Menoufia J. Plant Prod., Vol. 4 April (2019): 121 - 134

ESTIMATION OF COMBINING ABILITY FOR YIELD AND SOME (*Zea mays*, L.) AGRONOMICAL TRAITS IN NEW YELLOW MAIZE INBRED LINES USING TOP CROSSES METHOD

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Received: Feb. 10 , 2019 Accepted: Feb. 14 , 2019

ABSTRACT: ***Fifteen yellow inbred lines of maize were crossed with three yellow inbred testers Gz664, Gm 6061 and Gm 6042 to produce 45 hybrids during summer, 2015 at Gemmeiza Research Station. In summer season, 2016 the 45 hybrids and the three checks were evaluated under two locations i.e Gemmeiza and Nubaria Research Stations. The rustles of these studies can be summered that: mean squares of crosses and their partitions (lines, testers and lines x testers) showed highly significant for all traits under this study except, crosses, line, tester and line x tester mean squares for ear length and ear diameter under two locations. The additive and additive x additive gene actions played more important in the inheritance of ear length at Nub. Location and ear diameter at both locations, Non- additive gene effects played an important role in the inheritance of days to 50% silking, plant and ear heights and grain yield at both locations and ear length at Gemmeiza location. Regarding Gm 17 had negative and significant GCA effect in Gemmeiza location for plant and ear heights and positively significant for grain yield in both locations, For Gm 19which had positively significant GCA effect for grain yield in both locations Gm 37 had negatively significant GCA effect for days to 50 % silking in both locations and positive and significant GCA effect for grain yield in both locations. For grain yield, the three crosses (Gm17 x Gm 6061), (Gm22 x Gm 6042) and (Gm36 x Gm 6042) had positively highly significant SCA effects in both locations .***

Key words: ***(Zea mays L.), Top crosses, combining ability, Genotype x environment, Yellow Maize***

INTRODUCTION

The success of hybrid maize development depends on the ability of the breeding program to rapidly isolate lines that combine well in hybrid combinations and to identify appropriate heterotic combinations to maximize the vigor of the hybrid (Kim and Ajala, 1996). The general process to develop maize hybrids starts with the creation of a source segregating breeding population that is used to develop inbred lines through inbreeding and selection (Betran *et al*., 2004). Selected inbred lines are then evaluated in hybrid combinations across locations to select superior hybrids and to estimate their combining ability. The behavior of a line in hybrid combination is assessed through the estimation of general combining ability (gca) and specific combining ability (sca) effects. Combining ability analysis is an important method to evaluate the prepotency of cultures to be used in breeding programm and to assess the gene action involved in various characters so as to design an appropriate and efficient breeding method. Combining ability analysis provides these informatios and is frequently used by plant breeders to choose parents with a high general combining ability and hybrids with high specific combining ability effects. Numerous investigators reported that the additive gene effects played an effective role in the inheritance of grain yield (Paul and Debanth, 1999; Irshad-El-Haq *et al*., 2010 and El-Badawy 2013) and number of rows/ear (Mosa *et al*., 2009; Mosa, 2010 and Aly *et al*., 2011). While, Kamara (2012), Aly (2013), El-Badawy (2013) and EL-Hosary and Elgammaal (2013) that reported the non-additive gene effects represented the major role in the inheritance of grain yield and the other agronomical traits. Line X Tester analysis is an extension of the Top cross method in which several testers are used (Kempthorne,1957).

The main aims of this study (a) to estimate of combining ability of inbred lines for grain yield and the other agronomical traits. (b) to identify of type of gen action played an effective role in the inheritance of traits studied and (c) to identify the superior crosses to improve yielding ability in maize breeding program.

MATERIAL AND METHODS

Fifteen yellow inbred lines of maize; (Gm 10, 12, 14, 15, 17, 19, 20, 22, 23, 25, 35, 36, 37, 41 and 55) were crossed with three yellow inbred testers Gz 664, Gm 6061 and Gm 6042 to produce 45 hybrids during summer, 2015 at Gemmeiza Research Station name and origin for lines and testers are presented in (Table 1).

The F_1 of the 45 hybrids and the two standard check hybrids SC 162 and SC 168 were evaluated in randomized block design with four replications during summer, 2016 in the two Experimental Farms at Gemmeiza and Nubaria Research Station. Each entry comprised of one row having 25 plants per row in each replication in a plot size of 4.8 m^2. The data ware recorded on six quantitative characters j.e., days to 50 % silking plant height, ear height, ear length, ear diameter and grain yield ard. / fed., Line x Tester analysis was carried out using the procedure described by Kempthorne (1957). The superiority percentage was estimated over the two checks as per standard procedure.

Table (1): Name and origin of fifteen yellow inbred lines and three yellow inbred testers.

Lines	Origin
Gm 10, 12, 14, 15, 17, 19, 20, 22, 23 and 25	(Nub. yellow Pop.)
Gm 35, 36, 37, 41 and 55	(Comp.♯ 21)
Testers	Organ
Gz 664	SD.62MS(M017CW.153)
Gm 6061	Pool-18-627 M
Gm 6042	(Gm. yellow Pop.)

RESULTS AND DISCUSSION

1- Analysis of variance:

Mean squares for the six traits i.e., (days to 50% silking, plant height, ear height, ear length, ear diameter and grain yield) under two locations were computed (Table 2) Mean squares of crosses and their partitions (lines, testers and lines x testers) showed highly significant for all traits under this study, except crosses, line, tester and line x tester mean squares for ear length and ear diameter under two locations However, significant mean squares of parents and crosses where its magnitudes were larger than their corresponding mean squares of error would indicate the successful of planned crosses due to the presence of sufficient variability. The contribution of lines x testers interaction which were found to be highly significant, indicating that testers express similar orders of ranking according to the performance of their crosses with the three testers. These results were obtained by Sadek *et al*. (2001), Gamea *et al*. (2015) and Aboyousef *et al*. (2016).

Table (2): Analysis of variances for Days to 50%, Plant height, Ear height, Ear length , Ear diameter and Grain yield traits over two locations.

S.O.V	Df	Days to 50% silking		Plant height(cm)		Ear height(cm)	
		Gm	Nub	Gm	Nub	Gm	Nub
Rep	3	0.39	2.85	240.93	718.89	84.21	233.10
Crosses	44	19.81**	21.66**	563.68**	425.11**	542.18**	443.61*
Lines	14	26.08**	19.16**	482.88**	370.00**	675.73**	576.33**
Testers	2	100.51**	173.04**	675.14**	1072.92**	967.22**	1902.6**
Li x T	28	10.90**	12.09**	596.12**	406.40**	445.05**	273.03**
Error	308	1.09	0.93	39.51	209.99	36.49	133.01
C.V%		1.88	1.56	2.80	6.84	5.37	10.48

Table (2): Cont.

S.O.V	df	Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
		Gm	Nub	Gm	Nub	Gm	Nub
Rep	3	0.18	6.33	0.15	0.94	0.27	39.22
Cross	44	2.50	1.32	0.15	0.21	77.10**	68.41**
Line	14	1.27	1.35	0.12	0.28	76.43**	66.35**
Tester	2	1.57	0.34	0.04	0.09	70.12**	100.62**
LI x T	28	3.17	1.37	0.18	0.18	77.93**	67.14**
Error	308	2.60	1.85	0.12	0.22	3.03	7.63
CV%		8.31	7.27	7.16	10.83	5.76	9.14

2- Mean performance

Regarding Number of days to 50% silking, all crosses at Gemmeiza location and 41 crosses at Nub. location showed significant difference for earliness compared with SC.162 and 38 crosses at Nub. location showed significant for earliness compared with SC.168.

For plant height mean performance, it showed that out of 45 crosses, 33 crosses had significant and highly significant compared with SC162, 30 crosses had significant and highly significant compared with SC168 in Gemmeiza location, 43 crosses had significant and highly significant compared with check varieties SC162 and 168 at Nub. location.

For ear height mean performance, it showed that out of 45 crosses, 43 crosses had significant and highly significant compared with check varieties SC162 and SC168 at Gemmeiza location, 30 crosses had significant and highly significant compared with SC162 and 19 crosses had significant and highly significant compared with SC168 at Nub. location.

Insignificant differences for all crosses compared with check varieties SC162 and SC168.were optioned for ear length and ear diameter.

Grain yield, at Gemmeiza location three crosses; (Gm 17 x Gm 6061), (Gm 22 x Gm 6042) and (Gm 37 x Gz 664) had significant and positive values for grain yield compared with the best check SC168, while at Nub. Location two crosses (Gm 15 x Gz 664) and (Gm 20 x Gz 664) exhibited significant compered the same check for this trait in (Table 3).

Gene action

Estimation of genetical parameters for the traits studied under combined data are presented in Table (4). Results cleared that, δ^2 GCA-L was more than δ^2 GSA-T for ear height at Gemmeiza location for ear length at Nub. Location and grain yield at Gemmeiza location, meaning that most of additive gene action due to lines. These results are in harmony with those reported by Aly *et al*. (2011), Mousa and Aly (2012) and Aly (2013). The additive and additive x additive gene actions played more - locations, while, the non- additive gene effects played an important role in the inheritance of days to 50% silking, plant and ear heights and grain yield at both locations and ear length at Gemmeiza location. These results agreed with those reported by Todkar and Navale (2006), Singh and Roy (2007), Abdallah *et al*. (2009), Ibrahim *et al*. (2010) and Aboyousef *et al*. (2016). The results in Table (4) revealed that the GSA\SCA ratios were less than unity for most studied traits, indicating that SCA variances were more important than GCA variances and that the non-additive variance i.e. dominance, dominance x dominance and additive x dominance gene ainteractions were predominant in the genetic variance of the present genetic materials' for most studied traits, this may illustrate the high values of heterotic effects would be found in these materials besides the divergence of the two parental groups in origin .these results agreed with those reported by Todkar and Navale (2006), Singh and Roy (2007) Abdallah *et al.* (2009), Ibrahim *et al.* (2010) and Aboyousef *et al. (2016)* On the other hand, Aly *et al.* (2011), Mousa and Aly (2012) and Aly (2013) found that the additive and additive x additive gene actions played an important role in same traits.

Table (3): Mean performance of forty five crosses and two check varieties for Days to 50%, Plant height, Ear height, Ear length, Ear diameter and Grain yield traits over two locations.

traits	Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
crosses	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.
Gm10 x Gz664	58.75	66.75	222.50	237.50	113.75	113.75	19.35	19.35	4.65	4.65	29.13	27.66
Gm10 xGm6061	59.50	65.00	217.50	193.75	107.5	103.75	18.30	18.70	4.70	4.50	26.28	26.41
Gm10 x Gm6042	52.00	57.50	220.00	192.50	97.5	90.00	19.40	18.25	4.75	4.45	28.30	25.96
Gm12 x Gz664	59.25	66.00	227.50	213.75	106.25	112.50	19.30	18.20	4.70	4.25	22.29	30.05
Gm12 xGm6061	56.25	62.25	247.50	226.25	132.5	122.50	19.40	18.75	4.75	4.40	34.70	27.50
Gm12 x Gm6042	56.50	62.75	220.00	211.25	105	102.50	19.15	18.35	4.70	4.25	30.17	32.68
Gm14 x Gz664	58.25	63.75	230.00	211.25	123.75	125.00	19.30	18.85	4.80	4.25	29.65	28.03
Gm14 xGm6061	55.75	61.00	207.50	205.00	105	113.75	19.10	19.40	4.65	4.40	30.10	31.20
Gm14 x Gm6042	57.25	60.00	238.75	216.25	126.25	113.75	20.00	19.50	4.95	4.30	30.36	27.00
Gm15 x Gz664	59.25	65.25	220.00	215.00	112.5	115.00	19.95	19.50	4.65	4.35	22.73	40.43
Gm15 xGm6061	55.50	61.00	232.50	207.50	106.25	110.00	20.25	19.05	4.85	4.35	31.60	32.04
Gm15 x Gm6042	55.50	59.00	232.50	213.75	108.75	102.50	17.75	17.95	4.20	4.50	23.32	25.20
Gm17 x Gz664	58.75	66.50	212.50	210.00	111.25	116.25	20.05	18.10	4.15	4.45	28.73	32.45
Gm17 xGm6061	56.50	62.00	225.00	217.50	107.5	112.50	20.25	18.95	4.75	4.50	41.94	38.44
Gm17 x Gm6042	52.75	59.75	208.75	202.50	107.5	96.25	19.20	18.70	4.75	4.30	27.60	26.42
Gm19 x Gz664	59.00	64.75	246.25	226.25	143.75	137.50	18.75	18.35	4.70	4.40	33.60	31.79
Gm19 xGm6061	55.50	62.25	217.50	228.75	111.25	123.75	20.05	18.05	4.75	4.40	31.67	37.87
Gm19 x Gm6042	55.50	60.25	221.25	201.25	106.25	98.75	19.10	19.00	4.80	4.30	31.26	29.12
Gm20 x Gz664	59.50	66.75	221.25	222.50	122.5	126.25	17.35	18.55	4.65	4.50	30.70	41.54
Gm20 xGm6061	56.25	63.50	208.75	232.50	118.75	128.75	20.55	19.35	4.80	4.55	32.53	27.37
Gm20 x Gm6042	53.75	59.00	231.25	210.00	105	110.00	18.85	19.25	4.45	4.45	30.46	31.69
Gm22 x Gz664	58.75	62.75	227.50	223.75	128.75	111.25	20.60	18.85	4.85	4.50	29.55	27.53
Gm22 xGm6061	56.50	63.00	246.25	212.50	128.75	136.25	18.10	19.10	4.75	4.40	34.53	31.18

Table (3): Cont.

traits	Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
crosses	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.
Gm22 x Gm6042	56.50	59.75	240.00	220.00	140	116.25	19.90	18.85	4.75	4.45	40.74	32.80
Gm23 x Gz664	56.25	61.75	217.50	217.50	116.25	113.75	19.75	18.45	4.60	4.55	30.09	30.50
Gm23 xGm6061	53.75	60.00	226.25	216.25	115	107.50	20.25	18.20	4.75	4.40	33.85	28.92
Gm23 x Gm6042	52.25	58.50	211.25	197.50	100	103.75	19.00	18.75	4.70	4.55	25.86	28.43
Gm25 x Gz664	52.75	60.00	226.25	203.75	111.25	106.25	18.75	19.15	4.70	4.45	29.98	31.93
Gm25 xGm6061	53.75	59.25	212.50	201.25	107.5	103.75	19.75	19.65	4.80	4.35	30.62	32.23
Gm25 x Gm6042	52.50	59.50	217.50	198.75	103.75	100.00	19.75	18.55	4.60	4.55	30.72	27.42
Gm35 x Gz664	55.50	61.25	222.50	203.75	105	97.50	18.15	18.35	4.80	4.35	30.36	30.81
Gm35 xGm6061	53.75	62.75	215.00	222.50	105	102.50	20.25	18.00	4.80	4.35	28.80	30.10
Gm35 x Gm6042	55.50	61.00	245.00	221.25	138.75	108.75	20.25	18.15	4.90	4.50	21.63	22.96
Gm36 x Gz664	56.25	60.50	242.50	220.00	115	111.25	18.45	18.60	4.65	4.45	29.95	26.09
Gm36 xGm6061	54.00	60.00	190.00	200.00	90	102.50	19.90	17.60	4.75	4.30	22.62	24.92
Gm36 x Gm6042	56.75	61.00	222.50	210.00	107.5	110.00	20.25	18.05	4.70	4.50	35.90	30.55
Gm37 x Gz664	55.50	59.75	240.00	205.00	123.75	102.50	20.05	18.95	4.95	4.45	39.47	31.59
Gm37 xGm6061	55.25	61.00	218.75	211.25	103.75	113.75	20.20	19.35	4.70	4.40	33.02	35.64
Gm37 x Gm6042	53.75	60.00	227.50	208.75	108.75	105.00	20.00	19.00	4.70	4.45	29.55	28.85
Gm41 x Gz664	53.00	61.25	222.50	223.75	110	121.25	19.25	19.30	4.75	4.60	26.26	30.49
Gm41 xGm6061	54.75	60.50	213.75	207.50	102.5	100.00	18.50	17.75	4.55	4.50	33.21	32.78
Gm41 x Gm6042	50.75	59.75	216.25	205.00	98.75	95.00	19.35	19.60	4.85	4.60	31.56	32.97
Gm55 x Gz664	55.00	62.50	220.00	202.50	112.5	100.00	19.45	18.40	4.80	4.65	29.54	28.56
Gm55 xGm6061	57.25	64.50	225.00	210.00	105	106.25	18.75	18.40	4.75	4.50	26.74	21.76
Gm55 x Gm6042	55.75	61.00	227.50	202.50	105	101.25	20.35	19.45	4.60	4.50	28.92	29.65
SC 162	63	67	255.75	238.25	146.25	135.30	24.8	25	4.6	5	34.80	33.38
SC 168	61	66	235.00	220.30	140.00	120.20	21.4	20.6	4.8	5	36.98	36.49
LSD 0.05	1.46	1.35	8.80	20.29	8.46	16.15	2.26	1.90	0.48	0.66	2.44	3.87

Table (4): Estimates of the variance due to general combining ability (GCA), specific combining ability (SCA) and their interaction with locations for Days to 50%, Plant height, Ear height, Ear length, Ear diameter and Grain yield .

S.O.V	Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
	Gm	Nub	Gm	Nub	Gm	Nub	Gm	Nub	Gm	Nub	Gm	Nub
σ^2L	1.27	0.59	-9.44	-3.03	19.22	25.28	-0.158	-0.002	-0.005	0.008	-0.125	-0.066
σ^2T	1.49	2.68	1.32	11.11	8.70	27.16	-0.027	-0.017	-0.002	-0.002	-0.130	0.558
σ^2GCA	0.09	0.09	-0.31	0.18	0.93	1.63	-0.006	-0.001	0.000	0.000	-0.008	0.012
σ^2sca	2.45	2.79	139.15	49.10	102.14	35.01	0.143	-0.120	0.015	-0.010	18.725	14.878
GCA/SCA	0.036	0,032	-0,0022	0,0037	0,0091	0,046	-0,042	,0083	-	-	-0,0004	0,0008

All negative estimates of variance were considered zero

General combining ability effects ($g^{\wedge}_i$):

High positive values of GCA effects would be of interest in most traits, while for heading date, ear height and plant height, high negative values would be useful from the plant breeder point of view

Estimation of GCA effects ($g^{\wedge}_i$) for the fifteen yellow maize inbred lines and the three testers was tabulated in Table (6). For inbred line, Gm 10 had negative and significant GCA effects in plant height in location Gemmeiza and both locations for ear height. For Gm 15, it had positively significant GCA effects for grain yield in location Nub. Regarding Gm 17, had negative and significant SCA effects effects in location Gemmeiza for plant and ear heights and positively significant SCA effects for grain yield in both locations.

For Gm 19 had positively significant GCA effects for grain yield in both location.

Regarding Gm 20, it had negative and significant GCA effects for plant height and positively significant GCA effects for grain yield at location Gemmeiza.

For Gm 23, it had negatively significant GCA effects for days to 50 % silking in both locations and plant height in Gemmeiza location.

Regarding Gm 25, it had negatively significant GCA effects for days to 50 % silking, plant and ear heights in both locations.

For Gm 35, it had negative and significant GCA effects for days to 50 % silking in location Gemmeiza and ear height in Nub location.

Regarding Gm 36, it had negatively significant GCA effects for days to 50 % silking in Nub., plant and ear heights in Gemmeiza location.

For Gm 37, it had negatively significant GCA effects for days to 50 % silking in both locations and positive and significant for grain yield in both plant locations.

Regarding Gm 41, it had negatively significant GCA effects for days to 50 % silking in both locations and plant and ear heights in Gemmeiza location.

Testers:

The results showed that the tester Gz 664 had highly positive and significant GCA effects for grain yield in Nub location. Gm 6061 had negatively significant GCA effects for plant and ear heights in Gemmeiza location and had positively significant for grain yield in Gemmeiza location and Gm 6042 had negatively significant GCA effects for days to 50 %, silking, plant height in Nub location. and ear height in location Gemmeiza. (Table 5).

Specific combining ability effects ($s^{\wedge}_{ij}$) :

Specific combining ability effect of the 45 top crosses for traits studied are presented in Table (7) appeared that, number of days to 50% silking, five crosses at both locations,(Gemmeiza and Nub.); (Gm10 x Gm 6042), (Gm17 x Gm 6042), (Gm20 x Gm 6042), (Gm25 x Gz 664) and (Gm55 x Gz 664), had desirable negative and significant values of ($s^{\wedge}_{ij}$), While, six crosses at Gemmeiza location; (Gm14 x Gm 6061), (Gm15 x Gm 6061), (Gm19 x Gm 6061), (Gm35 x Gm 6061), (Gm36 x Gm 6061) and (Gm41 x Gz 664) and four crosses at Nub. Location; (Gm12 x Gm 6061), (Gm15 x Gm 6042), (Gm35 x Gz 664) and (Gm37 x Gz 664) showed regarding to negative significant for ($s^{\wedge}_{ij}$) towards earliness.

For plant height 14 crosses; (Gm12 x Gz 664), (Gm12 x Gm 6042), (Gm14x Gm 6061), (Gm15 x Gz 664), (Gm17 x Gm 6042), (Gm19 x Gm 6061) (Gm19 x Gm 6042), (Gm20 x Gm 6061), (Gm22 x Gz 664), (Gm23 x Gm 6042), (Gm35 x Gz 664), (Gm35 x Gm 6061), (Gm36 x Gm 6061) and (Gm55 x Gz 664) had negative and significant for ($s^{\wedge}_{ij}$) towards shortness in Gemmeiza location, while, the cross (Gm 10 x Gm 6061) had negative and significant ($s^{\wedge}_{ij}$) towards shortness in Nub. location.

For ear height, tow crosses (Gm19 x Gm 6042) and (Gm22 x Gz 664) had highly negatively and significant SCA effects ($s^{\wedge}_{ij}$) in Gemmeiza and Nub. Locations, while, 10 crosses; (Gm10x Gm 6042), (Gm12 x Gz 664), (Gm12x Gm 6042), (Gm14 x Gm 6061), (Gm19 x Gm 6061), (Gm20 x Gm 6042), (Gm23 x Gm 6042), (Gm35 x Gz 664), (Gm35 x Gm 6061) and (Gm36 x Gm 6061) had negative and significant values of ($s^{\wedge}_{ij}$) for low ear position in Gemmeiza location.

Table (5): General combining ability (GCA) effects of the three inbred lines as testers for grain yield and the other traits studied under two locations.

Testers		Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
		Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.
Gz664		1.34**	1.61	2.52**	3.75	4.611**	3.97	-0.18	0.01	-0.02	0.02	-0.783**	1.111**
Gm6061		-0.09	0.17	-3.81**	0.83	-2.722**	2.47	0.14	-0.08	0.03	-0.04	1.233**	0.311
Gm6042		-1.24**	-1.78**	1.29	-4.58*	-1.89*	-6.44	0.04	0.07	-0.01	0.02	-0.450*	-1.422**
Lsd gi	0.05	0.6	0.25	1.61	3.70	1.54	2.95	-	-	-	-	0.44	0.71
	0.01	0.78	0.32	2.09	4.81	2.00	3.83	-	-	-	-	0.58	0.92
Lsd gi- gj	0.05	0.85	0.35	2.27	5.24	2.18	4.17	-	-	-	-	0.63	1.0
	0.01	1.10	0.45	2.95	6.80	2.83	5.41	-	-	-	-	0.82	1.3

Table (6): General combining ability (GCA) effects of the 15 inbred lines for grain yield and the other traits studied under two locations .

lines		Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
		Gm	Nub	Gm	Nub	Gm	Nub	Gm	Nub	Gm	Nub	Gm	Nub
Gm 10		1.04*	1.39**	-4.06*	-4.08	-6.22**	-7.53*	-0.34	0.02	-0.16	0.14	-2.37**	-3.47**
Gm 12		1.62**	1.97**	7.61**	5.08	2.11	2.47	-0.09	-0.31	0.01	-0.19	-1.12*	-0.06
Gm 14		1.37**	-0.11	1.36	-1.17	5.86**	7.47*	-0.01	0.52	0.09	-0.19	-0.28	-1.56
Gm 15		1.04*	0.06	4.28*	0.08	-3.31	-0.86	-0.09	-0.06	-0.07	-0.11	-4.45**	2.36**
Gm 17		0.29	1.06**	-8.64**	-2.00	-3.72*	-1.69	0.49	-0.06	-0.24	0.06	2.63**	2.28**
Gm 19		0.96**	0.72**	4.28*	6.75**	7.94**	9.97**	-0.18	-0.31	0.09	-0.11	1.97**	2.61**
Gm 20		0.79*	1.39**	-3.64*	9.67	2.94	11.64**	-0.59	0.27	0.01	0.06	1.05	3.19**
Gm 22		1.54**	0.14	13.86**	6.75	20.03**	11.22**	-0.01	0.19	0.09	0.06	4.72**	0.19
Gm 23		-1.63**	-1.61**	-5.72**	-1.58	-2.06	-1.69	0.24	-0.06	-0.07	0.06	-0.37	-0.89
Gm 25		-2.71**	-2.11**	-5.31**	-10.75**	-4.97**	-6.69*	-0.01	0.44	0.01	0.06	0.22	0.36
Gm 35		-0.798*	-0.03	3.44	3.83	3.78*	-7.11*	0.16	-0.48	0.09	-0.11	-3.28**	-2.22**
Gm 36		-0.04	-1.19**	-5.72**	-2.00	-8.31**	-2.11	0.16	-0.64	0.01	-0.03	-0.78	-3.06**
Gm 37		-0.88**	-1.44**	4.69*	-3.67	-0.39	-2.94	0.66	0.27	0.09	-0.19	3.72*	1.78*
Gm 41		-2.88**	-1.19**	-6.56**	0.08	-8.72**	-4.61	-0.43	0.27	0.01	0.31	0.05	2.03*
Gm 55		0.29	0.97**	0.11	-7.00	-4.97**	-7.53*	0.07	-0.06	0.01	0.22	-1.70**	-3.56**
Lsd gi	0.05	0.60	0.55	3.59	8.28	3.45	6.59	-	-	-	-	0.99	1.58
	0.01	0.78	0.72	4.66	10.75	4.48	8.56	-	-	-	-	1.29	2.05
Lsd gi- gj	0.05	0.84	0.78	5.08	11.71	4.88	9.32	-	-	-	-	1.41	2.23
	0.01	1.09	1.01	6.59	15.20	6.34	12.10	-	-	-	-	1.83	2.90

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

Table (7): Specific combining ability effects of 45top crosses for days to 50%silking, plant height, ear height, ear length, ear diameter and grain yield in two locations.

Crosses	Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.
Gm10 x Gz664	0.66	2.06**	-0.02	25.83**	2.88	7.28	0.59	0.74	-0.23	0.23	1.95*	-0.11
Gm10 xGm6061	2.84**	1.74**	1.30	-15.00*	3.97	-1.22	-0.97	-0.17	-0.03	0.04	-2.82**	-0.56
Gm10 x Gm6042	-3.51**	-3.81**	-1.27	-10.83	-6.86*	-6.06	0.38	-0.57	0.26	-0.27	0.87	0.67
Gm12 x Gz664	0.58	0.73	-6.69*	-7.08	-12.94**	-3.97	0.09	-0.17	0.11	-0.19	-6.05**	-1.03
Gm12 xGm6061	-0.99	-1.59**	19.63**	8.33	20.63**	7.53	0.03	0.41	0.06	0.13	4.43**	-2.98*
Gm12 x Gm6042	0.41	0.86	-12.94**	-1.25	-7.69*	-3.56	-0.12	-0.24	-0.16	0.06	1.62	4.01**
Gm14 x Gz664	-0.17	0.56	2.05	-3.33	0.80	3.53	0.01	-0.51	0.02	-0.19	0.37	-1.78
Gm14 xGm6061	-1.24*	-0.76	-14.11**	-6.67	-10.61**	-6.22	-0.56	0.33	-0.03	0.13	-1.15	2.02
Gm14 x Gm6042	1.41**	0.19	12.05**	10.00	9.80**	2.69	0.54	0.18	0.01	0.06	0.78	-0.24
Gm15 x Gz664	1.16*	1.89**	-10.86**	-0.83	-1.27	1.86	0.84	0.58	0.19	-0.02	-2.47**	6.81**
Gm15 xGm6061	-1.16*	-0.92	7.97*	-5.42	-0.19	-1.64	0.78	0.41	0.14	0.04	4.52**	-0.89
Gm15 x Gm6042	-0.01	-0.97*	2.88	6.25	1.47	-0.22	-1.62	-0.99	-0.33	-0.02	-2.05*	-5.91**
Gm17 x Gz664	1.41**	2.14**	-5.44	-3.75	-2.11	3.94	0.51	-0.67	-0.64	0.06	-3.30**	-1.11
Gm17 xGm6061	0.59	-0.92	13.38**	6.67	1.47	1.69	0.19	0.41	0.31	0.38	7.93**	5.94**
Gm17 x Gm6042	-2.01**	-1.22*	-7.94*	-2.92	0.63	-5.64	-0.71	0.26	0.34	-0.44	-4.63**	-4.83**
Gm19 x Gz664	0.99	0.73	15.38**	3.75	18.72**	13.53*	-0.32	-0.17	0.02	-0.02	2.37**	-2.19
Gm19 xGm6061	-1.07*	-0.34	-7.02*	9.17	-6.44*	1.28	0.61	-0.34	-0.03	0.04	-1.90*	4.61**
Gm19 x Gm6042	0.08	-0.39	-8.36**	-12.92	-12.28**	-14.81*	-0.29	0.51	0.01	-0.02	-0.47	-2.41
Gm20 x Gz664	1.66**	2.06**	-1.69	-2.92	2.47	0.61	-1.41	-0.26	0.11	0.06	0.28	6.97**
Gm20 xGm6061	-0.16	0.24	-7.86*	10.00	6.05*	4.61	1.53	0.33	0.06	0.13	0.02	-6.48**
Gm20 x Gm6042	-1.51**	-2.31**	9.55**	-7.08	-8.53**	-5.22	-0.12	-0.07	-0.16	-0.19	-0.30	-0.49
Gm22 x Gz664	0.16	-0.69	-12.94**	1.25	-8.36**	-13.97*	1.26	-0.17	0.02	0.06	-4.63**	-4.03
Gm22 xGm6061	-0.66	0.99*	12.13**	-7.08	-1.03	12.53*	-1.56	0.16	-0.03	0.13	-1.65	0.27
Gm22 x Gm6042	0.49	-0.31	0.80	5.83	9.39**	1.44	0.29	0.01	0.01	-0.19	6.28**	3.76**

*, ** Indicate significance at 0.05 and 0.01 levels of probability, respectively

Table (7): Cont.

Crosses		Days to 50% silking		Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain yield (ard/fad.)	
		Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.	Gm.	Nub.
Gm23 x Gz664		0.83	0.06	-3.36	3.33	1.22	1.44	0.26	0.08	-0.06	0.06	0.70	0.06
Gm23 xGm6061		-0.24	-0.26	11.72**	5.00	7.30*	-3.31	0.44	-0.34	0.14	-0.37	2.93**	-0.64
Gm23 x Gm6042		-0.59	0.19	-8.36**	-8.33	-8.52	1.86	-0.71	0.26	-0.08	0.31	-3.63**	0.59
Gm25 x Gz664		-1.59**	-1.19*	4.97	-1.25	-0.86	-1.06	-0.49	-0.17	0.11	-0.19	0.37	0.31
Gm25 xGm6061		0.84	-0.51	-2.44	-0.83	2.72	-2.06	0.19	0.66	0.06	-0.12	-1.15	1.36
Gm25 x Gm6042		0.74	1.69**	-2.52	2.08	-1.86	3.11	0.29	-0.49	-0.16	0.31	0.78	-1.66
Gm35 x Gz664		-0.76	-2.02**	-7.52*	-15.83	-15.86**	-9.39	-1.16	0.24	0.02	-0.02	4.37**	1.89
Gm35 xGm6061		-1.07*	0.91	-8.69**	5.83	-8.52**	-2.89	0.53	0.08	-0.03	-0.21	0.60	1.69
Gm35 x Gm6042		1.83**	1.11*	16.22**	10.00	24.38**	12.28*	0.63	-0.32	0.01	0.23	-4.97**	-3.58**
Gm36 x Gz664		-0.76	-1.61**	21.63**	6.25	6.22*	-0.64	-0.91	0.66	0.11	-0.11	1.12	-2.28
Gm36 xGm6061		-1.57**	-0.67	-24.53**	-10.83	-11.44**	-7.89	0.28	-0.76	-0.19	-0.04	-8.15**	-2.73*
Gm36 x Gm6042		2.33**	2.28**	2.89	4.58	5.22	8.53	0.63	0.09	0.09	0.14	7.03**	5.01**
Gm37 x Gz664		-0.67	-2.11**	8.72**	-7.08	7.06*	-8.56	0.09	-0.26	0.02	0.06	6.12**	-1.61
Gm37 xGm6061		0.51	0.58	-6.19	2.08	-5.61	4.19	0.03	0.33	-0.03	-0.12	-2.15**	3.44*
Gm37 x Gm6042		0.16	1.53**	-2.53	5.00	-1.44	4.36	-0.12	-0.07	0.01	0.06	-3.97**	-1.83
Gm41 x Gz664		-1.17*	-0.86	2.47	7.92	1.64	11.86*	0.43	0.49	0.11	0.06	-3.22**	-2.61
Gm41 xGm6061		2.01**	-0.17	0.06	-5.42	1.47	-7.89	-0.64	-1.17	-0.19	-0.12	1.52	0.19
Gm41 x Gm6042		-0.84	1.03*	-2.53	-2.50	-3.11	-3.97	0.21	0.68	0.09	0.06	1.70	2.42
Gm55 x Gz664		-2.34**	-1.77**	-6.69*	-6.25	0.39	-6.47	0.18	-0.42	0.11	0.14	2.03*	0.72
Gm55 xGm6061		1.34**	1.66**	4.64	4.17	0.22	1.28	-0.89	-0.34	-0.19	-0.04	-2.98**	-5.23**
Gm55 x Gm6042		0.99	0.11	2.06	2.08	-0.61	5.19	0.71	0.76	0.09	-0.11	0.95	4.51**
Lsd gi	0.05	1.04	095	6.22	14.35	5.98	11.42	-	-	-	-	1.72	2.73
	0.01	1.34	1.24	8.08	18.62	7.76	14.82	-	-	-	-	2.24	3.55
Lsd gi- gj	0.05	1.46	1.35	8.80	20.29	8.46	16.15	-	-	-	-	2.44	3.87
	0.01	1.90	1.75	11.42	26.33	10.98	20.96	-	-	-	-	3.16	5.02

*, ** Indicate significance at 0.05 and 0.01 levels of probability, respectively

With respect to grain yield, three crosses (Gm17 x Gm 6061) , (Gm22 x Gm 6042) and (Gm36 x Gm 6042) had positively highly significant SCA effects in both locations. Eight crosses; (Gm10 x Gz 664), (Gm12 x Gm 6061), (Gm15 x Gm 6061), (Gm19 x Gz 664), (Gm23 x Gm 6061), (Gm35 x Gz 664) , (Gm37 x Gz 664) and (Gm55 x Gz 664) exhibited highly positively significant SCA effects at Gemmeiza location, six crosses; (Gm12 x Gm 6042), (Gm15 x Gz 664), (Gm19 x Gm 6061), (Gm20 x Gz 664), (Gm37x Gm 6061) and (Gm55x Gm 6042) these crosses had the best combiners for SCA($s^{\wedge}_{ij}$).

The parent showing high SCA in most important traits could be used in hybrid cultivar breeding when anailable, while the other parents exhibiting high GCA; possessing high amounts of additive genetic variance are more suitable for selection programs in the later generations.

Finally, it could be concluded that further improvement in earliness, plant and ear heights (towards shortness) and grain yield are still possible.

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تقدير القدرة على التالف لمحصول الحبوب وبعض الصفات الزراعية فى سلالات الذرة الشامية الصفراء الجديدة باستخدام طريقة الهجن القمية

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الملخص العربي

نفذت هذه التجربة خلال موسمين زراعيين هما موسم 2015 وموسم 2016 فى كلا من محطتي البحوث الزراعية بالجميزة والنوبارية . فى موسم 2015 تم عمل التهجين القمى لعدد 15 سلالة صفراء مرباه داخليا مع عدد 3 كشاف هما السلالة مرباه داخليا جيزة 664 والسلالة مرباه داخليا جميزة 6061 والسلالة مرباه داخليا جميزة 6042. في موسم 2016 تم تقييم الـ 45 هجين قمي الناتجة من التهجين فى الموسم السابق بالإضافة الي هجينين المقارنة 162 و168. تم تصميم التجربة في اربع مكرارت في قطاعات كاملة العشوائية وتم اجراء التحليل الوراثي طبقا لنموذج كمبثورن 1956.

وكانت الصفات محل الدراسة هي عدد الايام من الزراعة حتي ظهور 50% من النورة المؤنثة وارتفاع النبات والكوز وطول وقطر الكوز ومحصول الحبوب اردب /فدان .

وكانت النتائج علي النحو التالي :

1. تحليل التباين الراجع إلى المواقع عالي المعنوية لجميع الصفات محل الدراسة.
2. كان الفعل الجيني المضيف له الدور الاهم في وراثة صفات طول وقطر الكوز بينما كان الفعل الجيني الغير مضيف له الدور الأهم في دراسة صفات عدد الأيام من الزراعة حتى 50% من النورة المؤنثة وارتفاع النبات والكوز ومحصول الحبوب اردب للفدان.
3. اظهرت السلالات (Gm 19, 37) قدرة عالية على التآلف لصفة محصول الحبوب فى كلا الموقعين.
4. سجلت الهجن القمية (Gm22 x Gm 6042) , (Gm17 x Gm 6061)، (Gm36 x Gm 6042) تاثيرات عالية المعنوية للقدرة الخاصة على التالف0

أسماء السادة المحكمين

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