J. Agric. Sci. Mansoura Univ., 29 (3): 1023 - 1033, 2004

EVALUATION OF NEW INBRED LINES OF YELLOW MAIZE VIA LINE X TESTER ANALYSIS OVER THREE LOCATIONS

Mosa, H.E.; A.A. Motawei and Afaf A. I. Gabr
Maize Research Section, FCRI , ARC , Egypt

ABSTRACT

Nine inbred lines of yellow maize were top crossed to the three testers i.e L-121, S.C.SK-52 and composite-21 during the 2001season. The nine parental inbred lines, the three testers, the 27 top crosses and the two checks (S.C155 and T.W.C 352) were evaluated during the 2002 season at Sakha,Sids and Nubraria locations in a randomized complete block design with four replications. The data were recorded for grain yield/plant (g), number of rows/ear, number of kernels/row,ear position% and precentage of resistance to late wilt disease.Combining ability analysis was computed via line x tester procedures proposed by Kempthorne (1957). The results could be summarized as follows:-

Significant mean squares for locations, genotypes and their interactions were detected for all the studied traits. Significant lines (L), testers (T) and (L x T) interaction were detected for all studied traits except (L x T) interaction for number of kernels/row and ear position. While, the interaction between (L), (T) and (L x T) with locations were significant for grain yield/plant and resistance to late wilt disease. Additive genetic variance (gca) was predominanting than non-additive genetic variance (sca) in the inheritance of all traits. The non-additive genetic variance showed obvious interaction with locations for grain yield/plant, number of rows/ear and number of kernels/row.The parental inbred lines which showed the best desirable gca effects were SK-7070, SK-7078/2, SK-7078/30 for grain yield/plant, Gm1004 for number of rows/ear, SK-7070 for number of kernels/row, SK-7078/30 for ear position and SK-7017/10 for resistance to late wilt disease. On the other hand, the parental testers that exhibited the better general combining ability were L-121 for grain yield/plant and resistance to late wilt disease,S.C.SK-52 for number of rows/ear and ear position and composite-21 for number of kernels/row.The desirable heterotic effects for grain yield/plant relative to the check S.C.155 were recorded for top cross SK-7070 x L-121 (24.65%). Whereas, the highest heterosis values relative to the check T.W.C 352 were detected for the top crosses SK-7070 x L-121 (28.82%) and SK-7078/2 x L121 (17.73%). These two crosses would be prospective and recommended to be used immediately in maize breeding programs.

Keywords: Combining ability, heterosis, top crosses,homozygous heterozygous.

INTRODUCTION

Egyptian national maize research program has an optimistic plan to increase the national production of yellow maize through the development of new high yielding hybrids with resistante to major diseases and could be cultiveted in the new reclamed lands at Nubaria, Toshki and EL-Ewinate.

The desirable tester was defined as one that combines the greatest simplicity in use with the maximum information on performance to be expected from total lines, when used in other combinations or grown in other environments (Matzinger, 1953). Also, El-Hosary (1985)concluded that testers of broad genetic base are more efficient than those of narrow genetic base for the evaluation of gca of maize inbred lines .In this respect, Liakat and Tepore (1986) used four types of testers which are: open- pollinated variety,three way cross hybrid ,single cross hybrid and an inbred line for evaluating the combining ability of 19 inbred lines .They concluded that the inbred tester which had the narrowest genetic and lowest yield potentiality although it gave maximum genetic variation in the top crosses progenies for most studied traits. This result indicated that inbred line is very effective tester for evaluating the inbred lines.

Several investigators indicated that the additive genetic variance played an important role in the inheritance of grain yield, number of rows/ear, number of kernel/row, ear position and resistance to late wilt disease (Mahmoud 1996, Soliman and Sadek 1999, EL-Shenawy *et al.,* 2002, Amer *et al.,* 2003 and EL-Shenawy *et al.,* 2003). The non-additive genetic variance was also present but it was influenced by environment more than the additive genetic variance for grain yield trait (Sedhom, 1992 and Mosa, 2001). The main objectives of this work were :to estimate combining ability, values of heterosis and to identify the superior lines and top crosses which could be used in maize breeding programs.

MATERIALS AND METHODS

The materials used in this study were the new nine yellow maize inbred lines, viz. Sk-7017/4,Sk-7017/10,Sk-7017/2-4,Sk-7017/6,Sk-7029, Sk-7070,Sk-7078/2,Sk-7078/30 and Gm-1004. In 2001 season, top crosses mating system was carried out among the nine inbred lines with the three testers i.e. inbred line L-121, promising single cross SK-52 and composite variety-21 at Sakha Station. In 2002 season, the resulting 27 top crosses along with the 9 inbred lines, the 3 testers and the 2 commercial check i.e. S.C.155 and T.W.C 352 were evaluated at Sakha, Sids and Nubraria experimental Stations. A randomized complete blocks design with four replications was used in each of the three locations . At each replication, the entries were arranged in two sets as follows: 10 inbred lines (9 parental lines +1 tester line) and 31 crosses (27 top crosses + 2 testers +2 -check hybrids, respectively) and randomly distributed in each set. The plot size consisted of one row, 6 m long and 80 cm apart with 25 cm between hills. Three seeds were sown/ hill and later they were thinned to one plant/hill prior to the first irrigation. All agronomic field operations were practiced as usual with ordinary field maize cultivation. The data were recorded on, grain yield/plant (g) adjusted to 15.5% grain moisture, number of rows per ear, number of kernels per row and percentage of ear position and percentage of resistance to late wilt disease. Before calculating the combined analysis, test of homogeneity of error mean squares for the three locations was done as outline by Snedecor and Cochran (1980). When differences among top crosses were found significant, line x tester analysis according to Kempthorne (1957) was done for each location and combined over the three location. Heterosis percentage for grain yield was computed; over mid parent, over better parent (according to the formula adopted by Bhatt, 1971) and relative to commercial crosses i.e. S.C.155 and T.W.C 352 (according to Meredith and Bridge, 1972).

RESULTS AND DISCUSSION

The combined analysis of variance for five traits over the three locations was accomplished and the results are presented in Table 1.

Table (1):Combined analysis of variance for five traits over the three locations.

S.O.V	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease %
Locations (Loc)	78484.22**	4.25*	330.68*	936.24**	3303.14**
Rep/Loc	2013.11	2.17	64.11	38.21	372.31
Genotypes (G)	28971.99**	32.87**	372.34**	258.06**	165.11**
Parents (P)	32067.63**	41.98**	410.44**	375.53**	46.80
Crosses (C)	4334.15**	25.85**	21.70**	138.50**	197.85**
P vs C	635503.77**	115.17**	9069.58**	2074.53**	615.28**
G x Loc	1064.02**	2.26**	22.25**	14.46*	240.43**
P x Loc	1311.10**	3.84**	44.75**	22.83**	134.611**
C x Loc	909.89**	1.44	9.24	11.01	220.771**
P vs C x Loc	2355.94**	6.03**	13.02**	11.82	1915.573**
Error	449.20	1.16	10.21	10.48	61.40
C.V.%	15.44	7.28	9.13	5.75	8.36

*,** significant at 0.05 and 0.01 levels of probiabilty, respectively.

Significant differences among the three locations (Loc) were found for all traits. This suggested the presence of markedly differences among the three locations. The results in Table 2, showed that the means at Nubaria were higher than means the other locations for grain yield/plant, number of rows/ear, ear position. While Sakha and Sids locations showed more resistance to late wilt disease and higher mean number of kernels/row, resectively. Amer *et al.*, (2002) and Kedlubiec *et al.*, (2003) found significant differences among locations for grain yield. Regarding to Table 1, mean squares of genotypes (G) and their partitions i.e parents (P), crosses (C) and (P vs C or heterosis) for combined analysis were highly significant for all traits except (P) for resistance to late wilt disease. Also, significant genotypes i.e.(P), (C) and (P vs C) by locations interaction was observed for all traits except (C x Loc) for number of rows/ear, number of kernels/row and ear positions and (P vs C x Loc) for ear position. These results indicated that the tested genotypes varied from each other and ranked differently from one location to another.

Table (2): Mean for five traits at Sahka,Sids and Nubaria locations.

Location	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease %
Sakha	134.36	14.80	34.60	54.08	98.02
Sids	118.60	14.73	36.77	55.44	89.08
Nubaria	162.59	15.05	34.05	63.91	94.18
Over all mean	138.51	14.86	35.14	57.81	93.76
L.S.D 0.05	11.48	0.27	2.04	7.82	4.93
0.01	16.56	0.39	2.95	11.29	7.12

Mean performance of parents and top crosses for five traits over three locations are shown in Table 3.

Table (3): Mean performance of parents and top crosses for five traits over the three locations.

Genotype	Grain yield/plant (g)	Number.of rows/ear	Number .of kernels/row	Ear position %	Resistance to late wilt disease%
SK-7017/4	74.538	12.7	31.7	57.471	90.53
SK-7017/10	51.401	12.4	25.1	55.961	93.87
SK-7017/2-4	52.705	12.5	25.9	56.391	92.40
SK-7017/6	76.047	12.6	29.4	55.964	92.66
SK-7029	42.281	12.8	23.0	46.868	89.71
SK-7070	83.515	14.2	28.7	53.566	96.17
SK-7078/2	60.856	13.0	25.3	43.351	93.71
SK-7078/30	51.357	15.7	25.8	42.438	92.98
Gm-1004	53.476	17.1	24.4	53.773	93.34
Line-121	65.871	13.3	22.8	52.942	95.45
S.C.SK-52	216.430	17.5	41.9	56.804	93.48
Comp-21	155.475	15.2	36.9	59.139	96.06
SK-7017/4 x Line-121	175.768	13.5	37.0	61.938	97.55
SK-7017/4 x S.C.SK-52	148.851	14.4	37.1	58.994	90.67
SK-7017/4 x Comp-21	140.579	14.7	37.1	61.210	88.86
SK-7017/10 x Line-121	166.091	13.8	36.8	58.117	98.10
SK-7017/10 x S.C.SK-52	143.928	14.0	38.0	59.551	98.30
SK-7017/10 x Comp-21	162.474	14.7	38.3	58.415	97.39
SK-7017/2-4 x Line-121	157.865	13.4	35.3	59.124	96.27
SK-7017/2-4 x S.C.SK-52	141.614	14.2	37.1	59.559	94.97
SK-7017/2-4 x Comp-21	154.819	14.1	38.4	60.498	95.19
SK-7017/6 x Line-121	166.893	13.7	37.0	61.490	97.81
SK-7017/6 x S.C.SK-52	140.187	14.2	36.5	61.168	90.00
SK-7017/6 x Comp-21	164.925	13.9	38.2	63.726	88.55
SK-7029 x Line-121	161.141	13.8	37.4	57.477	97.59
SK-7029 x S.C.SK-52	130.998	14.8	36.1	55.800	92.37
SK-7029 x Comp-21	135.754	14.9	37.6	56.123	92.78
SK-7070 x Line-121	206.392	14.1	40.1	56.533	95.84
SK-7070 x S.C.SK-52	174.947	14.7	39.8	56.153	97.30
SK-7070 x Comp-21	184.293	15.6	40.8	57.835	94.71
SK-7078/2 x Line-121	188.628	15.1	39.5	54.410	87.94
SK-7078/2 x S.C.SK-52	158.361	16.4	38.4	52.441	83.65
SK-7078/2 x Comp-21	176.899	15.6	39.3	52.374	92.36
SK-7070/30 x Line-121	184.593	16.1	38.2	52.459	96.55
SK-7070/30 x S.C.SK-52	164.301	17.0	38.3	50.757	86.45
SK-7070/30 x Comp-21	171.015	16.7	37.5	51.737	95.50
Gm-1004 x Line-121	173.557	17.8	38.2	58.107	97.53
Gm-1004 x S.C.SK-52	126.814	19.2	36.2	56.728	89.47
Gm-1004 x Comp-21	167.923	17.6	40.0	58.448	95.76
Checks S.C 155	165.58	15.31	35.88	55.80	99.33
T.W.C.352	160.22	16.35	39.8	59.40	98.04
L.S.D 0.05	16.95	0.86	2.55	2.59	6.26
0.01	22.32	1.13	3.36	3.41	8.25

The inbred line SK-7070 had the highest mean performance for grain yield/plant and resistance to late wilt disease compared with other inbred lines.The inbred line SK-7017/4 had the highest mean for number of kernels/row and ear position, while inbred line Gm-1004 was higher for number of rows/ear. The mean performance of testers showed that the promising tester S.C SK- 52 showed significantly superior as compared with the two checks i.e.S.C.155 and T.W.C 352 for grain yield/plant, number of rows/ear and number of kernels/row. These results indicated that this cross could be used as a new commercial single cross in maize production and in breeding programs. The mean performance of top crosses showed that the single crosses SK-7070 x L-121, SK-7078/2 x L-121, SK7070/30 x L-121, SK-7017/4 x L-121,Gm-1004 x L-121,SK-7017/6 x L-121 , SK-7017/10 x L-121 and three way crosses SK-7070 x S.C SK-52 and SK-7070/30 x S.C SK-52 had higher values for grain yield/plant comparing with the two checks.These results suggested the utilization of these crosses in maize breeding programs.

Percentage of heterosis for grain yield/plant relative to mid parent (M.P),high parent (H.P) and constant parent (C.P) are presented in Table 4. The best significant heterotic effects were existed in 19 top crosses relative to (M.P), 10 top crosses relative to (H.P), one top cross SK-7070 x L-121 (24.65%) relative to S.C.155 and two top crosses SK-7070 x L-121 (28.82%) and SK-7078/2 x L-121 (17.73%) relative to T.W.C352. In the basis of these results, it could be concluded that the two top crosses SK-7070 x L-121 and SK 7078/2 x L-121 are prospective genetic materials to be used for improving the yielding ability in maize breeding programs. Many investigators reported high heterosis for grain yield of maize among them, Sedhom (1992), Mohamed (1999) and Mosa (2001).

Table (4): Percentage of heterosis for grain yield/plant (g) relative to mid-parent M.P , high parent H.P and constant parent C.P i.e., (relative to S.C.155 and T.W.C 352) over the three locations.

Top cross	Grain yield/plant (g)			
	M.P	H.P	C.P	
			S.C.155	T.W. C352
SK-7017/4 x Line-121	150.35**	135.81**	6.15	9.70
SK-7017/4 x S.C.SK-52	2.32	-31.22**	-10.10	-7.09
SK-7017/4 x Comp-21	22.23**	-9.58	-15.09	-12.26
SK-7017/10 x Line-121	183.24**	152.15**	0.309	3.66
SK-7017/10 x S.C.SK-52	7.47	-23.26**	-13.08	-10.17
SK-7017/10 x Comp-21	57.07**	4.5	1.88	1.41
SK-7017/2-4 x Line-121	166.27**	139.67**	-4.66	-1.47
SK7017/2-4 x S.C.SK-52	5.23	-34.57**	-14.47	-11.61
SK-7017/2-4 x Comp-21	48.74**	-0.42	-6.49	-3.37
SK-7017/6 x Line-121	135.19**	119.46**	0.79	4.16
SK-7017/6 x S.C.SK-52	-4.14	-35.23**	-15.34	-12.5
SK7017/6 x Comp21	42.47**	6.08	-0.39	2.94
SK-7029 x Line-121	197.97**	93.53**	-2.68	0.57
SK-7029 x S.C.SK-52	1.27	-39.47**	-20.89*	-18.24*
SK-7029 x Comp-21	37.29**	-12.68	-18.01	-15.27
SK-7070 x Line-121	176.33**	147.13**	24.65**	28.82**
SK-7070 x S.C.SK-52	16.65*	-19.17*	5.66	9.19
SK-7070 x Comp-21	43.20**	18.54*	11.30	15.02
SK-7078/2 x Line-121	198.18**	186.36**	13.92	17.73*
SK-7078/2 x S.C.SK-52	14.22	-26.83**	-4.36	-1.16
SK-7078/2 x Comp-21	63.54**	13.78	6.84	10.41
SK-7078/30 x Line-121	214.95**	28.76**	11.48	15.21
SK-7078/30 x S.C.SK-52	22.71**	-24.09**	-0.77	2.55
SK-7078/30 x Comp-21	65.36**	9.99	3.28	6.74
Gm-1004 x Line-121	190.86**	163.48**	4.82	8.32
Gm-1004 x S.C.SK-52	-6.029	-41.41**	-23.41**	-20.85*
Gm-1004 x Comp-21	60.72	8.01	1.42	4.81
L.S.D 0.05	14.69	16.96	16.96	16.96
0.01	19.33	22.32	22.32	22.32

*,** significant at 0.05 and 0.01 levels of probability, respectively.

Data in Table 5 ,showed that the mean squares for lines (L) testers (T) and (L x T) interactions were either significant or highly significant for all the studied traits except (L X T) interaction for number of kernels/row and ear position. This indicated that the inbred lines differed significantly in their behavior with respect to top crosses. Also, testers were significantly different from each other in top crosses. While, significant (L xT) interaction means that the inbred lines performed differently in crosses with respect to yielding ability depending on the type of tester used. These results are in agreement with those obtained by: Mosa (2001), Ashish and Singh (2002), Dodiya and Joshi (2002) and Duarte *et al.*, (2003). Mean squares for (L x Loc), (T x Loc) and (L x T x Loc) interactions were either significant or highly significant for grain yield/plant and resistance to late wilt disease, but it was not significant for number of rows/ear, number of kernels/row and ear position, meaning that (L),(T) and (L x T) interaction were affected by locations for grain yield/plant and resistance to late wilt disease .Similar results were recorded by Mahmoud (1996) and EL-Shenawy *et al.*, (2003).

Table (5): Mean squares of testing top crosses for five traits of combined analysis over the three locations.

S.O.V	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease%
Line (L)	7210.13**	75.51**	43.69**	420.66**	255.926**
Tester (T)	21004.89**	17.4**	36.39*	35.36*	604.455**
L xT	810.15**	2.06*	8.87	10.38	117.989*
L xLoc	1273.40**	1.74	8.07	11.05	330.74**
T x Loc	1057.98**	0.75	27.25	14.69	748.32**
L x T x Loc	709.8*	1.38	7.57	10.85	97.69*
Error	449.20	1.16	10.21	10.48	61.402

***,** significant at 0.05 and 0.01 levels of probability, respectively.**

Estimation values of genetic components and their interactions with locations for all the studied traits over all locations are presented in Table 6. The results showed that the σ^{-2} gca (additive genetic variance) were larger than σ^{-2} sca (non-additive genetic variance) for all traits, indicating that additive genetic variance played an important role in the inheritance of all the studied traits.Similar results were recorded by Liakat and Tepora (1986), Mahmoud (1996),Amer *et al.,* (2002), EL-Shenawy *et al.*, (2002) and EL-Shenawy *et al.,* (2003) .On the other hand, the magnitude of the interaction for σ^{-2} sca x Locations was markedly higher than those of σ^{-2} gca x location for grain yield/plant, number of rows/ear and number of kernels/row, while it was vice versa for ear position and resistance to late wilt disease. These results indicated that the non-additive genetic variance was more sensitive to environmental differences than additive genetic variance for grain yield/plant, number of rows/ear and number of kernels/row and it was the oppisite for ear position and resistance to late wilt disease. These results are in common agreement with those of Mahmoud (1996), Mosa (2001) and EL-Shenawy *et al.*,(2003).

Table (6): Estimate values of genetic variance components for five traits over the three locations

Genetic parameters	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease %
σ^2 GCA	178.35	0.618	0.29	2.99	-3.122
σ^2 SCA	8.36	0.056	0.1088	-0.0392	1.692
σ^2 GCA/ σ^2 SCA	21.3	11.04	2.67	2.99	1.845
σ^2 GCA x Loc	29.85	-0.005	0.420	0.244	18.41
σ^2 SCA x Loc	65.16	0.0545	-0.6613	0.099	9.073
σ^2 GCAxLoc/ σ^2 SCAx Loc	0.46	0.054	0.420	2.46	2.029

The general combining ability effects of inbred lines and testers for five traits over three locations are presented in Table 7. Significant and desirable gca effect were detected in inbred lines SK-7070, SK- 7078/2, SK-7078/30 for grain yield/plant ,Sk-7078/2,Sk-7078/30 and Gm-1004 for number of rows/ear, SK-7070 and SK-7078/2 for number of kernels/row, SK-7078/2 and Sk-7078/30 for ear position and SK-7017/10 and SK-7070 for resistance to late wilt disease. These lines could be used as good combiners in maize breeding programs. On other hand, the tester inbred line L-121 was the best general combiner for grain yield/plant and resistance to late wilt disease. However, the tester SK-52 was the best combiner for number of rows/ear and ear position and the tester composite variety-21 was the best combiner for number of kernels/ear. The superiority of the homozygous inbred lines as good tester was noticed by several investigators among them: Liakat and Tepora (1986), AL-Nagger *et al.,* (1997) and Amer *et al.,*(2002). The superiority of the heterozygous crosses or varieties as good testers were noticed by other authors among them: Grogan and Zuber (1957), Sokolov and Kostyuchenco (1978), EL-Hosary (1985), Mohamed (1999) and EL-Shenawy *et al.,* (2003).

Table (7): Estimates of general combining ability effects for nine inbred lines and three testers over three locations.

Line	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease%
SK-7017/4	-6.7714*	-0.9726**	-0.8722	3.2619**	-1.215
SK-7017/10	-4.3398	-0.9626**	-0.2489	1.2452**	3.3593*
SK-7017/2-4	-10.4048**	-1.2226**	-0.9789	2.2752**	1.905
SK-7017/6	-4.5008	-1.2426**	-0.7122	4.6785**	-1.4527
SK-7029	-19.2064**	-0.6459	-0.8989	-0.9848	0.6723
SK-7070	26.7052**	0.0507	2.2844**	-0.6115	2.379*
SK-7078/2	12.7919**	0.5341*	1.1578*	-4.3781**	-5.5903**
SK-7078/30	11.4656**	1.4507**	0.0811	-5.7981**	-0.7383
Gm-1004	-5.7394**	3.0107**	0.1878	0.3119	0.6807
Tester					
Line-121	13.8218**	-0.4670**	-0.2167	0.2885	2.5586**
S.C.SK-52	-14.0600**	0.2863**	-0.4411	-0.6570*	-2.1082**
Comp-21	0.2382	0.1807	0.6578*	0.3685	-0.4503
L.S.D gl 0.05	6.993	0.352	1.044	1.058	2.56
0.01	9.11	0.464	1.375	1.393	3.37
L.S.D gt 0.05	3.997	0.203	0.603	0.611	1.48
0.01	5.262	0.268	0.794	0.804	1.95

*,** significant at 0.05 and 0.01 levels of probability, respectively.

Estimates of specific combining ability effects of the top crosses for all traits over the three locations are presented in Table 8. Significant sca effects were detected with 3 top crosses for grain yield/plant and number of rows/ear, respectively and two top crosses for resistance to late wilt disease.

Correlation coefficients between five traits over the three locations are presented in Table 9. The correlation coefficient between grain yield/plant with number of rows/ear and number of kernels/row were highly significant and positive, indicating that these traits were related and any increase in number of rows/ear and number of kernels/row lead to an increase in grain yield and vice versa. Therefore, indirect selection for linked traits with grain yield/plant would be useful and effective for improvining grain yield/plant. These results are in harmony with those of Amer *et al.*,(2002) and Mosa (2003).

Table (8): Estimates of specific combining ability effects of top crosses for five traits over the three locations.

Top cross	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease%
SK-7017/4 x Line-121	6.8802	-0.2663	0.1700	0.9381	2.6301
SK-7017/4 x S.C.SK-52	7.8450	-0.0696	0.4244	-1.0663	0.4219
SK-7017/4 x Comp-21	-14.7252*	0.3359	-0.5944	0.1281	-3.052
SK-7017/10 x Line-121	-5.2284	0.1037	-0.6633	-0.8652	-1.3892
SK-70-17/10 x S.C.SK-52	0.4903	-0.4496	0.7111	1.5104	3.4776
SK-7017/10 x Comp-21	4.7381	0.3459	-0.0478	-0.6452	-2.0883
SK-7017/2-4 x Line-121	-7.3894	-0.0363	-1.4133	-0.8952	-1.7659
SK-7017/2-4 x S.C.SK-52	4.2413	0.0504	0.6111	0.4904	1.6049
SK-7017/2-4 x Comp-21	3.1481	-0.0141	0.8022	0.4048	0.1610
SK-7017/6 x Line-121	-4.2604	0.2237	-0.0600	-0.9285	3.1338
SK-7017/6 x S.C.SK-52	-3.0897	0.0004	-0.2856	-0.3030	-0.0144
SK-7017/6 x Comp-21	7.3501	-0.2241	0.3456	1.2315	-3.1193
SK-7029 x Line-121	4.6882	-0.2130	0.5767	0.7248	0.7868
SK-7029 x S.C.SK-52	2.4270	0.0337	-0.4989	-0.0096	0.2296
SK-7029 x Comp-21	-7.1152	0.1793	-0.0778	-0.7152	-1.0163
SK-7070 x Line-121	4.0276	0.3304	0.0433	-0.5985	-2.6679
SK-7070 x S.C.SK-52	0.4603	-0.7930*	0.0478	-0.0330	3.4577
SK-7070 x Comp-21	-4.4879	0.4626	-0.0911	0.6315	-0.7900
SK-7078/2 x Line-121	0.1769	-0.1230	0.6500	1.0481	-2.5986
SK-7078/2 x S.C.SK-52	-2.2083	0.3937	-0.2256	0.0237	-2.2288
SK-7078/2 x Comp-21	2.0314	-0.2707	-0.4244	-1.0719	4.8273*
SK-7078/30 x Line-121	-2.5318	-0.0696	0.4267	0.5181	1.1534
SK-7078/30 x S.C.SK-52	5.0580	0.1370	0.7211	-0.2363	-4.2728*
SK-7078/30 x Comp-21	-2.5262	-0.0674	-1.1478	-0.2819	3.1193
Gm-1004 x Line-121	3.6372	0.0504	0.2700	0.0581	0.7174
Gm-1004 x S.C.SK-52	-15.2240*	0.6970*	-1.5056	-0.3763	-2.6758
Gm-1004 x Comp-21	11.5868*	-0.7474*	1.2356	0.3181	1.9583
L.S.D S_{ij} 0.05	11.5	0.60	1.8	1.83	4.43
0.01	15.78	0.83	2.37	2.5	5.80

* significant at 0.05 level of probability.

Table (9):Correlation coefficient between five traits over the three locations.

Trait	Grain yield/plant (g)	Number of rows/ear	Number of kernels/row	Ear position %	Resistance to late wilt disease %
Grain yield/plant(g)	-----	0.44**	0.951**	-0.176	0.186
Number of rows/ear		-----	0.458**	-0.399	-0.093
Number of kernels/row			-----	-0.186	0.083
Ear position %				-----	0.009
Resistance to late wilt disease %					-----

** significant at 0.01 level of probability.

REFERENCES

AL-Naggar, A.M.;H.Y.EL-Sherbieny and A.A.Mahmoud (1997). Effectiveness of inbred, single crosses and population as testers for combining ability in maize. Egypt.J.plant breed., 1:35-46.

Amer,E.A.;A.A.EL-Shenawy and A.A.Motawei (2003).Combining ability of new maize inbred lines via line x tester analysis. Egypt.J.plant breed.7(1): 229-239.

Amer, E.A.;A.A.EL-Shenawy and H.E.Mosa (2002). A comparison of four testers for the evaluation of maize yellow inbreds. Egypt J.Appl.Sci.,17 (10) : 597-610.

Ashish, S.and I.S.Singh (2002). Evaluation and classification of exotic inbreds over locations based on line x tester analysis in maize (*Zea mays* L.). Crop Improvement.,29 (2) :184-189.

Bhatt, G.M.(1971). Heterotic performance and combining ability in a diallel cross among spring wheats (*T.aestivum* L.). Australian Jour.Agric.Res.22:359-369.

Dodiya,N.S. and V.N.Joshi(2002).Gene action for grain yield and its attributes in maize(*Zea mays* L.).Indian J.of genetic and plant Breeding.,62(3):253-254.

Duarte,I.A.;J.M.Ferreira and C.N.Nuss (2003).Screening potential of three maize top cross testers. Pesquisa Agropecuaria Brasileira. , 38 (3):365-372.

EL-Hosary, A.A.(1985).Study of combining ability in some top crosses in maize.Egypt.J.Agron., 10(1-2) : 39-47.

El-Shenawy,A.A.; E.A. Amer and H.E.Mosa (2003).Estimation of combining ability of newly-developed inbred lines of maize by (line x tester)analysis.J.Agric.Res.Tanta.Univ.,29(1):50-63.

EL-Shenawy,A.A.; H.E.Mosa and R.S.H.Aly (2002). Genetic analysis of grain yield per plant and other traits on maize early inbred lines.J.Agric.Sci,Mansoura Univ.,27 (4) 2019-2026.

Grogan, C.O. and M.S.Zuber (1957). A comparative study of top cross tester parent of maize.J.Amer.Soc.Agron.,49:68-72.

Kedlubiec, W.;R.Kuriata;J.Horobiowska; C.Karwowska and Z.Kurczych (2003). Estimation of combining ability of inbred lines of maize. Part II.Use of flint lines as testers of maternal lines.Biulctyen Instytutu Hodowli I Aklimatyzacji Roslin. No.226/227:359-363.

Kempthorne, O.(1957). An introduction to genetic statistical. John wiley-sons Inc.,New York.

Liakat,M.A. and N.M.Tepore (1986). Comparative performances of four types of testers for evaluating corn inbred lines from two populations. Philippine.J Crop Sci.,4(5): 175-179.

Mahmoud,A.A.(1996). Evaluation of combining ability of newly developed inbred lines of maize.Ph.D. Thesis, Fac.Agric., Cairo, Univ.,Egypt.

Matzinger,D.F.(1953). Comparison of three types of testers for the evaluation of inbred lines of corn.Agric J.45:493-495.

Meredith, W.R. and R.R. Bridge (1972). Heterosis and gene action in cotton *Gossypium hirsutum* L. Crop Sci.,:12:304-310.

Mohamed, E.M.(1999). Evaluation of some new inbred lines of maize (Zea mays L.) Ph.D. Thesis, Fac.Agric., Moshtohor, Zagazig Univ.,Egypt.

Mosa,H.E. (2001). A comparative study of the efficiency of some maize testers for evaluation a number of white maize inbred lines and their combining ability under different environmental conditions. Ph.D.Thesis, Fac.Agric., Kafr EL-Sheikh, Tanta Univ., Egypt.

Mosa,H.E.(2003). Heterosis and combining ability in maize (Zea mays L.). Minufiya J.Agric.Res.,5(1) : 1375-1386.

Sedhom,S.A.(1992). Development and evaluation of some new inbred lines of maize. Proc 5th Conf.Agron. Zagazig,13-15 Spet.,(1): 269-280.

Snedecor, G.W. and W.G.Cochran (1980). Statistical Method 7th ed. Iowa Stat University press, Ames, Iowa, USA.

Sokolov,B.P. and V.I.Kostyuchenko (1978). Choice of testers for the evaluation of combining ability in maize lines in top crosses. Sel.Skokhazyaistvennaya Biolog.,13(1):44-48.

Soliman, F.H. and S.E.Sadek (1999). Combining ability of new maize inbred lines and its utilization in the Egyption hybrid program. Bull.Fac.Agric,.Cairo Univ.,50:1-20.

تقييم سلالات جديدة صفراء من الذرة الشامية من خلال تحليل التهجينات القمية على مستوى ثلاث مواقع

حاتم الحمادى موسى – عاصم عبده مطاوع – عفاف احمد اسماعيل جبر
مركز البحوث الزراعية– معهد المحاصيل الحقلية– قسم بحوث الذرة الشامية.

أستخدم في هذا البحث ٩ سلالات صفراء من الذرة الشامية تم تهجينها مع ٣ كشافات هى سلالة ١٢١، ه.ف سخا -٥٢ و صنف تركيبى- ٢١ وذلك بمحطة البحوث الزراعية بسخا عام ٢٠٠١. قيمت الأباء و الهجن القمية الناتجة منها و اثنين من الأصناف التجارية (ه .ف ١٥٥ و ه.ث٣٥٢) و ذلك فى محطات بحوث سخا، سدس و النوبارية عام ٢٠٠٢ و ذلك فى تصميم االقطاعات الكاملة العشوائية فى أربع مكررات. تم التحليل الوراثى للقدرة على الأئتلاف باإستخدام تصميم (السلالة × الكشاف) طبقا لــ kempthorne (1957) لصفات محصول الحبوب للنبات، عدد الصفوف بالكوز، عدد الحبوب بالصف، موضع الكوز ونسبة المقاومة لمرض الذبول المتأخر .ويمكن تلخيص أهم النتائج فيما يلى:

- كان تباين المواقع والتراكيب الوراثية و تفاعلهما معنويا فى جميع الصفات تحت الدراسة.

- كان تباين السلالات و الكشافات و تفاعلهما معنويا فـــى جميـــع الصفــات مـــا عــدا تفـــاعل السلالة × الكشاف لكلا من صفة عدد الحبوب بالصف و موقع الكـــوز، بينمـــا تبـــاين تفـــاعل المواقع مع كل من السلالات و الكشافات و تفاعليهما معاً معنويا فقط لصفات محصول الحبوب للنبات و المقاومة لمرض الذبول المتأخر.
- كان التباين الوراثي المضيف أكثر أهمية من التباين الوراثى غير المضيف فى وراثـــة جميـــع الصفات، كذلك كان التباين الوراثى غير المضيف أكثر تأثرا بالبيئة لصفات محصول الحبـــوب للنبات، عدد الصفوف بالكوز وعدد الحبوب بالصف.
- كانت أفضل السلالات فى القدرة العامة على الأئتلاف هـــى الســـلالات ســـخا ٧٠٧٠، ســـخا ٢/٧٠٧٨،سخا ٣٠/٧٠٧٨ لصفة محصول الحبوب للنبات، جميزة ١٠٠٤ لصفة عدد الصفـوف بالكوز، سخا ٧٠٧٠ لصفة عدد الحبوب بالصف، سخا ٣٠/٧٠٧٨ لصفة موقع الكوز و ســـخا ١٠/٧٠١٧ لصفة المقاومة لمرض الذبول المتأخر. كما اظهر الكشاف سلالة ١٢١أفضل قـــدرة على الائتلاف لصفات محصول الحبوب للنبات و المقاومة لمرض الذبـــول المتـــأخروكذلك الكشاف ه .ف سخا-٥٢ لصفات عدد الصفوف بالكوز وموقع الكوز والكشاف صنف تركيبـــى-٢١ لصفة عدد الحبوب بالسطر.
- أظهرت النتائج أن أفضل الهجن فى قوة الهجين لصفة محصول الحبوب للنبات بالمقارنةبالهجين الفردى الأصفر ١٥٥ كان الهجين سخا ٧٠٧٠ × سلالة ١٢١ حيث يزيد بنسبة ٢٤,٦٥%، بينما أفضل الهجن بالنسبة للهجين الثلاثى الأصفر ٣٥٢ كانت الهجينين سخا ٧٠٧٠ x ســـلاله ١٢١ حيث يزيد بنسبة ٢٨,٨٢% وسخا ٧٠٧٨ /٢ x سلالة ١٢١ يزيد بنسبة ١٧,٧٣%. لذلك يمكـــن استخدام هذين الهجينين فى برنامج تربية الذرة الشامية كهجن عالية المحصول.