tallest combiners were 1 and 3 lines and the shortest combiners were 5, 6 and 7. The rest of lines were inconsistent. The longest ear lengths were these of 1 and 3 lines, while the shortest were those 5, 6 and 8 lines.

GCA of ear width ranged from -0.28 to 0.26. The thinned group included lines, 5 and 8, while the thickest lines were 2 and 3 lines. GCA effects of number of rows/ears ranged from -0.91 to 0.94, with 2 and 3 lines that were the highest and 4 and 7 lines the lowest in number of rows. For number of kernels/row, the GCA effects ranged from – 1.11 to a maximum of 1.18. Line 2 was the highest in both number of rows and number of kernels/row.

The GCA effects for 1000-kernel weight ranged from -42.9 to 36.3. The heaviest GCA was recorded for line 1 and 7, while the lightest GCA was recorded for line 5 and 8. For grain yield, GCA effect ranged from -0.43 to 0.28. Lines 4, 6 and 7 had a significant negative effect, while lines 1, 2, 3 and 8 had a significant positive effect.

Summary of the SCA effects for the 28 hybrids, grown for two years are presented in Table 8. The magnitude of SCA was comparable to GCA. The number of significant SCA ranged from 6 to a maximum of 12 (42.9%), indicating that SCA was less important than GCA.

The estimates of various variance components and constants of the environmental and genetic parameters are given in Table 5. The main components of the variation, among the 28 hybrids under test, were due to GCA effects (K^2_g) for number of days to pollen-shedding, mid-silking, plant and ear heights, ear width and 1000-kernel weight. For ear length and number of kernels/row, both the environmental and GCA components had the major share. The environmental components of number of kernels/row and grain yield were the highest, followed by SCA and GCA effects.

To compare the importance of environmental, genotypic and genotypic x year interaction of the 28 single crosses, the relative contribution of previous components were calculated as advised by Baker (1987), and they are given in Table 6. The portion of the environmental variation was less than 5% for all studied characters except for ear length, grain yield, and number of kernels/ear, where the effect of environment ranged from 5.8 (ear length) to 11.9 (number of kernels/ear). The interaction between SCA and year was less than 5% for all characters, except for 1000-kernel weight (8.2%) and grain yield (6.4%). On the other hand, the GCA x year interaction ranged from 0 (for number of kernels/ear and 1000-kernel weight) to a maximum of 3.3 for grain yield. Both GCA and SCA accounted for about 90% of the variation among single crosses. However, GCA had a major share and SCA had a minor portion, except for grain yield and number of kernels/ear and they were both the main sources of variation. The respective portions of GCA and SCA were 54.7 and 33.4% (for number of kernels/ear) and 31.9 and 52.1% for grain yield.

In summary, it could be concluded that, although the variation due to the interaction between GCA and SCA were significant, they played a minor role in the inheritance of the ten characters under study. GCA was the major source of variation for nine characters, while SCA was the major contributor for number of kernels/ear.

Combining ability of inbred lines is the main factor, determining future usefulness of the lines for hybrids. Sprague and Tatum (1942) emphasized that GCA and SCA were relative to and dependent on the set of inbred lines under evaluation. They found that GCA was more important than SCA for unselected lines and the reverse was true for previously selected lines. However, Hallauer and Miranda (1981) indicated that the relative importance of GCA and SCA depended on types of genetic materials used, methods used and traits studied. They indicated that GCA was the function of the additive genetic variance, while the SCA was due to dominance variance in the absence of epistasis.

The highest yielding ten single crosses among the 28 single crosses under evaluation and their characters are given in Table 7. As shown in Table 3, the highest value for GCA was recorded for lines 1, 3 and 8. These lines were one of the parents of 5, 4 and 3 of the top yielding single crosses, respectively. None of the top yielding single crosses outyielded the Pioneer check hybrid, SC 3062. However, seven hybrids surpassed the recommended hybrid, G S.C. 155. The top yielding hybrid, L1 x L3, was similar to SC 3062 in plant height. It was later in silking by 4.4 days; however, its ear diameter and length were higher. At the same time, 1000-kernel weight for L1 x L3single cross was lighter than the two check cultivars. The top yielding six single crosses were not significant from the best check hybrid. These hybrids (L1 xL3, L1 x L8, L5 x L8, L1 xL5 and L1 xL2) are recommended for further evaluation across more locations.

Table (1): Pedigree and origin of the parental inbred lines used in the study.

No.	Ega line No.	Pedigree	Origin
L1	4559	Antigua G2XA.E.D	CIMMYT(Mexico)
L2	5129	ACROSS 8645	CIMMYT(Mexico)
L3	4850	POOL 31(IITA)	CIMMYT (Mexico)
L4	4967	ACROSS 8624	CIMMYT(Mexico)
L5	5082	ACROSS 8536	CIMMYT(Mexico)
L6	5744	K.Y 4174	U.S.A
L7	4627	POP 45 Y	CIMMYT(Mexico)
L8	5032	ACROSS 8528	CIMMYT(Mexico)

Table 2. Combined ANOVA for 8 x 8 maize diallel cross grown over two years for four agronomic characters.

SOV	MS					
	Number of days to 50% pollen-shedding	Number of days to silking	Plant height (cm)	Ear height (cm)	D.F	EMS
Years (Y)	0.02	5.79	19388**	17395**	1	
Rep/Y	3.10	3.06	246	53	6	
Gca	183.44**	157.60**	4082**	5472**	7	$\sigma^2_e + 24\sigma^2_{gy} + 48 K^2_g$
Sca	7.28**	7.59**	218**	234**	20	$\sigma^2_e + 4\sigma^2_{sy} + 8 K^2_s$
gca x Y	4.08**	2.64**	211**	165**	7	$\sigma^2 e + 24\sigma^2_{gy}$
sca x Y	1.05**	0.63*	26	72	20	$\sigma^2_e + 4\sigma^2_{sy}$
Combined error	0.33	0.33	55	42	162	σ^2_e
Mean	56.4	55.5	262	148		
C.V	1.0	1.0	2.8	4.4		

*, ** indicate significance at the 0.05 and 0.01 levels of probability, respectively.

Table 3. Combined ANOVA for 8 x 8 maize diallel cross grown at two years for grain yield and its components.

	MS					
	Grain yield (kg/plot)	**Ear length (cm)**	**Ear width (cm)**	**1000 kernel weight (g)**	**Number rows/ ear**	**Number Kernels/ row**
Year (Y)	6.8285**	29.87**	0.0457	1732	6.18*	601.60**
Rep/Y	0.5768	0.74	0.143	1746	0.65	23.85
GCA	3.5640**	34.84**	1.2126**	27420**	27.73**	25.10**
SCA	0.8712**	3.41**	0.1112**	1470	2.84*	16.00**
GCA x Y	0.5086**	1.95*	0.0402*	218	1.71*	1.06
SCA x Y	0.2488*	0.53	0.0288*	1084**	1.09**	2.68
Combined error	0.1229	0.89	0.0150	213	0.55	2.91
Mean	4.94	22.1	5.03	322	17.3	45.3
CV%	7.1	3.5	2.4	4.5	4.3	3.8

***, ** indicate significance at the 0.05 and 0.01 levels of probability, respectively.**

Table 4. Estimates of the GCA effects for the eight lines calculated from the 8 x 8 maize diallel grown at the two years for characters under study.

Characters	GCA effect							
	g1	g2	g3	g4	g5	g6	g7	g8
Number of days to pollen-shedding	0.02	1.69*	0.90*	2.50*	-1.04*	-2.44*	-2.88*	1.25*
Number of days to mid silking	-0.19*	1.19*	1.08*	2.60*	-0.88*	-2.06*	-2.75*	1.00*
Plant height (cm)	16.7*	-0.4	11.2*	-4.5*	-10.6*	-3.6*	-6.1*	-2.7*
Ear height (cm)	20.1*	1.8*	2.6*	6.9*	-10.3*	-13.3*	-7.3*	-0.4
Ear length (cm)	1.77*	0.04	0.61*	-0.16	-0.65*	-0.53*	-0.48*	-0.69*
Ear width (cm)	-0.04*	0.26*	0.16*	0.01	-0.28*	0.09*	-0.03*	-0.11*
No of rows ear^{-1}	-0.62*	0.94*	0.81*	-0.91*	0.65*	0.20	-0.90*	-0.17
No of kernels ear^{-1}	0.64*	1.18*	0.15	0.74*	-0.17	0.08	-0.23	-1.11*
1000 kernel weight (g)	36.3*	0.08	8.2*	-1.3	-42.9*	-6.1*	21.7*	-16.1*
Grain yield kg ($plot^{-1}$)	0.28*	0.13*	0.28*	-0.43*	-0.05	-0.26*	-0.18*	0.24*

***, ** indicate significance at the 0.05 and 0.01 levels of probability, respectively.**

Table 5. Estimates of genotypic, environmental and genotypic x environmental parameters derived from 8x8 maize diallel grown over two years for different characters.

Characters	Estimate of variance components or constant				
	σ^2_e	σ^2_{sy}	K^2_s	σ^2_{gy}	K^2_g
Number of days to pollen-shedding	0.33	0.18*	0.16**	0.78**	3.74**
Number of days to mid silking	0.33	0.08*	0.10**	0.87	3.23**
Plant height (cm)	55.06	0.00	6.48**	23.94**	80.66**
Ear height (cm)	41.81	7.54*	5.14**	20.27**	110.56**
Ear length (cm)	0.89	0.00	0.04*	0.36**	0.69**
Ear width (cm)	0.0150	0.0034*	0.0011*	0.0103**	0.0244**
No of rows ear^{-1}	0.55	0.14*	0.05*	0.22*	0.54**
No of kernels ear^{-1}	2.91	0.00	0.00	1.67**	0.51**
1000 kernel weight (g)	213	218**	0.20	55.2**	567**
Grain yield kg plot^{-1}	0.1229	0.0315**	0.0160**	0.0778**	0.0636**

***, ** indicate significance at the 0.05 and 0.01 levels of probability, respectively.**

Table 6. Relative contribution of environmental, general combining ability (GCA) and specific combining ability (SCA) and their interaction with year (Y) to the variation among the 28 single crosses means grown over two years.

Characters	Relative contribution (%)				
	Environmental σ^2_e /ry	SCA*Y/y	GCA*Y/y	SCA	GCA
Number of days to pollen shedding	0.8	1.0	0.9	9.1	88.2
Number of days to mid silking	0.6	0.5	0.7	11.7	86.5
Plant height	3.5	0.0	1.7	12.3	82.5
Ear height	2.1	1.5	1.0	8.0	87.4
Ear length	5.8	0.0	1.1	19.3	73.8
Ear width	3.0	2.7	0.9	16.3	77.1
No of rows ear^{-1}	5.0	4.7	1.6	15.0	73.7
No of kernels ear^{-1}	11.9	0.0	0.0	54.7	33.4
1000 kernel weight	2.0	8.2	0.0	4.2	85.6
Grain yield plot^{-1}	6.3	6.4	3.3	31.9	52.1

Table 7. Mean performance of the ten top yielding single crosses and the two check hybrids averaged over the two years.

Single cross	Grain yield (kg plot^{-1})	No. of days to mid silking	Plant height (cm)	Ear length (cm)	Ear width (cm)	No. of rows (ear^{-1})	No. of kernels row^{-1}	1000-kernel weight (g)
L2xL3	5.99	59.9	282	22.1	5.63	20.3	44.9	328
L1xL8	5.87	57.9	275	23.4	4.90	16.7	43.8	347
L5xL8	5.50	56.4	251	20.8	4.70	17.7	42.5	273
L3xL8	5.49	59.3	278	23.3	4.93	17.3	47.7	311
L1xL5	5.39	53.9	266	23.3	4.70	17.4	46.6	308
L1xL2	5.38	58.6	280	24.6	5.15	16.8	46.3	383
L2xL5	5.33	56.0	247	21.4	5.05	19.0	47.3	280
L3xL6	5.12	54.5	262	22.2	5.20	17.9	45.5	335
L3xL7	5.04	53.7	268	22.1	4.98	16.8	43.9	353
L1xL7	5.02	53.7	277	22.8	5.00	16.7	42.7	267
SC 3062	5.74	55.5	283	21.0	5.20	14.8	46.2	405
SC 155	4.88	53.5	297	18.1	5.10	15.1	38.2	404
LSD(5%)	0.36	0.7	8	0.8	0.13	0.8	1.9	15

Table 8. Summary of SCA effects of the 28 single crosses grown over two years.

Statistic	Grain yield (kg plot^{-1})	No. days to pollen shedding	No. of days to mid-silking	Plant height (cm)	Ear height (cm)	Ear length (cm)	No. of rows ear^{-1}	No. kernels row^{-1}
Max Min	0.62 -0.61	2.76 -1.72	2.72 -1.49	9.4 -9.6	7.2 -11.2	1.16 -1.22	1.29 -0.65	2.91 -3.51
No. of significant positive SCA	6	7	6	3	6	5	5	3
No. of significant negative SCA	3	10	6	4	5	7	5	3
Percent of significant SCA	32.1	60.7	42.9	25.0	39.3	42.9	35.7	21.4
Hybrids with significant desirable SCA	1 x 8 2 x 3 2 x 5 4 x 7 5 x 8 6 x 7	1 x 5 2 x 5 2 x 6 3 x 5 3 x 7 4 x 8 5 x 8 6 x 7 6 x 8 7 x 8	1 x 5 2 x 5 2 x 6 3 x 5 3 x 7 6 x 8	2 x 4 2 x 8 3 x 6 7 x 8	1 x 3 1 x 8 2 x 5 3 x 6 6 x 7	1 x 2 2 x 7 3 x 8 4 x 6 5 x 7	1 x 7 2 x 3 2 x 8 4 x 5 6 x 7	3 x 8 5 x 7 6 x 7

REFERENCES

Baker, R.J. (1978). Issues in diallel analysis. Crop Sci. 18:533-536.

Cockerham, C.C. (1963). Estimation of genetic variances. In: Statistical Genetics and Plant Breeding (Hanson, W.D. and Robinson, H.F., eds.). NAS-NRC Publication No. 982, Washington, D.C., U.S.A. pp. 53-94.

Comstock, R.E. and H. F. Robinson. (1948). The components of genetic variance in populations of biparental progenies and their use in estimating the average degree of dominance. Biometrics 4:254-266.

Dehghanpour, Z., B. Ehdaie and M. Moghaddam. (1996). Diallel analysis of agronomic characters in white endosperm corn. J. of Genetics and Breeding 50(4): 357-365.

El-Hosary, A. A. and S. A. Sedhom. (1990). Diallel analysis of yield and other agronomic characters in maize (*Zea mays* , L.). Annals of Agric. Sci. 28: 4, 1987-1998, Moshtohor, Egypt.

Gardner, C.O. and S.A. Eberhart. (1966). Analysis and interpretation of the variety cross diallel and related populations. Biometrics 22: 439-452.

Geraldi, I.O. and J. B. Miranda. (1988). Adapted models for the analysis of combining ability of varieties in partial diallel crosses. Braz. J. Genet. 11: 419-430.

Griffing, J. B. (1956). Concept of general and specific combining abilities in relation to diallel systems. Austr. J. Biol. Sci. 9: 463-493.

Hallauer, A. R.and J. R. Miranda. (1981). Quantitative Genetics in Maize Breeding. Iowa State University Press, Ames, Iowa, USA.

Hoegemeyer, T.C. and A. R. Hallauer. (1976). Selection among and within full-sib families to develop single crosses of maize. Crop Sci. 16: 76-81.

Jones, D.F. (1918). The effects of inbreeding and crossbreeding upon development. Connect. Agric. Exp. Sta. Bull. 207: 5-100.

Lamkey, K.R. and A. R. Hallauer. (1986). Performance of high x high, high x low and low x low crosses of lines from BSSS maize synthetic. Crop Sci. 26: 1114-1118.

Mathur, R. K. and S. K. Bhatnagar. (1995). Partial diallel cross analysis for grain yield and its component characters in maize (*Zea mays* L.).Annals of Agric. Res. 16 : (3): 324-329.

Matzinger, D. F., G. F. Sprague and C. C. Cockarham. (1959). Diallel crosses of maize in experiments repeated over locations and years. Agron. J. 51:346-350.

Shull, G.F. (1909). A pure line method of corn breeding. Amer. Breed. Assoc. Rep. 5: 51-59.

Sprague, G.F. and L. A. Tatum. (1942). General vs. specific combining ability in single crosses of corn. Amer. Soc. Agron. 34: 923-932.

Stangland, G.R., W. A. Russell and O. S. Smith. (1983). Evaluation of the performance and combining ability of selected lines derived from improved maize populations. Crop Sci. 23: 647-651.

Sughroue, J.R. and A R. Hallauer. (1997). Analysis of the diallel mating design for maize inbred lines. Crop-Sci.37: 400-405.

الملخص العربى

القدرة العامة و الخاصة على الإئتلاف و تفاعلهما مع السنوات لثمانى سلالات من الذرة الشامية الصفراء

د. أحمد ل. عبدالموجود ، د. مصطفى س. الأشمونى ، د. بشرى بشاى و هشام توفيق

تهدف هذه الدراسة الى تقدير القدرة العامة و القدرة الخاصة على الائتلاف و تفاعلهم مع الأعوام لعدد ثمانى سلالات من الذرةالشامية الصفراء. تم اجراء كل الهجن التبادلية الممكنة بين هذه السلالات من الذرة الشامية فى موسم ٢٠٠٢. و تم تقييم هذه الثمانى و عشرين هجينا فرديا بالإضافة الى اثنين من الهجن الفردية التجارية فى موسمى ٢٠٠٣ و ٢٠٠٤ بمحطة البحوث والتجارب الزراعية فى شركة ايجاسيد بمحافظة المنيا. تمت دراسة عدد من الصفات النباتية بالاضافة الى صفات محصول الحبوب ومكوناته على عشر نباتات داخل كل قطعة تجريبية. وحسب تحليل التباين لكلا الموسمين معا و تم تقصيص التباين الى قدرة عامة و قدرة خاصة على الائتلاف باستخدام طريقة Griffing's method 4 model-I واعتبر تأثير السلالات ثابتا بينما تأثير الاعوام عشوائيا. و تبين من التحليل ان القدرة العامة على الخلط كانت معنوية فى كل الصفات و كذلك القدرة الخاصة كانت معنوية لجميع الصفات ما عدا صفة ميعاد طرد ٥٠% من الحريرة.و اظهرت ثلاث سلالات من السلالات الثمانية قدرة عامة موجبة على الائتلاف لصفة محصول الحبوب.و كان التفاعل بين القدرة العامة على الائتلاف والسنوات معنويا لثمانى صفات من الصفات المدروسة. حسبت نسبة مساهمة مصادر الأختلاف المختلفة للاختلافات بين الهجن الفردية وظهر ان نسبة مشاركة التفاعل بين القدرة العامة و الخاصة و الأعوام محدودة ، فى حين ان النسبة العظمى كانت للقدرة العامة لثمان صفات و لعبت القدرة الخاصة جزءا ثانويا من الإختلاف. بالنسبة لصفة محصول الحبوب و عدد الحبوب لصفوف الكوز لعبت القدرة العامة و الخاصة دورا مهما. وتم التعرف على ستة هجن فردية كانت متميزة فى المحصول و رشحت لمزيد من التقييم مستقبلا.