J. of Plant Production, Mansoura Univ., Vol. 12 (2):109 - 113, 2021

Journal of Plant Production

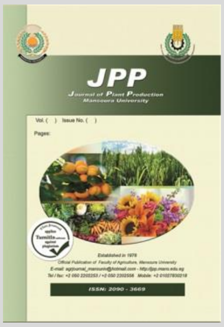
Journal homepage: www.jpp.mans.edu.eg
Available online at: www.jpp.journals.ekb.eg

Combining Ability of White Maize Inbred Lines Via Line X Tester Analysis

Cross Mark

Mousa, S. Th. M. ; H. A. A. Mohamed* ; R. S. H. Aly and H. A. Darwish

Maize Research Department, FCRI, Ismailia ARS, ARC, Egypt



ABSTRACT

Combining ability analysis was conducted using line x tester design for seven inbred lines of maize which were crossed to three single crosses as testers at Ismailia Agricultural Research Station during 2016 growing season. In 2017 season, 21 crosses in addition to one check hybrid were evaluated at three locations. Highly significant differences were found between the locations for all studied traits. Mean squares due to crosses, their partitions and their interaction with locations were significant or highly significant for all studied traits, except for lines and lines x testers for number of ears/plant and testers for number of rows/ear. The best inbred lines for general combining ability effects were Gz-8093, Gz-8092 and Gz7253 for earliness and Tep-6240 for grain yield. the tester SC 131 was the best general combiner for days to 50% silking toward earliness, grain yield, number of ears/plant, ear length and ear diameter. The cross Gz-8093 x SC131 had the desirable SCA effects for all traits also. The additive gene effects were more important than the non-additive gene effects in inheritance of days to 50% silking, number of ears/plant, ear length and ear diameter while, the non-additive was more important than additive for grain yield, number of rows/ear and number of kernels/row. The non-additive gene effects were more affected by environment than additive gene effects for all traits except for number of ears/plant. The cross Gz-8093 x SC131 highly significantly outyielded to the TWC 324, suggesting the use of this cross in maize breeding programs.

***Keywords**: Maize, *Zea mays L*, Combining ability, Gene effects, Genetic components

INTRODUCTION

Maize (Zea *mays* L.) is one of cereals of greatest importance in the world crops Golbashy *et al.*, (2010). Combining ability helps to determine the most appropriate parents and provide ample genetic information on trait inheritance. In this regard, Girma *et al*., (2015) reported that extremely general combining ability (GCA) and specific combining ability (SCA) effects lead to high heterosis. The significant GCA implies that breeders can exploit the available genetic variability in the identification of elite materials with desirable characteristics, whereas significant SCA effects suggest that promising single cross combinations may be found. However, the genotypes tested should exhibit enough genetic diversity for an effective breeding program Betran *et al.*, (2003). Combining ability studies were also used to study yield characters and heterotic groups for inbred lines with the aim of developing new hybrids with good quality, high yield and tolerance of multiple diseases Xingming *et al*., (2001). Breeders need knowledge to improve new maize genotypes based on the type and relative magnitude of the components of genetic variance and their interaction with environment. Ali *et al.* (2014) and Ram *et al.* (2015). The objectives of this investigation were to estimates the general combining ability effects of lines and testers and specific combining ability effects of crosses for grain yield and its components, identify the nature of gene action controlling the inheritance of these traits and identify the superior crosses for yielding ability.

MATERIALS AND METHODS

The materials of the current study consisted of seven new white inbred lines of maize i.e. Gz-8093, Gz-8092, Gz-7253, Gz-7142, AED-7135, AED-6132, and Tep-6420, developed at Ismailia Agricultural Research Station. In summer season 2016, the 7 inbred lines were top crossed to each of the three testers single crosses SC10, SC128 and SC131. In summer season 2017, produced 21 crosses and the commercial check hybrid i.e. TWC 324 were evaluated in replicated yield trails conducted at Ismailia, Sakha and Sids Agricultural Research Stations. A randomized complete block design (RCBD) with four replications was used at each location. Plot size was one ridge, 6 m long, 80 cm apart (4.8 m^2) and hills were spaced 25 cm along the ridge. Two seeds were planted per hill and thinned later to one plant per hill to provide a population density of approximately 21000 plants/feddan (one feddan=4200 m^2). All agricultural practices were applied as recommended at the proper time. Data were recorded for seven agronomic traits; days to 50% silking, grain yield/plot (kg) adjusted to 15.5% grain moisture content and converted to ardab per feddan (ardab=140 kg), no. of ears/plant, ear length (cm), ear diameter (cm), number of rows/ear and number of kernels/row. Analysis of variance was performed for the combined data across three locations according to Snedecor and Cochran (1967). The means of genotypes were compared using the least significant differences (L.S.D) at 5% and 1% level of probability according to Gomez and Gomez (1984).

* Corresponding author.
E-mail address: hanymageed@yahoo.com
DOI: 10.21608/jpp.2021.154325

Line x tester analysis was applied as described by Kempthorne (1957) and as explained by Singh and Chaudhary (1985) to obtain information about the combining ability of lines and testers as well as to estimate the types of gene action controlling grain yield and other studied traits in the tested lines.

RESULTS AND DISCUSSION

Analysis of variance:

The combined analysis of variance across three locations for 21 crosses for seven traits is presented in Table 1. Results showed significant differences among the three locations for all traits, indicating the presence of a clear variation among the three locations in climatic and soil conditions for these traits. Significant or highly significant differences among crosses (C) were detected for all traits, indicating that crosses had a wide genetic diversity among themselves for these traits providing opportunity for selection. Significant or highly significant mean square were observed for lines (L), testers (T) and their interaction (LxT) for all studied traits, except for (T) for number of rows/ear and (L) and (LxT) for number of ears/plant, meaning that great diversity exists among inbred lines and among testers; also indicated that the inbred lines performed differently in their respective crosses depending on the type of testers used for these traits. These results are in agreement with those reported by several authors among of them. Mosa (2003), Mousa and Aly (2012), Barh *et al*., (2015), Darshan and Marker (2019), Abd El-Moula *et al*., (2009) and Mousa and Abd El-Azeem (2009). The interaction of crosses x locations (C x Loc) and their partitions i.e., L x Loc, T x Loc and L x T x Loc were significant or highly significant for all traits, meaning that the lines, testers and crosses differed in their order from location to another, also indicated that it would be worthwhile to evaluate testcrosses under multi-environments, especially for grain yield, which was regarded as a complex polygenic trait Darrah and Hallauer (1972).

Table 1. Line x tester analysis of 21 three-way crosses for seven traits combined across three locations.

SOV	d.f	Days to 50% Silking	Grain Yield (ard/fed)	No. of ears /plant	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels/ row
Locations (Loc.)	2	26.111**	2820.426**	0.3538**	35.881**	0.156**	10.982**	24.33**
Reps/Loc.	9	0.266	7.049	0.0027	0.282	0.012	0.171	1.35
Crosses(C)	20	12.303**	40.589**	0.0061*	3.279**	0.122**	1.436**	10.18**
Lines (L)	6	11.120**	39.297**	0.0034	4.619**	0.138**	2.225**	12.80**
Testers (T)	2	20.433**	77.268**	0.0222**	3.061**	0.373**	1.319	20.48**
Lines × Testers	12	11.539**	35.122**	0.0048	2.645**	0.073**	1.062*	7.16**
C × Loc.	40	5.461**	27.530**	0.0097**	1.803**	0.086**	1.578**	8.55**
Lines × Loc.	12	4.190**	40.867**	0.0159**	3.466**	0.109**	1.236*	16.60**
Testers × Loc.	4	4.444**	39.886**	0.0162**	0.705*	0.119**	1.427*	6.57**
L× T ×Loc	24	6.266**	18.802**	0.0055**	1.154**	0.068**	1.941**	4.85**
Pooled error	180	0.302	8.558	0.0036	0.332	0.035	0.558	2.10

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

Mean performance

Table 2. presented mean performance of the 21crosses and one check for seven traits of maize combined over three locations. Mean values of crosses for days to 50% silking ranged from 58.83 days for Gz-8093 x SC 131to 62.50 days for AED-6132 x SC-10. Furthermore, 15 new three-way crosses (TWC) were significantly earlier than the check hybrid. The best crosses from them were Gz 8093 x SC 131 followed by AED 6132 x SC 131 and Gz 7253 x SC 128. For grain yield, results revealed that the highest cross was Gz 8093 x SC 131 (31.83 ard/fed) while the lowest one was Gz 7142 x SC 128 (25 ard/fed). Five crosses (Gz 8092 x SC 131, AED 6132 x SC 131, Tep 6420 x SC 10, Tep 6420 x SC 128 and Tep 6420 x SC 131) were not significantly outyielded the check for yield TWC 324 (28.48 ard/fed), while the cross Gz-8093 x SC 131 highly significantly outyielded the TWC 324. This study suggests that use of these six crosses as good as three-way crosses for maize breeding programs. Number of ears/plant ranged from 0.98 for Gz 8092 x SC10, AED 7135 x SC10 and AED 6132 x SC128 to 1.08 for Gz 8093 x SC131. For ear length, the cross Gz-7253 x SC 10 recorded the lowest value (18.56 cm). In the contrast, the highest value was recorded by the cross Gz-8093 x SC 131 (20.97cm). Two crosses (Gz-8093 x SC 131 and AED 7135 x SC10) had significantly longer ears than the check TWC 324. Ear diameter ranged from 4.42 cm for Tep-6420 x SC10 to 4.88 cm for Gz-8093 x SC 131. Three crosses (Gz-8093 x SC 131, Gz-8092 x SC 128 andGz-8092 x SC 131) recorded significantly thicker ears than the check TWC 324. For number of rows per ear means ranged from 13.63 for Gz-7142 x SC 128 to 15.07 for Gz-8093 x SC 131; seven crosses, Gz-8093 x SC 128, Gz-8093 x SC 131, Gz-8092 x SC 131, Gz-7253 x SC 128, AED 7132 x SC128, AED 7132 x SC131 and Tep-6420 x SC128 significantly surpassed the check TWC 324 for number of rows. Number of kernels per row ranged from 39.17 for cross Gz-7253 x SC 10 to 43.23 for Gz-8093 x SC 131, only one cross (Gz-8093 x SC 131) significantly surpassed the check TWC 324. From above results, two three-way crosses (Gz-8093 x SC 131 and AED 6132 x SC131) showed earliness and superiority for grain yield and its components. This study recommended the future use of these crosses in maize breeding program.

General combining ability (GCA) effects:

Estimates of general combining ability effects of seven inbred lines and three testers for seven traits combined across three locations are presented in Table 3. The best inbred lines for general combining ability (GCA) Gz-8092, Gz-8093 and Gz-7253 for earliness, Tep-6420 for grain yield, Gz 8093 for ear length, ear diameter, number of rows/ear and number of kernels/row, AED 7135 for ear length, and AED 7132 for number of rows/ear. The best tester for GCA effect was SC 131 for earliness, grain yield, number of ears/plant, ear length and ear diameter and SC 128 for number of kernels/row. Superiority of the single cross as good tester was reported by several investigators among them, Amer *et al.* (2003), Mousa and Aly (2012), Dufera *et al*., (2018), Darshan and Marker (2019), Motawei *et al*., (2019) and Mohamed (2020).

Table 2. Mean performance of 21 three-way crosses and one check for seven traits combined across three locations.

cross	Days to50% silking	Grain yield (ard/fed)	No.of ears /plant	Ear length (cm)	Ear diameter (cm)	No.of rows /ear	No.of kernels / row
Gz-8093×SC10	61.08	25.96	0.99	19.21	4.49	14.17	40.84
Gz-8093×SC128	60.33	25.83	0.99	19.53	4.61	14.50	41.38
Gz-8093×SC131	58.83	31.83	1.08	20.97	4.88	15.07	43.23
Gz-8092×SC10	59.92	25.09	1.00	18.88	4.49	14.32	40.08
Gz-8092×SC128	61.75	25.83	0.98	19.64	4.65	14.10	41.93
Gz-8092×SC131	59.58	29.18	1.01	19.38	4.65	14.60	41.75
Gz-7253×SC10	60.25	28.43	1.03	18.56	4.54	14.17	39.17
Gz-7253×SC128	59.62	27.84	1.00	19.31	4.63	14.62	41.14
Gz-7253×SC131	60.75	26.69	1.01	19.07	4.63	14.03	40.83
Gz-7142×SC10	61.25	26.42	1.02	19.15	4.47	13.90	39.82
Gz-7142×SC128	61.08	25.00	1.02	18.73	4.44	13.63	40.75
Gz-7142×SC131	62.17	25.06	1.01	18.73	4.51	14.08	39.97
AED-7135×SC10	61.33	28.34	1.01	20.09	4.49	14.20	40.99
AED-7135×SC128	60.42	27.90	0.99	19.53	4.63	14.13	41.24
AED-7135×SC131	60.58	27.70	1.02	19.33	4.48	14.17	41.33
AED-6132×SC10	62.50	26.23	0.98	19.10	4.53	14.30	40.57
AED-6132×SC128	62.25	25.78	0.98	19.28	4.58	14.57	40.32
AED-6132×SC131	59.00	30.23	1.04	19.86	4.61	14.90	41.16
Tep-6420×SC10	61.58	28.87	1.03	19.21	4.42	14.03	41.50
Tep-6420×SC128	61.58	28.57	1.01	19.21	4.58	14.63	42.46
Tep-6420×SC131	60.75	28.78	1.03	19.53	4.55	13.97	40.38
TWC-324 (check)	61.83	28.48	1.97	19.50	4.49	13.50	41.89
LSD 0.05	0.44	2.34	0.04	0.46	0.15	0.60	1.16
0.01	0.58	3.08	0.06	0.61	0.20	0.97	1.53

Table 3. Estimates of general combining ability effects for seven inbred lines and three testers for seven traits combined across three locations.

Inbred line/Tester	Days to 50% silking	Grain Yield (ard/fed)	No. of ears /plant	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels row
Gz-8093	-0.722**	0.465	0.010	0.554**	0.094**	0. 288*	0.825**
Gz-8092	-0.389**	-0.707	-0.015	-0.046	0.033	0.049	0.263
Gz-7253	-.500**	0.248	0.001	-0.369**	0.038	-0.017	-0.614*
Gz-7142	0.694**	-1.915**	0.004	-0.477**	-0.092**	-0417**	-0.814**
AED-7135	-0.028	0.573	-0.004	0.304**	-0.029	-0.123	0.197
AED-6132	0.444**	0.004	-0.007	0.067	0.005	0.299*	-0.312
Tep 6420	0.500**	1.332**	0.012	-0.033	-0.048	-0.079	0.455
SC-10	0.325**	-0.360	-0.003	-0.175**	-0.075**	-0.135	-0.568**
SC-128	0.242**	-0.727*	-0.015*	-0.029	0.025	0.022	0.325*
SC-131	-0.567**	1.087**	0.017**	0.204**	0.051*	0.113	0.244
LSD (L) 0.05	0.180	0.956	0.022	0.188	0.061	0.244	0.474
0.01	0.236	1.256	0.028	0.247	0.081	0.321	0.623
SE gi-gj (L)	0.022	0.115	0.003	0.023	0.007	0.029	0.057
LSD (T) 0.05	0.118	0.626	0.012	0.123	0.040	0.160	0.310
0.01	0.154	0.822	0.017	0.162	0.053	0.210	0.408
SE gi-gj (T)	0.009	0.049	0.001	0.010	0.003	0.013	0.244

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

Specific combining ability (SCA) effects:

Table 4. showed estimates of specific combining ability (SCA) effects of the 21 test crosses for seven studied traits. The results revealed that the desirable cross for SCA effects were Gz 8093x SC131 for earliness, grain yield, number of ears/plant, ear length, ear diameter and number of kernels/row also crosses Gz 8092x SC 10, Gz 7253x SC 10, Gz 7253 x SC 128, Gz 7142 x SC 10, Gz 7142 x SC 128, AED 7135 x SC 128 for earliness, AED 6132 x SC 131for earliness and grain yield and Cross Gz 8092 x SC 128, Gz 7253xSC128, Gz 7142 x SC 10 and AED 7135 x SC10 for ear length. These crosses could be used in the maize hybrid program.

Genetic parameters:

Estimates of genetic parameters and their interaction with location are presented in Table 5. The results revealed that the general combining ability GCA variances were larger than specific combining ability SCA variances for days to 50% silking, number of ears/plant, ear length and ear diameter indicating that additive genetic variance played the major role than non-additive gene effects in the inheritance of these traits. These results are similar with those reported by Mosa (2010), AL AbdAlhadi *et al.*, (2013) and Tessema *et al.*, (2014). While the SCA variance was larger than GCA effects for grain yield, number of rows/ear and number of kernels/row, indicating that non-additive gene effects are more important than additive gene effects in the inheritance of these traits. These results are similar with those reported by Abdel-Moneam *et al.*, (2009) and Aly *et al.*, (2011). Moreover, results showed that interactions of SCA x Location was higher than GCA x Location for all traits, except for number of ears/plant, indicating that the non-additive type of gene action was more effected by environmental condition than additive gene action. Similar results were reported by Aly and Mousa (2008), Mosa (2010), Mousa and Aly (2012) and El-Gazzar *et al.*, (2013).

Table 4. Estimates of specific combining ability effects for 21 three-way crosses for seven traits combined across three locations.

cross	Days to 50% silking	Grain yield (ard/fed)	No.of ears /plant	Ear length (cm)	Ear diameter (cm)	No.of rows /ear	No.of kernels / row
Gz-8093×SC10	0.675**	-1.554	-0.025	-0.517**	-0.091	-0.276	-0.407
Gz-8093×SC128	0.008	-1.312	-0.013	-0.346*	-0.075	-0.100	-0.766
Gz-8093×SC131	-0.683**	2.866**	0.038*	0.863**	0.166**	0.376	1.173**
Gz-8092×SC10	-0.825**	-1.249	0.008	-0.242	-0.030	0.113	-0.604
Gz-8092×SC128	1.091**	-0.139	-0.005	0.370*	0.028	-0.261	0.353
Gz-8092×SC131	-0.266	1.388	-0.004	-0.129	0.002	0.148	0.251
Gz-7253×SC10	-0.381*	1.137	0.017	-0.244	0.014	0.029	-0.643
Gz-7253×SC128	-0.631**	0.913	0.004	0.359*	0.006	0.322	0.439
Gz-7253×SC131	1.012**	-2.051*	-0.020	-0.115	-0.020	-0.352	0.204
Gz-7142×SC10	-0.575**	1.285	0.006	0.456**	0.070	0.163	0.207
Gz-7142×SC128	-0.659**	0.236	0.017	-0.108	-0.055	-0.261	0.248
Gz-7142×SC131	1.234**	-1.520	-0.023	-0.348*	0.015	0.098	-0.455
AED7135×SC10	0.230	0.721	0.006	0.617**	0.031	0.168	0.371
AED7135×SC128	-0.603**	0.647	0.001	-0.096	0.073	-0.056	-0.272
AED7135×SC131	0.373*	-1.367	-0.006	-0.520**	-0.104	-0.113	-0.099
AED6132×SC10	0.925**	-0.827	-0.017	-0.139	0.031	-0.154	0.454
AED6132×SC128	0.758**	-0.900	-0.005	-0.102	-0.019	-0.044	-0.688
AED6132×SC131	-1.683**	1.727*	0.021	0.241	-0.012	0.198	0.234
Tep6420×SC10	-0.048	0.487	0.006	0.069	-0.025	-0.043	0.621
Tep6420×SC128	0.036	0.555	0.001	-0.077	0.042	0.400	0.687
Tep6420×SC131	0.012	-1.042	-0.006	0.008	-0.017	-0.357	-1.308**
LSD Sij 0.05	0.311	1.655	0.037	0.326	0.106	0.423	0.821
LSD Sij 0.01	0.409	2.175	0.049	0.428	0.140	0.555	1.079
SE Sij- Sik	0.065	0.345	0.008	0.068	0.022	0.088	0. 171

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

Table 5. Genetic parameters and their interactions with locations for seven traits of maize combined across three locations.

Genetic Parameters	Days to 50% silking (days)	Grain Yield (ard/fed)	No. of ears /plant	Ear length(cm)	Ear diameter(cm)	No.of rows /ear	No. of kernels row
GCA	0.26	0.82	0.001	0.30	0.004	0.02	0.26
SCA	0.10	2.21	0.0001	0.19	0.003	0.04	0.42
GCA × Loc	0.18	1.50	0.0006	0.08	0.004	0.03	0.47
SCA × Loc	1.49	2.56	0.0004	0.20	0.008	0.34	0.68

REFERENCES

Abd El-Moula, M. A. and A. M. M. Abd El-Aal (2009). Evaluation of some new yellow maize inbred lines via top cross analysis. Egypt. J. of Appl. Sci. 24 (12A): 148-166.

Abdel-Moneam, N. A., A. N. Attia, M. I. El-Emery and E. A. Fayed (2009). Combining ability and Heterosis for some agronomic traits in crosses of maize. Pakistan Journal of Biological Sciences, 12(5): 433-438.

AL AbdAlhadi, R.A.; S.A. Moammar and A.A. AL-Mansour (2013). Combining Ability in Grain Yield and Other Related Traits of Sweet Corn (*Zea mays sacharata* L.) in Syria. International Journal of Plant Breeding, 7 (2).96-100.

Ali, A.; H. Rahman; L. Shah; K.A. Shah and S. Rehman (2014). Heterosis for grain yield and its attributing components in maize variety using line x tester analysis method. Academic J. Agri. Res. 2 (11): 225-230.

Aly, R.S.H.; E.M.R. Metwali and S.T.M. Mousa (2011). Combining Ability of Maize (*Zea mays* L.) Inbred Lines for Grain Yield and Some Agronomic Traits Using Top Cross Mating Design. Global Journal of Molecular Sciences, 6 (1): 01-08.

Aly, R. S. H. and S. Th. M. Mousa (2008). Estimation of combining ability for newly developed white inbred lines of maize (*Zea mays* L.) *via* line x tester analysis. Egyptian Journal of Applied Sciences, 23(2B): 554 – 564.

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. Proceed Third Pl. Breed. Conf. April 26, 2003, Giza.

Barh Anupam; N.K Singh; S. S Verma; J.P Jaiswal and P.S Shukla (2015). Combining ability analysis and nature of gene action for grain yield in maize hybrids. International Journal of Environmental & Agriculture Research.Vol-1, Issue-8, December, 2-9.

Betran, F.J.; J.M. Ribaut; D. Beck; Leon de Gonzalez (2003). Genetic diversity, SCA and heterosis in tropical maize under stress and non-stress environment. Crop Sci. 43:797-806.

Darrah, L.L. and A.R. Hallauer (1972). Genetic effects estimate from generation means in four diallel sets of maize inbreds. Crop Sci. 12: 615-621.

Darshan, S.S. and S. Marker (2019). Heterosis and combining ability for grain yield and its component characters in quality protein maize (*Zea mays* L.) hybrids. Electronic Journal of Plant Breeding, 10 (1): 111 – 118.

Dufera T.; T. Bulti and A. Girum (2018). Heterosis and combining ability analysis of quality protein maize (*Zea mays* L.) inbred lines adapted to mid-altitude sub-humid agro-ecology of Ethiopia. African Journal of Plant Science, 12(3): 47-57.

El-Gazzar, I.A.; M.A. El-Ghonemy and S. Th. Mousa (2013). Evaluation of new inbred lines of white maize *via* line x tester analysis over three locations. J. Plant Production, Mansoura Univ. 4: 897-906.

Girma, C.H.; A. Sentayehu; T. Berhanu and M. Temesgen (2015). Test cross performance and combining ability of maize (*Zea mays* L.) inbred lines at Bako, 639 Western Ethiopia. Global J. of Sci. Fron. Res. 15(4) 1:1-12.

Golbashy, M.; M. Ebrahimi; S. Khavari Khorasani and R. Choucan (2010). Evaluation of drought tolerance of some corn (*Zea mays* L.) hybrids. Iran. Afr. J. Agric. Res. 5 (19): 2714-2719.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research. 2nd Ed. John Wiley and Sons. Inc. New York.

Kempthorne, O. (1957). An Introduction to Genetic Statistics. John Wiley-Sons Inc., New York U.S.A.

Mohamed, H.A.A. (2020). Combining ability of newly developed white maize (*Zea mays* L.) inbred lines via top cross analysis. Zagazig J. Agric. Res. 47 (3): 657-668.

Mosa, H.E. (2003). Heterosis and combining ability in maize (*Zea Mays* L.). Minufiya. J. Agric. Res.28:1375-1386.

Mosa, H.E. (2010). Estimation of combining ability of maize inbred lines using top cross mating design. J. Agric. Res. Kafar El-Sheikh Univ. 36 (1)1-16.

Motawei, A.A.; H.E. Mosa; M.A.G. Khalil; M.M.B. Darwish and H.A.A. Mohamed (2019). Combining ability and heterotic grouping of two sets of new maize inbred lines. Egypt. J. Plant Breed. 23(4):667–679.

Mousa, S. Th.M. and M.E.M. Abd El-Azeem (2009). Combining ability of new yellow maize inbred lines using line x tester analysis. Anual. of Agric. Sci., Moshtohor, 47(1): 35-42.

Mousa, S. Th.M. and R. S. H. Aly (2012). Estimation of combining ability effects of new white maize inbred lines (*Zea mays* L.) *via* line x tester analysis. Egypt J. Agric. Res. 90 (4): 77-90.

Ram, L.; R. Singh; S.K. Singh and R.P. Srivastava (2015). Heterosis and combining ability studies for quality protein in maize. J. Crop Breed. and Genet. 1 (2): 8-25.

Singh, R.K. and D.B. Chaudhary (1985). Biometrical Methods in Quantitative Genetic Analysis. Kalyani Publisher. New Delhi, 3rd Ed., P.39-68.

Snedecor, G.W. and W.G. Cochran, (1967). Statistical methods. 6th Edition, Iowa State Univ., Press. Ames, Iowa, USA.

Tessema T, A. Sentayehu, M. Temesgen and W. Dagne (2014). Test Cross Mean Performance and Combining Ability Study of Elite Lowland Maize (Zea mays L.) Inbred Lines at Melkassa, Ethiopia. Advances in Crop Science and Technology 2:140.

Xingming, F.; T. Jing; H. Bihua and L. Feng (2001). Analyses of combining ability and heterotic groups of yellow grain quality protein maize inbreds. Seventh Eastern and Southern Africa Regional maize conference 11th -15th February. pp. 143-148.

القدرة على التآلف لسلالات الذرة الشامية البيضاء باستخدام تحليل السلالة في الكشاف

سمير ثروت محمود موسى ، هاني عبد الله عبد المجيد محمد ، رزق صلاح حسانين على و هاني عبد العاطي عبد العاطي درويش
قسم بحوث الذرة الشامية – محطة البحوث الزراعية بالإسماعيلية-مركز البحوث الزراعية

تم في هذه الدراسة اختبار سبع سلالات جديدة من الذرة الشامية للقدرة على التالف عن طريق تحليل السلالة في الكشاف حيث تم تهجينها مع ثلاثة من الكشافات البيضاء وهي هجين فردى 10وهجين فردى 128وهجين فردى131 بمحطة البحوث الزراعية بالإسماعيلية خلال الموسم الصيفي 2016. تم تقييم ال 21 هجين بالإضافة الى واحد من الهجن التجارية هو هجين ثلاثي 324و ذلك في ثلاث محطات بحوث زراعية بالإسماعيلية وسخا وسدس خلال الموسم الصيفي 2017 أظهرت النتائج ان التباينات الراجعة للهجن ومجزئاتها (السلالات والكشافات والسلالة × الكشاف) وكذلك لتفاعلاتها مع المواقع كانت معنوية او عالية المعنوية ماعدا تباين السلالات وتفاعل السلالات في الكشافات لصفة عدد الكيزان للنبات وكذلك تباين الكشافات لصفة عدد الصفوف بالكوز. كانت أفضل السلالات في القدرة العامة على التآلف هي سلالات Gz-8093 و Gz-8092 و Gz-7253 للتبكير و Tep-6420 لمحصول الحبوب وGz-8093 وAED-7135 لطول الكوز وGz-8093 لقطر الكوز وعدد الصفوف بالكوز وعدد الحبوب بالصف بينما اظهر الكشاف SC131 أفضل قدرة على التالف لصفات التبكير ومحصول الحبوب وعدد الكيزان للنبات وطول الكوز وقطر الكوز. أفضل الهجن في القدرة الخاصة على التآلف هي Gz 8093 x SC131 في كل الصفات وكذلك الهجين AED-6132 x SC131لصفتي التبكير ومحصول الحبوب. كان الفعل الجيني المضيف أكثر أهمية في وراثة صفات عدد الأيام لظهور 50 % من الحرائر للنورات المؤنثة ولعدد الكيزان للنبات وطول الكوز وقطر الكوز في حين كان الفعل الجيني غير المضيف هو المهم في وراثة صفات محصول الحبوب وعدد الصفوف بالكوز وعدد الحبوب بالصف. علاوة على ذلك كان الفعل الجيني غير المضيف أكثر تأثرا بالمواقع مقارنة بالفعل الجيني المضيف لجميع الصفات ماعدا صفة عدد الكيزان للنبات. أظهرت النتائج تفوق ال هجينGz8093 x SC131 عن هجين المقارنة (الهجين الثلاثي 324) ولذلك توصى الدراسة باستخدامه في البرامج المستقبلية لتربية الذرة الشامية.