J. Agric. Sci. Mansoura Univ., 27 (2): 733 - 737, 2002

COMPARISON AMONG THE FOUR METHODS OF GRIFFING (1956) IN COMPLETE DIALLEL SET OF MAIZE INBRED

Galal, A.A.; E.A. Amer and A.A. El-Shenawy
Field Crops Research Institute, Agric. Res. Center.

ABSTRACT

Complete diallel set of 7 inbred, 21 single crosses and 21 reciprocal crosses were used for this study. The four methods of Griffing 1956 computed to obtain general combaining ability (G.C.A),spicific combining ability (S.C.A) and reciprocal effects for six characters. Grain yield (ard/fed), silking date, plant height, ear height, resistance to late wilt and resistance to downy mildew diseases were recorded. Generally, the results based on mean ($\bar{x}$), coefficient of variability (C.V) experimental error ($\sigma^2 e$) and appropriate G.C.A/S.C.A mean square ratio emphasized that method – 4 was suitable in the case of diallel study for all studied traits, while the results optioned depending on including G.C.A/S.C.A ratio revealed that method –3 including single crosses and their reciprocal gave similar results with respect to gene action

INTRODUCTION

General and specific combining ability were firstly defined by Sparague and Tatum (1942). The term of general combining ability is used to designate the average performance of a line or a population in hybrid combinations. The term of " specific combining ability " is used to designate these cases in which certain combinations do relatively between or worse than would be expected on the base of the average performance of the parents involved. Griffing (1956) developed four method for analyzing diallel crosses. The apropriate model chosen for this study was method-4, model-1. Several investigators used method -4 to obtain. G.C.A and S.C.A are including the crosses only in diallel sests. However numerous investigators used method -2 which involving parents and their crosses (Aly, 1999). Mean while few investigators used method-1, to obvious the maternal or reciprocal effects, (Mousa, 1997). And El-shenawy and Tolba (2001). who found that the maternal effects was important in genetic study of maize, Dawood el al (1994) compared two methods of diallel cross analysis in maize and they found that Griffing (1956) method-4 model-1 was appropriate method for genetic analysis in maize The ultimate goal of this study was to compare among the 4 methods whose developed by Griffing (1956). To determine the appropriate method for obtaining G.C.A and S.C.A in addition of reciprocal effects in complete diallel set for six characters.

MATERIALS AND MOTHEDS

This study was assess to compare the four statistical genetics of Griffing methods1956.In 1999 seven inbreds of maize were crossed in complet diallel set at Sakha Agricultural Research Station. These inbreds were sd.34 sk-36 , sd. 58, sd.62, sk-170, sk-266 and G.603.The 7 inbred, 21 single crosses and their reciprocal were tested at Sakha Station in 2000 and 2001 seasons. The experiment arranged in randomized complet black design (R.C.B.D.) with four replications. The plot size was one row, 80 cm appart

and 25 cm between hills. Data were recorded on grain yield (ard/fed), 50% silking, plant and ear height, resistance to late wilt percent and resistance to dawny mildew percent .The analysis of variance was carried out by the four analysis method of diallel cross according to Griffing (1956) method 1,2,3 and 4 model –I. Using high speed computer. The homogenity of error was tested using Bartlett test according to Sendecor and Cochran (1967).

RESULTS AND DISCUSSION

Tables 1,2.3.and 4 show analysis of variance for the four methods Griffing 1956 model 1. The variance between years for all methods were significant for silking date, ear height,. The resistance to late wilt and resistance to downy mildew disease were not significant, however the significance obtained for grain yield (ard/fed) method-2 and method – 4. The genotypes variations were significant for all studied characters in four Griffing's method. The G.C.A mean squares were significant for all traits at method–1, method–2 and method-3 but G.C.A in method – 4 was significant in all traits except grain yield and plant height were not significant. Variances of S.C.A were significant in all method for all traits except resistance to late wilt disease was not significant in methods 2 and 4. The reciprocal variances were significant in methods 1and 3 for all traits with respect to the first order interaction by years, in the four methods, G.C.A x y, S.C.A x y and r x y appeared significant for the six traits and could by negligible. The previews result concluded that S.C.A effect were the majority of then G.C.A effect for all traits, althow the two component were the same important. In this respect, Nawar (1985), compared between seven analysis of diallel crosses in maize included the two Griffing's method-2 and 4, model-II, Gardner's method 1967 and Hayman 1954 a and b. They showed that the genetic analysis which were carried out by different methods of analysis of diallel crosses, in general, gave a similar results with respect to gene action. Table (5) shows means, C.V, σ^2 e and G.C.A/S.C.A with respect to mean values, method-4 including single cross in one way represent the highly values for five traits folwed by method –3 including crosses and reciprocal, mean while silking date gave the revears twared earliness. Regarding to the coeffecient of variabilities and the environmental variances (σ^2 e), the results showed that the lowest and reliabilte C.V and, σ^2 e obtained in method-3 for all traits studied except for resistance to downy mildew disease whereas method-3 was the lowest C.V. and G.C.A/S.C.A. mean squares ratio, method–3 has high valus flowed by method– 4 for grain, plant height and resistance to late disease characters, meanwhile the contrast was occurred for silking date, ear height and resistance to dawny mildew disease, whereas method-4 gave the highest ratio flowed by method –3. The conculusion that the results best on means ($\bar{x}$), coefficient of variability (c.v), environmental variances (σ^2e), and appropriate G.C.A/S.C.A mean square ratio emphasized that method-4 was suitable in the case of diallel study for all characters, while the results obtained depending on G.C.A/S.C.A ratio revealed that method-3 including single crosses and their reciprocal gave a similar result with respect to gene action

Table (1): Combined analysis of variance of complete diallel set for six studied traits according to Griffing(1956) method-1 model-1 over all two years.

S.O.V	d.f	Grain yield ard/fed	50 % silking	Plant height	Ear height	R.L.W.	R.D.M.
Years(y)	1	33.0**	9286.9**	1370.6	6604.3**	660.7*	321.5
Rep./y	6	72.8	70.24	3688.9	1003.8	162.7	942.7
Genotype(G)	48	457.8**	47.87**	7962.3**	3532.4**	450.8**	4360.8*
g.c.a	6	118.8**	8.89**	1859.1**	19804.3**	360.8**	1421.8**
s.c.a	21	936.4**	95.73**	15353.8**	5987.0**	395.1**	5208.6**
Recip.	21	76.1**	11.15**	2314.6**	1542.9**	532.3**	4352.8**
G XY	48	23.7	2.31	284.5	171.5*	11.8	461.2*
g.c.a x y	6	33.1	2.26	328.2	170.5	145.4	598.9*
s.c.a x y	21	14.0	1.66	315.4	208.2*	102.6	527.0
Recip x y	21	30.8	2.97	241.1	135.2	108.9	356.0
Poold error	288	17.7	2.20	273.3	113.3	99.1	313.7
X		29.66	66.9	291.2	164.6	92.9	56.7
C.V.		14.2	2.21	5.7	6.4	10.7	31.2

Table (2): Combined analysis of variance of complete diallel set for six traits according to Griffing (1965) Method-2 Model-1 over all two years .

S.O.V	d.f	Grain yield ard/fed	50 % silking	Plant height	Ear height	R.L.W	R.D.M
Years(y)	1	153.6**	5580.1**	180.4	3528.2**	1538.8	1383.1
Rep./y	6	40.9	60.5	2762.3	500.5	254.9	578
Genotype(G)	27	704.5**	66.5**	13158.2**	5412.4**	330.6**	4517**
g.c.a	6	60.1	4.5	1145.5	1129.9*	167.5	1256.4
s.c.a	21	435.7**	41.4**	8131.5**	3156.6**	164.7	2544.8**
GxY	27	21.98	2.82	307.2	217.1*	136.2	446.5
g.c.a x y	6	15.1	1.64	273.4	205.7	127.6	305.6
s.c.a x y	21	9.8	1.36	119.4	80.8	51.1	199.7
Error	162	17.1	2.29	252.6	134.8	111.6	343.7
X		27.9	67.5	290	163.5	93.6	56.4
C.V.		14.8	2.24	5.48	7.1	11.3	32.9

Table (3): combined analysis of variance of complete diallel set for six traits according to Griffing (1956) Method-3 Model-1 over all two years.

S.O.V	D.F.	Grain yield ard/fed	50 % silking	Plant height	Ear height	R.L.W.	R.D.M.
Years(y)	1	24.67	7956.0**	1022.0**	6283.4**	443.9	35.69
Rep./y	6	69.8	45.8	3220.8	920.2	96.1	1134.9
Genotype(G)	41	58.9**	12.7**	1644.7**	1155.5**	404.3**	3820.9**
g.c.a	6	51.2**	12.8**	761.8**	510.3**	466.8**	3000**
s.c.a	14	36.2**	15.0**	1018.3**	850.9**	185.4**	3375**
Recip.	21	76.1**	11.2**	2314.6**	1542.9**	832.3**	4352.8**
G XY	41	26.0*	2.68*	241.4	122.2*	105.5*	450.4*
g.c.a x y	6	38.1*	2.34	166.97	88.9	120.4*	724.5*
s.c.a x y	14	13.7	2.39	273.9	117	88.3	474.5
Recip x y	21	30.8*	2.97	241.1	135.18	108.9*	356.0
Poold error	246	17.6	1.84	268.2	81.9	74.4	321.1
X		32.47	66.1	302.3	171.3	93.6	58.7
C.V.		12.9	2.05	5.42	5.3	9.2	30.5

Table (4): combined analysis of variance of complete diallel set for six traits according to Griffing (1965) Method-4 Model-1over all two years .

S.O.V	D.F.	Grain yield ard/fed	50 % silking	Plant height	Ear height	R.L.W	R.D.M
Years(y)	1	158.1*	4250.1**	17.36	3198.1**	1281.5	583.1
Rep./y	6	33.2	32.6	2396.2	387.8	127.7	597.1
Genotype(G)	20	47.2**	10.44**	495.4**	762.5**	162.4**	3425.3**
g.c.a	6	27.6	10.34**	198.0	689.0**	267.6**	4841.2**
s.c.a	14	55.6**	10.49**	622.9**	793.9**	117.3	2818.6**
GxY	20	25.9	3.71*	217.6	132.2*	128.8*	444.4
g.c.a x y	6	30.3	4.33*	104.6	146.6*	179.1*	675.8
s.c.a x y	14	24.1	3.45*	266.0	126.1	107.2	345.2
Error	120	16.8	1.77	229.98	79.4	68.3	378.6
X		33.02	66.1	311.9	176.6	95.2	60.3
C.V.		12.4	2.02	4.86	5.05	8.68	32.3

Table (5): Means ($\bar{x}$), coefficient of variability (c.v.), environmental effect ($\sigma^2 e$) and G.C.A/S.C.A. for 4 methods of Griffing,S 199-59 model-1 for six traits over all two years.

		Grain yield ard/fed	50% silking	Plant height	Ear height	R.L.w	R.D.M
$\bar{X}$	M1	29.66	66.9	291	165	92.9	56.7
	M2	27.9	67.5	290	164	93.6	56.4
	M3	32.47	66.1	302	171	93.6	58.7
	M4	33.02	2.21	312	177	95.2	60.3
C.V.	M1	14.2	2.24	5.70	6.4	10.7	31.2
	M2	14.8	2.05	5.48	7.1	11.3	32.9
	M3	12.4	2.02	5.42	5.3	9.2	30.5
	M4	12.4	2.2	4.86	5.1	8.7	32.3
σ^2 e	M1	17.7	2.29	273.3	113.3	99.1	313.7
	M2	17.1	1.84	252.6	134.8	111.6	343.7
	M3	17.6	1.77	268.2	81.9	74.4	321.1
	M4	16.8	0.09	230	79.4	68.3	378.6
g.c.a/s ca	M1	0.13	0.11	0.12	0.32	.091	0.27
	M2	0.14	.85	0.14	0.36	1.02	.49
	M3	1.41	.99	0.75	0.60	2.52	.89
	M4	0.50	0.99	0.32	0.87	2.28	1.72

* - M = method

REFFERENCES

Aly, R.S.H. (1999). Genetic studies for some agronomical and technological characters on maize (Zea mays L.). M.Sc. Thesis Departement of genetics Fac. of Agric. Kafer El-Sheikh Tanta Univ. Egypt.

Dawood, M.I.; A.A. Nawar and A.M. shehata (1994). Comparison between two methods od diallel cross analysis in maize (Zea Mays L.). Menofiya J. Agric. Res., 19 (1): 2363-2378.

El- Shenawy, A.A. and S.A.E. Tolba (2001). General and specific combining ability and reciprocal effects in complete diallel set of maize inbred. J. Agric. Sci., Mansoura Univ., 26 (3): 1271-1279.

Gardener, C.O. (1967). Simplified methods for estimating constant and computing sums squares for a diallel cross analysis. Reprint from fitotecnia Latinoamericana, 4: 1-12.

Griffing J.B. (1956). Concept of general and specific combining ability in relation to diallel crossing system. Austral. J. Biol. Sci., 9: 463-493.

Hyman, B.I. (1954a). The analysis of variance of diallel Tables Biometrics. 10: 235-244.

Hyman, B.I. (1954b). the theory and analysis of diallel crosses. Genetics 39: 789-909.

Mousa, S.Th.M. (1997). Breeding studies on maize (Zea mays L.). M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Nawar, A.A. (1985). A comparison between seven analysis methods of diallel crosses in maize (Zea Mays L.). Menofiya J. Agric. Res., Vol. 10 (2): 739-758.

Sendecor, G.W. and W.G. Cochran (1967). Statistical methods. 6th Ed. Iowa State Univ. Press, Ames., Iowa, U.S.A.

Sparague, G.F. and L.A. Tatum (1942). General Vs. Specific combining ability in single crosses of corn. J. Amer. Soc. Agron., 34: 923-932.

مقارنة بين الأربع طرق لتحليل نظام التزاوج الدائري الكـامل Griffing (1956) فى سلالات الذرة الشامية

عبد الرحمن عبد الرحمن جلال – عصام عبد الفتاح عامر – عباس عبد الحى الشناوى

معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

استخدم فى هذه الدراسة داي أليل كامل مكون من ٧ سلالات و ٢١ هجين و ٢١ هجيـــن عكسى لأربع طرق لتحليل الديأليل حسب Griffing (1956) لتحديد القدرة العامة على التـــألف (G.C.A.) والقدرة الخاصة على التألف S.C.A. والتاثير العكسى Rec. لستة صفات وهـى محصول الحبوب (اردب/فدان) و التزهير (٥٠ % حريرة) وارتفاع النبـــات والكـــوز والنســـبة المئوية للمقاومة لمرض الذبول المتأخر والبياض الزغبى وكانت الدراسة لتقدير المتوسطات ($\bar{x}$) ومعامل الاختلاف (C.V.) والتباين البيئي ($\sigma^2 e$) ونسبة متوسط مجموع المربعـــات G.C.A. ونسبة متوسط مجموع المربعات S.C.A. وكانت Method-4 مناسبة لتحليل جميع الصفـــات ولكن أوضحت النتائج التى تتضمن نسبة G.C.A/S.C.A أن Method –3 المشتملة علـــى الهجن والهجن العكسية تعطى نفس التفاعل الجينى.