Annals of Agric. Sci., Moshtohor **ISSN 1110-0419**
Vol. 60(2) (2022), 393 – 408 **https://assjm.journals.ekb.eg**

Superiority and Gene Action of Some New Promising Maize Crosses Under Two Nitrogen Levels

Immam, M.T. H., S.A. Sedhom, G.A. Sary and A.M. Saad
Fac. of Agric., Benha Univ., Egypt.
Corresponding Author: S.A. Sedhom, Faculty of Agriculture, Benha University, Egypt.
E-mail: Sedhom.mansour@fagr.bu.edu.eg. **https://orcid.org/0000-0002-5394-1184**

Abstract

Line x tester technique was used in this study where ten new inbred lines were top crossed to two superior testers of maize. The obtained 20 top crosses and two checks (SC 128 and SC 2031) were assessed under 80 and 120 kg N/ feddan. In each experiment Randomized Complete Block design with three replications was used. Data recorded on days to 50% tasseling, ear height, ear length, ear dimeter, shelling % and grain yield ton fed^{-1}. The cross M30 x M8 expressed the best mean value for days to 50% tasseling, while cross M34xM8 gave the best values for ear length and grain yield fed^{-1}. Specific combining ability mean squares were more important than those of general combining ability for all traits revealing the important role on non-additive gene action in controlling these traits. The tester M8 was the best for earliness and grain yield fed^{-1}. The best general combining effects were detected with line M25 for days to 50% tasseling and parent M 30 for grain yield plant^{-1}. The cross M7xCIMMYT14 had the best SCA effects for grain yield. The cross M34xM8 expressed the best heterotic effects for grain yield fed^{-1} relative to both checks under all environments.

Key words: Maize, Combining ability, heterosis.

Introduction

Maize (*Zea mays* L.) ranked the second-best cereal crop in Egypt after wheat with a cultivated area of 0.99 mega ha in 2019 which produced 7.49 Gg (**FAOSTAT, 2020**). Such productivity does not face the current demand either for human nutrition or animal feeding. Therefore, several attempts are being made by corn breeders to make use of yield potentiality of this crop to overcome the problem of grain shortage. One of the main strategies to enhance the productivity of maize is the utilization of line x tester technique under different environmental conditions.

This technique is immensely helpful for breeders since it provides vital information about the gene action responsible for the inheritance of important agronomic traits in maize. It also effective in screening available materials from which the breeder selects the best parents of breeding program. Studying the nature of gene action is the key to a successful breeding program towards the development of higher yield potentiality of maize hybrids under different nitrogen levels. Line x tester analysis allows the estimation of general combining ability which is a function of additive genetic variance. It also permits the calculation of specific combining ability which is function of non-additive gene action. Based upon the nature of gene action responsible for the trait, maize breeders determine the appropriate breeding method to achieve his objectives. If the trait is governed by additive gene action then selection program is the best in this case, while hybrid program is preferred when non-additive gen action is predominant. The importance of additive genetic variance in controlling yield and other important traits was reported by **Kamara et al. (2014), Kahriman *et al.* (2016), Andsysni et al. (2018), Bayoumi et al. (2018), Noelle *et al.* (2019), El Hosary (2020a+ b), Neveen Hamouda *et al.* (2021) and Sedhom *et al.* (2021**). While, the importance of non-additive gene action was reported by **Sedhom et al. (2012), El-Badawy (2013)**, **Mahesh et al. (2013), Ahmed et al. (2017), Andayani et al. (2018),** and **Kamara et al. (2020).**

Also estimation of heterosis is of prime importance for corn breeders to detect the best maize genotypes which expressed superiority over prevailing hybrids. Studying this phenomenon, helps corn breeders solving the problem of grain shortage through growing desirable hybrids on a large commercial scale (**Kamara and Reham, 2015; Youstina Sedhom et al. 2017; Omnya Turkey et al. 20018, Noelle et al. 2019, El-Hosary, 200b; and Sedhom et al. 2021**).

Therefore, the present work aimed at studying general and specific combining ability as well as heterosis for earliness, yield and some other important traits in maize under two different nitrogen levels.

Materials and Methods

Ten new inbred lines of maize were crossed to two promising testers in the pattern Line x tester analysis to evaluate some maize traits under two nitrogen levels at the Faculty of Agric., Moshtohor during 2018 and 2019 seasons. The parental inbred lines included M7, M30 and M57 (isolated from the variety Cairo 1), M15, M34 and M66 (isolated from Giza 2), CLM 343 and CLM 19 (from CIMMYT), and M24 and M25 (isolated from Pioneer 514). The two testers were M8 (isolated from Giza 1) and CIMMYT 14 (from CIMMYT).

In 2018 season, the line x tester model was utilized where ten parental inbred lines were planted with two elite testers. At flowering time, twenty top crosses were obtained with enough seeds to the evaluation of the next year.

In 2019 season, two adjacent experiments were undertaken on May 20th. The first experiment received 80 kg N/ fad, while the second one received 120 kg N/ fed. In both experiments, 20 crosses + two checks (S.C. 128 and S.C. 2031) were evaluated in RCBD using 3 replications. Each plot consisted of ridge of 3 m length and 70 cm width. The distance between plants was 25 cm apart. Irrigation, pest control and other cultural practices were properly practiced as recommended for the area. Six traits were recorded, i.e., days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield (ton fad^{-1}).

Statistical analysis was conducted for the six traits in each experiment and after testing homogeneity between the two experiments, combined analysis was performed according to **Steel et al., (1997).** General and specific combining abilities were estimated for all traits according to **Kempthorne (1957).**

Relative increase of studied top crosses (standard heterosis) relative to both check hybrids was estimated for all traits under each nitrogen level and combined of both levels as follows:

The relative increase (heterobeltosis) =

$$\frac{\text{F1 - Check variety}}{\text{Check variety}} \text{X}\,100$$

Appropriate L.S.D values were computed according to the following formulae to test the significance of these heterotic effects.

L.S.D. for heterosis relative to check variety = t x

$$\sqrt{\frac{2MSe}{r}}$$

Where:

t: is the tabulated t value at a stated level of probability for the experimental error degree of freedom and r: refers to replications.

Results & Discussion

Analysis of variance and mean performance

Analysis of variance for days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield (ton fad^{-1}) under 40 and 80 kg N/ fad. As well as combined data are presented in Table 1. Nitrogen level mean squares were significant for all studied traits indicating that increasing nitrogen fertilization levels had clear effect on the performance of studied traits. Mean values of both nitrogen levels for all traits are presented in Table 2. Increasing nitrogen levels caused an increase of most studied traits. These results are logic since increasing nitrogen levels from 40 to 80 kg N/ fad. led to increase photosynthetic activities which in turn positively affects the growth and yield of maize plant. These results agree with those obtained by **Meseka et al. (2013), Kamara et al. (2014), El-Naggar et al. (2015), Kamra and Rehan (2015), Omnya Turkey et al. (2018) and Ogunniyan et al. (2019).**

Mean squares due to genotypes were significant for all studied traits under N1, N2 and combined data (Table 1). Such results indicated that the studied maize genotypes possess higher genetic variability regarding the studied traits. Moreover, significant mean squares due to the interaction of crosses and their partitions from one side and nitrogen levels from the other levels were significant for most studied traits revealing that these genotypes behaved differently from one nitrogen level to another. The variability among maize genotypes were reported by several investigators **Sedhom et al. (2012), Kamara et al. (2014)**, **Kahriman *et al.* (2016), Noelle et al. (2019), EL-Hosary (2020a), and El Gazzar (2021), Neven Hamouda et al. (2021) and Sedhom *et al.* (2021).**

Mean values of days to 50% tasseling, ear height, ear diameter, shelling % and grain yield (ton fed^{-1}) under N1 and N2 nitrogen levels and combined analyses are presented in Table 2. For days to 50% tasseling, the cross M30 x M8 exhibited most desirable under N1 (51.00 day), N2 (51.33 day) and combined analyses (51.17 day). The cross M25 x M8 ranked the second best for this trait under all environments. Concerning ear height, the best mean values were detected for the crosses M25 x M8 under N1 (123 cm) and combined data (128.17 cm), and the cross M57 x CIMMYT 14 in N2 (131 cm) with significant difference from both check hybrid (S.C. 128 and SC 2031). The top cross M34 x M8 exhibited the most significant and desirable mean performance for ear length and grain yield ton fed^{-1} recording 21.33, 21.67 and 21.50 cm; and 5.14, 5.41 and 5.27 ton fed^{-1}, under N1, N2 and combined analyses, respectively as compared to the check hybrids. The highest mean values for shelling% were detected for the cross (M30 x M8) under N1 and combined data. However, the best main values for shelling % was detected for the cross CLM343 x M8 under N2 condition being 86.63% as compared to the SC 128 (Table 2).

Generally, the three top crosses namely, M 30 x M8, M34 x M 8, and M 30 x CIMMYT 14 were considered prospective for future maize breeding program.

Analysis of combining ability

Table 1 showed mean squares GCA and SCA for days to 50% tasseling, ear height, ear length, shelling % and grain yield ton fed^{-1} under N1 and N2 nitrogen levels and combined data. Data revealed that mean squares due to specific combining ability were much higher than those of general combining ability for all studied traits revealing the importance of non-additive gene action in controlling these characters. Moreover, the interaction between both types of combining ability and nitrogen level cleared that SCA was more influenced by nitrogen levels than GCA for all studied traits. The importance of non-additive gene action in controlling earliness, yield and its components was previously reported by **Noelle et al. (2019), El Hosary (2020a+ b), Neveen Hamouda *et al*. (2021) and Sedhom *et al*. (2021**) On the contrary, the importance of additive gene action in governing the studied traits were previously reported by **Sedhom et al. (2012), El-Badawy (2013)**, **Mahesh et al. (2013), Ahmed et al. (2017), Andayani et al. (2018),** and **Kamara et al. (2020).**

Estimates of general combining ability effects for days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield ton fed^{-1} under N1 and N2 nitrogen levels and combined analyses are presented in Table 3 and Figures (1-6). The tester M8 was the best general combiner for days to 50% tasseling, ear length and grain yield fed^{-1} under both nitrogen levels and combined data. For ear length, the best general combining ability effects were detected for the tester CMMYT 14 under N1 and combined data. The best general combiner for days to 50% tasseling was inbred M25. Also, this parental line (M25) had the best GCA effects for ear length under N2 environment (Table 3). Parental line M30 had the most desirable GCA effects for ear diameter and grain yield fed^{-1} recording 0.58**, 0.35** and 0.47**; and .51**, .44** and 0.47** under N1, N2 and combined analyses, respectively. Parent M34 was the best general combiner for ear length while parent M57 expressed significant and desirable GCA effects for ear height under N2 nitrogen level.

Specific combining ability effects for days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield fed^{-1} under all environments are presented in Table 4. Regarding days to 50% tasseling, the cross M57xCIMMYT 14 expressed the highest significant and negative SCA effects recording -2.25** and -1.17* under N2 nitrogen level and combined data, respectively. None of the studied crosses exhibited significant desirable SCA effects under N1 level of nitrogen. For ear height, the best SCA effects were detected for the cross M25xM8 under N1 (-12.58**), N2 (-8.75**) and combined data (-10.67**). The top cross M7xCIMMYT 14 recorded the most desirable SCA effects for ear length (1.78**, 1.91** and 1.84**) and grain yield fed^{-1} (0.54**, 0.54** and 0.53**) under N1 and N2 nitrogen levels and combined data, respectively. The cross M34xM8 gave the best SCA effects for ear diameter and shelling%. None of he studied crosses exhibited desirable SCA effects for shelling % under N2 nitrogen level.

Generally, the crosses M25x M8, M34x M8 and M7xCIMMYT 14 are of prime importance regarding earliness and yield potentiality in maize breeding programs.

Standard Heterosis

Results in Tables 5 and 6 showed heterosis values for days to 50% tasseling, ear height, ear length, ear diameter, shelling percentage and grain yield ton fed^{-1} relative to S.C. 128 and S.C 2031 under N1 and N2 levels and combined analyses. Two, three and two crosses exhibited negative and significant heterotic effects for days to 50% tasseling relative to S.C 128 at N1, N2 levels and combined data, respectively. The respective heterotic values relative to S.C. 2031 were none, three and one (Table 5). However, the best heterotic effects for days to 50% tasseling were detected for the cross M 30 x M 8 relative to S.C 128 and S.C 2031 recording -5.25** and -4.06*, respectively in the combined analysis.

Early maturity in maize favourable trait for corn breeders because it enables plants to escape destructive injuries caused by *Sesamia cretica ledi chilo simplex* and *Pyrausta nubilialis*. Similar results were obtained by **Youstina Sedhom *et al*. (2017)** and **Patil *et al* (2020**) and **El-Hosary (2020b).**

For ear height, negative and significant heterotic effects relative to SC 128 were detected for three, two and three crosses under the first, second N level and combined data, respectively (Table 5). The respective heterotic values for ear height relative to SC 2031 were detected for three, two and three crosses. However, the most desirable heterotic effects relative to both checks were recorded for the crosses M 25 x M 8 under all environments.

Regarding ear length, two crosses expressed positive and significant heterotic effects relative to S.C. 128 for each nitrogen level and combined data. Desirable heterotic effects relative to S.C. 2031 were obtained for two, three and two crosses under first, second N levels and combined analyses, respectively.

For ear diameter, significant and positive heterotic effects were recorded in two, one and three crosses relative to SC 128 and three, three and two crosses relative to SC 2031 under N1 and N2 nitrogen levels and combined data, respectively. Regarding shelling %, two crosses only expressed significant and positive heterotic effects relative to SC 128 under the first nitrogen level. None of the studied crosses exhibited significant and desirable heterotic effects relative to SC 128 under N2 level of nitrogen and combined data (Table 6). Four crosses expressed significant and positive heterotic effects relative to SC 2031 under N1, N2 nitrogen level and combined analysis. However, the best heterotic effects relative to SC 2031 were detected for the crosses M34xM8 under N1 nitrogen level and combined data. For grain yield ton fed^{-1}, twelve, three and eight crosses exhibited significant and positive heterotic effects relative to SC 128. The respective heterotic effects relative to SC 2031 were one, two and one crosses.

Table 1. Analysis of variance for days to 50% tasseling, ear height, ear length, ear diameter, shelling% and grain yield (ton fed^{-1}) under two nitrogen levels and combined data.

S.O.V	df		Days to 50% tasseling			Ear height (cm)			Ear length (cm)			Ear diameter (cm)			Shelling %			Grain yield (ton fed^{-1})		
	S	C	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
Environment (E)		1			2674**			19085**			3191**			2166**			64859**			1985.4**
Rep	2		1.32	0.45		3.62	35.82		0.84	0.99		0.19	0.02		2.49	1.97		0.06	0.07	
Rep/E		4			0.88			19.72			0.92			0.11			2.23			0.06
Crosses	19	19	10.68**	7.96**	14.17**	178.78**	163.88**	279.02**	8.22**	4.76**	12.08**	0.47**	0.11**	0.44**	16.00**	4.04**	13.78**	0.69**	0.52**	0.96**
Lines	9	9	5.59**	5.60**	8.79**	87.08**	146.19**	166.06**	5.73**	5.53**	10.93**	0.39**	0.14**	0.47**	10.21**	3.45*	6.72**	0.43**	0.66**	0.84**
Testers	1	1	93.75**	40.02**	128.13**	93.75*	91.27*	185.01**	69.34**	12.88**	70.99**	1.50**	0.04	1.01**	31.54**	10.58**	39.33**	2.49**	1.00**	3.32**
Lines x testers	9	9	6.53**	6.76**	6.89**	279.94**	189.64**	402.43**	3.92**	3.09**	6.69**	0.43**	0.08**	0.36**	20.06**	3.90**	18.00**	0.75**	0.33**	0.82**
Crosses x E		19			4.46**			63.64**			0.90			0.13**			6.26**			0.25**
Line x E		9			2.40			67.20**			0.33			0.06			6.94**			0.25**
Testers x E		1			5.63*			0.01			11.22**			0.53**			2.79			0.17*
Line x Testers x E		9			6.39**			67.14**			0.33			0.16**			5.96**			0.26**
Error	38	76	1.65	1.50	1.58	24.95	29.29	27.12	1.06	1.02	1.04	0.07	0.04	0.06	2.59	1.90	2.24	0.05	0.05	0.05
C.V					2.32			3.60			5.45			4.82			1.77	4.88	4.72	4.80
variance GCA					0.08			1.40			0.06			0.00			0.05	-0.001	0.00	0.00
variance SCA					0.89			62.55			0.94			0.05			2.63	0.23	0.09	0.13
GCA x E					0.04			1.47			0.07			0.00			0.04			0.00
SCA x E					2.49			75.89			0.71			0.08			3.87			0.20

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

Table 2. Mean performance of studied top crosses for days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield (ton fed^{-1}) under two nitrogen levels and combined data.

Genotype	Days to 50% tasseling			Ear height (cm)			Ear length (cm)			Ear diameter (cm)			Shelling %			Grain yield (ton fed^{-1})		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
M7x M8	55.33	53.67	54.50	140.33	150.00	145.17	19.13	19.33	19.23	4.13	4.93	4.53	85.00	84.33	84.67	4.41	4.43	4.42
M15x M8	54.67	54.00	54.33	145.00	153.67	149.33	19.40	19.73	19.57	4.33	5.07	4.70	86.37	85.63	86.00	4.85	4.91	4.88
CLM343x M8	54.33	51.00	52.67	137.33	143.33	140.33	18.20	18.53	18.37	4.80	4.87	4.83	83.33	86.63	84.98	4.78	4.74	4.76
CLM19x M8	56.00	53.33	54.67	143.67	145.33	144.50	17.67	17.80	17.73	4.50	5.07	4.78	85.50	85.23	85.37	4.86	4.46	4.66
M24x M8	51.67	53.00	52.33	144.33	148.67	146.50	19.40	19.67	19.53	4.50	5.13	4.82	82.63	83.73	83.18	4.86	5.09	4.98
M25x M8	51.33	51.67	51.50	123.00	133.33	128.17	18.20	18.67	18.43	4.27	5.00	4.63	83.50	84.33	83.92	4.83	4.96	4.90
M30x M8	51.00	51.33	51.17	141.67	143.33	142.50	21.00	21.33	21.17	5.07	5.13	5.10	87.00	85.10	86.05	5.02	5.25	5.14
M34x M8	53.00	53.00	53.00	153.33	155.00	154.17	21.33	21.67	21.50	5.33	5.20	5.27	87.23	86.23	86.73	5.14	5.41	5.27
M36x M8	54.00	54.33	54.17	138.33	142.33	140.33	20.33	20.60	20.47	4.00	4.87	4.43	82.67	86.23	84.45	4.78	5.07	4.93
M57x M8	52.33	54.00	53.17	143.33	144.33	143.83	18.53	19.07	18.80	4.50	4.93	4.72	84.37	84.07	84.22	4.12	4.70	4.41
M7x CIMMYT 14	56.00	56.67	56.33	144.33	146.67	145.50	20.53	21.00	20.77	4.87	5.03	4.95	85.13	84.83	84.98	5.06	5.10	5.08
M15x CIMMYT 14	55.00	56.33	55.67	128.67	140.67	134.67	17.33	19.00	18.17	4.83	5.00	4.92	81.47	83.50	82.48	4.43	4.93	4.68
CLM343x CIMMYT 14	56.33	56.67	56.50	143.33	143.33	143.33	16.07	17.33	16.70	4.33	4.93	4.63	80.97	84.60	82.78	3.30	3.78	3.54
CLM19x CIMMYT 14	56.00	54.00	55.00	149.33	154.00	151.67	16.73	18.47	17.60	5.13	5.27	5.20	84.60	85.30	84.95	4.58	4.50	4.54
M24x CIMMYT 14	57.00	55.00	56.00	150.67	152.33	151.50	16.00	17.33	16.67	4.87	5.00	4.93	83.67	83.87	83.77	4.26	4.42	4.34
M25x CIMMYT 14	55.33	52.67	54.00	150.67	153.33	152.00	16.80	19.27	18.03	4.93	5.13	5.03	86.53	86.20	86.37	4.31	4.50	4.41
M30x CIMMYT 14	56.00	54.67	55.33	137.33	147.33	142.33	®17.47	19.07	18.27	5.50	5.67	5.58	84.90	85.43	85.17	5.11	5.16	5.14
M34x CIMMYT 14	57.67	53.33	55.50	134.33	154.67	144.50	17.57	19.33	18.45	4.60	4.87	4.73	77.47	83.10	80.28	3.77	5.02	4.40
M36x CIMMYT 14	54.67	54.33	54.50	152.67	160.67	156.67	16.53	19.00	17.77	4.93	5.00	4.97	83.40	84.03	83.72	4.10	5.00	4.55
M57x CIMMYT 14	54.67	52.00	53.33	144.00	131.00	137.50	16.67	17.33	17.00	4.60	4.80	4.70	84.97	82.27	83.62	4.66	4.02	4.34
SC 128	53.67	54.33	54.00	145.00	147.00	146.00	19.27	19.67	19.47	4.67	4.87	4.77	84.23	84.80	84.52	4.18	4.81	4.49
SC 2031	53.00	53.67	53.33	142.33	144.00	143.17	19.00	19.33	19.17	4.60	4.87	4.73	83.33	83.40	83.37	4.78	4.82	4.80
Over all mean	10	53.77	54.14	142.41	147.01	144.71	18.33	19.21	18.77	4.7	5.03	4.86	84.01	84.67	84.34	4.55	4.78	4.67
LSD 0.05	2.10	1.90	2.00	7.87	8.60	8.24	1.59	1.57	1.58	0.50	0.32	0.42	2.64	2.31	2.48	0.35	0.39	0.37
LSD 0.01	2.75	2.50	2.63	10.32	11.28	10.81	2.09	2.06	2.07	0.66	0.42	0.55	3.46	3.03	3.25	0.46	0.51	0.49

Table 3. General combining ability effects for days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield (ton fed^{-1}) under both nitrogen levels as well as combined data.

Genotypes	Days to 50% tasseling			Ear height (cm)			Ear length (cm)			Ear diameter (cm)			Shelling %			Grain yield (ton fed^{-1})		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
Testers																		
M8	-1.25**	-0.82**	-1.03**	-1.25	-1.23	-1.24	1.08**	0.46*	0.77**	-0.16**	-0.03	-0.09**	0.72*	0.42	0.57**	0.20**	0.13**	0.17**
CIMMYT 14	1.25**	0.82**	1.03**	1.25	1.23	1.24	-1.08**	-0.46*	-0.77**	0.16**	0.02	0.09**	-0.73*	-0.42	-0.57**	-0.20**	-0.13**	-0.17**
L.S.D. (gi) 0.05	0.46	0.44	0.32	1.79	1.94	1.32	0.37	0.36	0.26	0.10	0.07	0.06	0.58	0.49	0.38	0.08	0.08	0.06
L.S.D. (gi) 0.01	0.60	0.58	0.42	2.35	2.55	1.73	0.48	0.48	0.34	0.13	0.09	0.08	0.76	0.65	0.50	0.10	0.11	0.07
L.S.D. (gi-gj) 0.05	0.65	0.62	0.55	2.53	2.74	2.28	0.52	0.51	0.45	0.14	0.10	0.10	0.81	0.70	0.66	0.11	0.11	0.10
L.S.D (gi-gj) 0.01	0.85	0.82	0.72	3.32	3.60	3.00	0.68	0.67	0.59	0.18	0.13	0.14	1.07	0.92	0.86	0.15	0.15	0.13
Lines																		
M7	1.05*	1.42**	1.23**	0.05	1.17	0.61	1.59**	0.99*	1.29**	-0.20	-0.06	-0.13	1.03	-0.15	0.44	0.17	0.00	0.08
M15	0.22	1.42**	0.82*	-5.45**	0.00	-2.72	0.12	0.19	0.16	-0.12	-0.01	-0.07	-0.12	-0.17	-0.14	0.08	0.15	0.11
CLM343	0.72	0.08	0.40	-1.95	-3.83	-2.89	-1.11**	-1.24**	-1.18**	-0.14	-0.15	-0.14*	-1.89	0.88	-0.50	-0.52**	-0.51**	-0.52**
CLM19	1.38**	-0.08	0.65	4.22*	2.50	3.36*	-1.05*	-1.04*	-1.04**	0.11	0.12	0.12	1.02	0.53	0.77	0.16	-0.30**	-0.07
M24	-0.28	0.25	-0.02	5.22*	3.33	4.28**	-0.54	-0.68	-0.61*	-0.02	0.02	0.00	-0.89**	-0.93	-0.91*	0.00	-0.02	-0.01
M25	-1.28*	-1.58**	-1.43**	-5.45**	-3.83	-4.64**	-0.74	-0.21	-0.48	-0.10	0.02	-0.04	0.98	0.53	0.76	0.01	-0.04	-0.02
M30	-1.12*	-0.75	-0.93*	-2.78	-1.83	-2.31	0.99*	1.02*	1.01**	0.58**	0.35**	0.47**	1.92**	0.53	1.22**	0.51**	0.44**	0.47**
M34	0.72	-0.58	0.07	1.55	7.67**	4.61**	1.21**	1.32**	1.26**	0.27*	-0.01	0.13	-1.69*	-0.07	-0.88*	-0.11	0.43**	0.17**
M36	-0.28	0.58	0.15	3.22	4.33*	3.78*	0.19	0.62	0.41	-0.24*	-0.11	-0.17*	-1.00	0.40	-0.30	-0.12	0.26**	0.07
M57	-1.12*	-0.75	-0.93*	1.38	-9.50**	-4.06**	-0.65	-0.98*	-0.81**	-0.15	-0.18*	-0.17*	0.63	-1.5**	-0.47	-0.17	-0.41**	-0.29**
L.S.D. (gi) 0.05	1.03	0.98	0.71	4.00	4.33	2.95	0.82	0.81	0.58	0.21	0.16	0.13	1.29	1.10	0.85	0.18	0.18	0.13
L.S.D. (gi) 0.01	1.35	1.29	0.93	5.25	5.69	3.87	1.08	1.06	0.76	0.28	0.21	0.17	1.69	1.45	1.11	0.23	0.24	0.17
L.S.D (gi-gj) 0.05	1.45	1.39	1.00	5.65	6.12	4.17	1.16	1.14	0.82	0.30	0.22	0.19	1.82	1.56	1.20	0.25	0.25	0.18
L.S.D (gi-gj) 0.01	1.91	1.82	1.32	7.43	8.05	5.48	1.53	1.50	1.07	0.40	0.29	0.25	2.39	2.05	1.57	0.33	0.34	0.24

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

Table 4. Specific combining ability effects for days to 50% tasseling, ear height, ear length, ear diameter, shelling % and grain yield (ton fed^{-1}) under both nitrogen levels as well as combined data.

Genotypes	Days to 50% tasseling			Ear height (cm)			Ear length (cm)			Ear diameter (cm)			Shelling %			Grain yield (ton fed^{-1})		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
M7x M8	0.92	-0.25	0.33	-0.75	2.92	1.08	-1.78**	-1.91**	-1.84**	-0.21	0.11	-0.05	-0.79	-0.97	-0.88	-0.534*	-0.54**	-0.53**
M15x M8	1.08	0.08	0.58	9.42**	7.75**	8.58**	-0.04	-0.71	-0.38	-0.09	0.19	0.05	1.72	0.34	1.03	0.00	-0.21	-0.10
CLM343x M8	0.25	-1.58*	-0.67	-1.75	1.25	-0.25	-0.01	-0.48	-0.24	0.39*	0.13	0.26**	0.46	0.29	0.38	0.53**	0.28*	0.41**
CLM19x M8	1.25	0.92	1.08*	-1.58	-3.08	-2.33	-0.61	-1.41*	-1.01*	-0.16	0.06	-0.05	-0.27	-0.76	-0.52	-0.07	-0.22	-0.15
M24x M8	-1.42	0.25	-0.58	-1.92	-0.58	-1.25	0.63	0.09	0.36	-0.03	0.23	0.10	-1.24	-0.79	-1.02	0.10	0.13	0.11
M25x M8	-0.75	0.75	0.00	-12.58**	-8.75**	-10.67**	-0.38	-1.38*	-0.88*	-0.18	0.09	-0.04	-2.24*	-1.66	-1.95**	0.06	0.02	0.04
M30x M8	-1.25	-0.42	-0.83	3.42	-0.75	1.33	0.69	0.06	0.37	-0.06	-0.11	-0.08	0.33	-0.89	-0.28	-0.25	-0.16	-0.20*
M34x M8	-1.08	1.08	0.00	10.75**	1.42	6.08**	0.81	0.09	0.45	0.52**	0.32*	0.42**	4.16**	0.84	2.50**	0.48**	-0.01	0.23*
M36x M8	0.92	1.25	1.08*	-5.92*	-7.92**	-6.92**	0.82	-0.28	0.27	-0.31*	0.09	-0.11	-1.09	0.38	-0.36	0.14	-0.17	-0.02
M57x M8	0.08	2.25**	1.17*	0.92	7.92**	4.42*	-0.14	-0.21	-0.18	0.11	0.23	0.17	-1.03	0.17	-0.43	-0.47**	0.13	-0.17
M7x CIMMYT 14	-0.92	0.25	-0.33	0.75	-2.92	-1.08	1.78**	1.91**	1.84**	0.21	-0.11	0.05	0.79	0.98	0.88	0.54**	0.54**	0.53**
M15x CIMMYT 14	-1.08	-0.08	-0.58	-9.42**	-7.75**	-8.58**	0.04	0.71	0.37	0.09	-0.19	-0.05	-1.72	-0.34	-1.03	0.00	0.21	0.10
CLM343xCIMMYT14	-0.25	1.58*	0.67	1.75	-1.25	0.25	0.01	0.47	0.24	-0.39*	-0.12	-0.26**	-0.46	-0.29	-0.37	-0.53**	-0.28*	-0.41**
CLM19x CIMMYT 14	-1.25	-0.92	-1.08	1.58	3.08	2.33	0.61	1.41*	1.01*	0.16	-0.06	0.05	0.28	0.76	0.52	0.07	0.22	0.15
M24x CIMMYT 14	1.42	-0.25	0.58	1.92	0.58	1.25	-0.63	-0.09	-0.36	0.02	-0.23	-0.10	1.24	0.79	1.02	-0.10	-0.13	-0.11
M25x CIMMYT 14	0.75	-0.75	0.00	12.58**	8.75**	10.67**	0.38	1.38*	0.88*	0.18	-0.09	0.04	2.24*	1.66	1.95**	-0.06	-0.02	-0.04
M30x CIMMYT 14	1.25	0.42	0.83	-3.42	0.75	-1.33	-0.69	-0.06	-0.38	0.06	0.11	0.08	-0.33	0.89	0.28	0.25	0.16	0.20*
M34x CIMMYT 14	1.08	-1.08	0.00	-10.75**	-1.42	-6.08**	-0.81	-0.09	-0.45	-0.52**	-0.33*	-0.43**	-4.16**	-0.84	-2.50**	-0.48**	0.01	-0.23*
M36x CIMMYT 14	-0.92	-1.25	-1.08*	5.92*	7.92**	6.92**	-0.82	0.27	-0.28	0.31*	-0.09	0.11	1.09	-0.38	0.36	-0.14	0.17	0.02
M57x CIMMYT 14	-0.08	-2.25**	-1.17*	-0.92	-7.92**	-4.42*	0.14	0.21	0.18	-0.11	-0.23	-0.17	1.03	-0.17	0.43	0.47**	-0.13	0.17
L.S.D (gi) 0.05	1.45	1.45	1.00	5.65	5.65	4.17	1.16	1.16	0.82	0.30	0.30	0.19	1.82	1.82	1.20	0.25	0.25	0.18
0.01	1.91	1.91	1.32	7.43	7.43	5.48	1.53	1.53	1.07	0.40	0.40	0.25	2.39	2.39	1.57	0.33	0.33	0.24
L.S.D (gi-gj)0.05	2.06	2.06	1.74	7.99	7.99	7.22	1.64	1.64	1.41	0.43	0.43	0.33	2.58	2.58	2.08	0.36	0.36	0.31
0.01	2.70	2.70	2.29	10.51	10.51	9.49	2.16	2.16	1.86	0.56	0.56	0.43	3.38	3.38	2.73	0.47	0.47	0.41

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

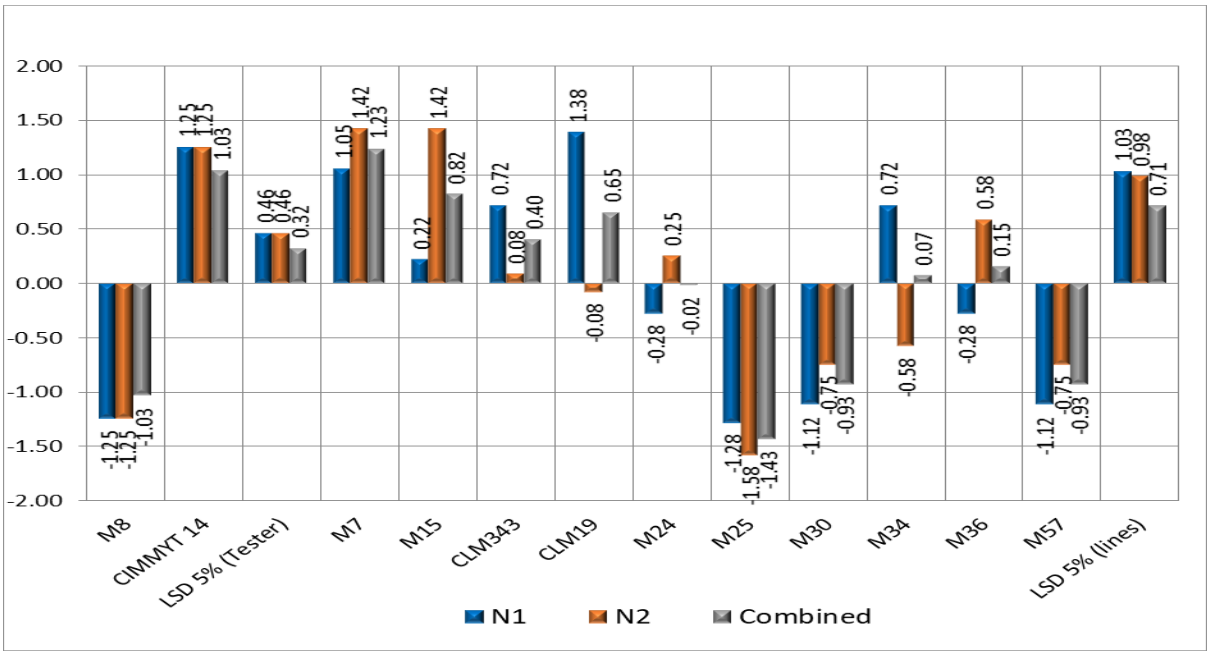

Fig. (1): GCA effects for days to 50% tasseling under N1 and N2 fertilization levels and combined data.

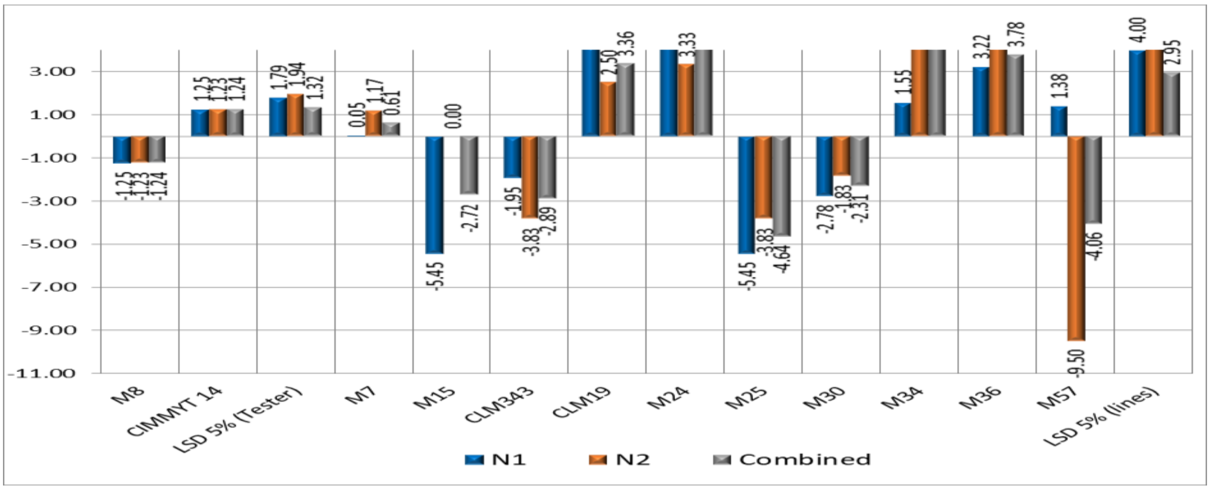

Fig. (2): GCA effects for ear height under N1 and N2 fertilization levels and combined data

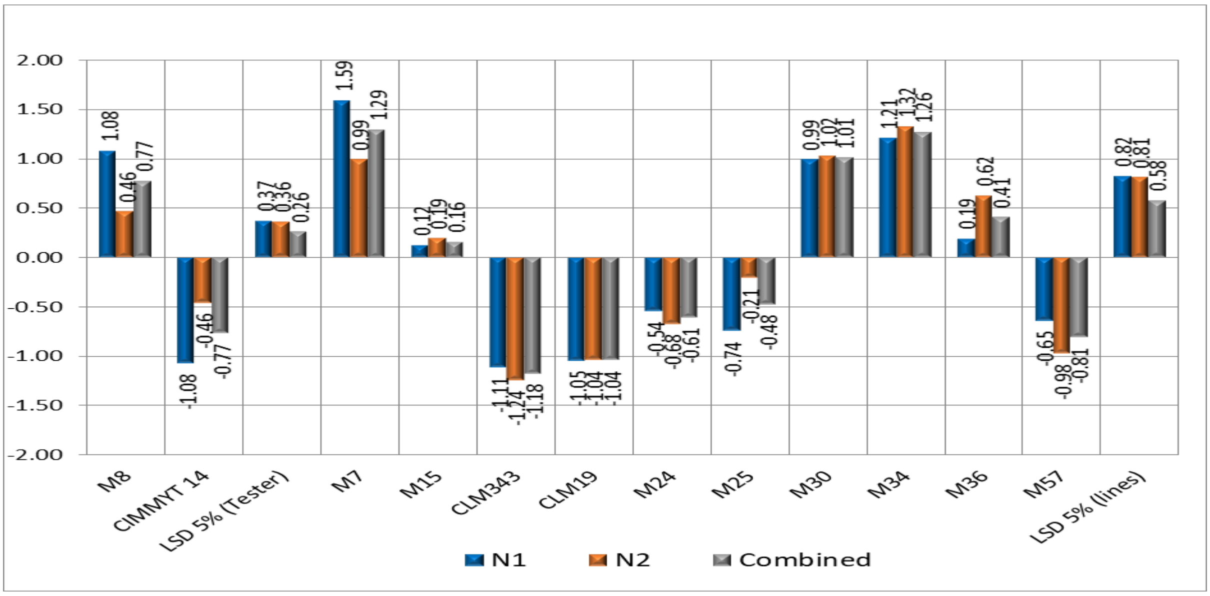

Fig. (3): GCA effects for ear length under N1 and N2 fertilization levels and combined data

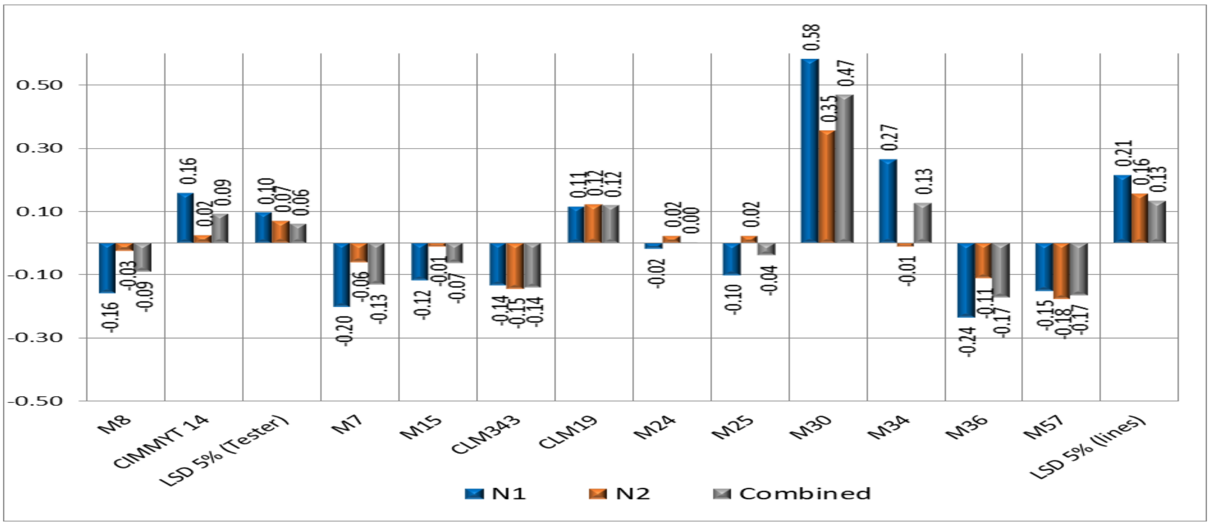

Fig. (4): GCA effects for ear diameter under N1 and N2 fertilization levels and combined data.

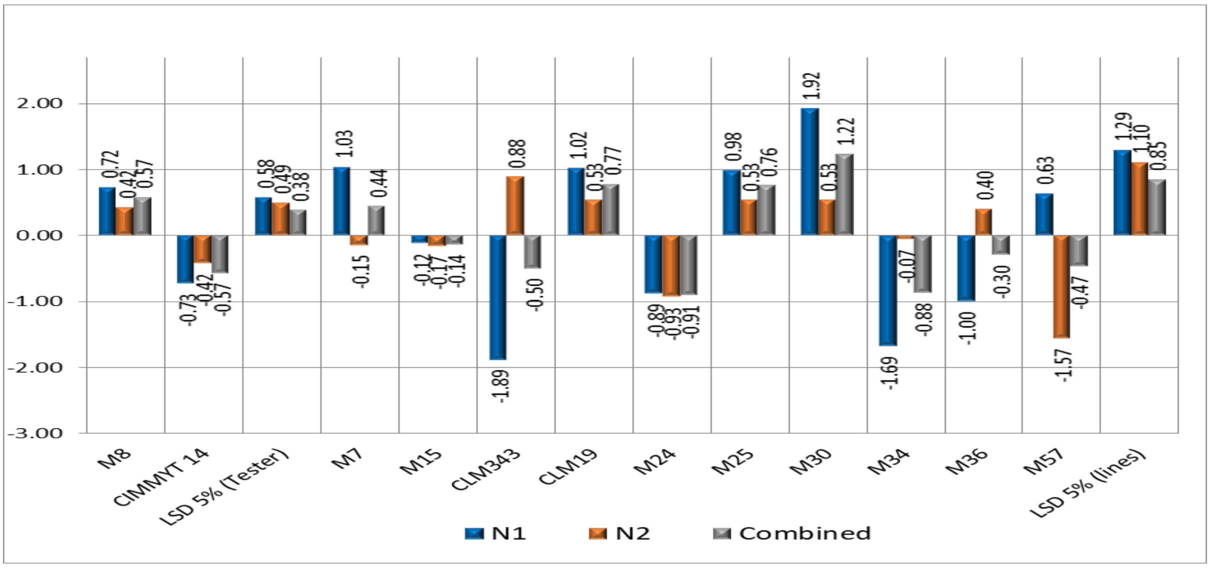

Fig. (5): GCA effects for shelling % under N1 and N2 fertilization levels and combined data.

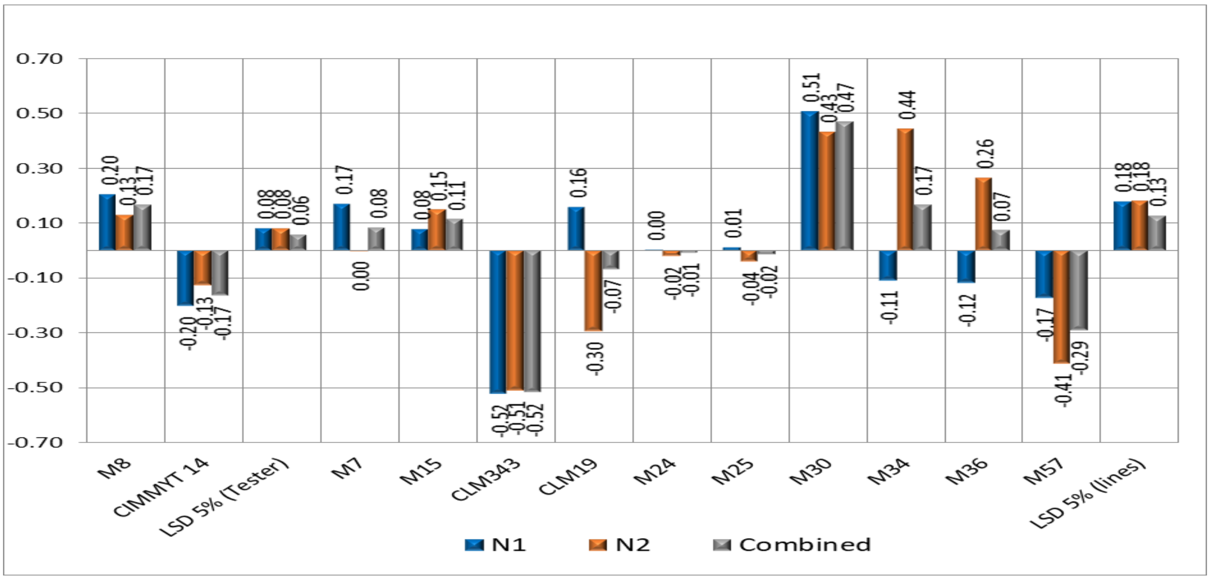

Fig. (6): GCA effects for grain yield (ton fed^{-1}) under N1 and N2 fertilization levels and combined data.

Table 5. Standard heterosis for days to 50% tasseling, ear height, and ear length relative to S.C. 128 and S.C. 2031 under both nitrogen levels as well as combined data.

Genotypes	Days to 50% tasseling						Ear height (cm)						Ear length (cm)					
	Relative to S.C. 128			Relative to S.C2031			Relative to S.C. 128			Relative to S.C. 2031			Relative to S.C. 128			Relative to S.C. 2031		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
M7x M8	**3.11**	**-1.23**	**0.93**	**4.40***	**0.00**	**2.19**	**-3.22**	**2.04**	**-0.57**	**-1.41**	**4.17**	**1.40**	**-0.69**	**-1.69**	**-1.20**	**0.70**	**0.00**	**0.35**
M15x M8	**1.86**	**-0.61**	**0.62**	**3.14**	**0.62**	**1.88**	**0.00**	**4.54**	**2.28**	**1.87**	**6.71***	**4.31**	**0.69**	**0.34**	**0.51**	**2.11**	**2.07**	**2.09**
CLM343x M8	**1.24**	**-6.13****	**-2.47**	**2.52**	**-4.97****	**-1.25**	**-5.29**	**-2.49**	**-3.88**	**-3.51**	**-0.46**	**-1.98**	**-5.54**	**-5.76**	**-5.65**	**-4.21**	**-4.14**	**-4.17**
CLM19x M8	**4.35***	**-1.84**	**1.23**	**5.66****	**-0.62**	**2.50**	**-0.92**	**-1.13**	**-1.03**	**0.94**	**0.93**	**0.93**	**-8.30***	**-9.49***	**-8.90***	**-7.02**	**-7.93**	**-7.48**
M24x M8	**-3.73**	**-2.45**	**-3.09**	**-2.52**	**-1.24**	**-1.88**	**-0.46**	**1.13**	**0.34**	**1.41**	**3.24**	**2.33**	**0.69**	**0.00**	**0.34**	**2.11**	**1.72**	**1.91**
M25x M8	**-4.35***	**-4.91***	**-4.63***	**-3.14**	**-3.73***	**-3.44**	**-15.17****	**-9.30****	**-12.21****	**-13.58****	**-7.41**	**-10.48****	**-5.54**	**-5.08**	**-5.31**	**-4.21**	**-3.45**	**-3.83**
M30x M8	**-4.97***	**-5.52****	**-5.25****	**-3.77**	**-4.35***	**-4.06***	**-2.30**	**-2.49**	**-2.40**	**-0.47**	**-0.46**	**-0.47**	**9.00***	**8.47***	**8.73***	**10.53***	**10.34***	**10.43***
M34x M8	**-1.24**	**-2.45**	**-1.85**	**0.00**	**-1.24**	**-0.62**	**5.75***	**5.44***	**5.59**	**7.73****	**7.64***	**7.68****	**10.73***	**10.17***	**10.45***	**12.28****	**12.07****	**12.17****
M36x M8	**0.62**	**0.00**	**0.31**	**1.89**	**1.24**	**1.56**	**-4.60**	**-3.17**	**-3.88**	**-2.81**	**-1.16**	**-1.98**	**5.54**	**4.75**	**5.14**	**7.02**	**6.55**	**6.78**
M57x M8	**-2.48**	**-0.61**	**-1.54**	**-1.26**	**0.62**	**-0.31**	**-1.15**	**-1.81**	**-1.48**	**0.70**	**0.23**	**0.47**	**-3.81**	**-3.05**	**-3.42**	**-2.46**	**-1.38**	**-1.91**
M7x CIMMYT 14	**4.35***	**4.29**	**4.32***	**5.66****	**5.59****	**5.63****	**-0.46**	**-0.23**	**-0.34**	**1.41**	**1.85**	**1.63**	**6.57**	**6.78**	**6.68**	**8.07**	**8.62***	**8.35***
M15x CIMMYT 14	**2.48**	**3.68**	**3.09**	**3.77**	**4.97****	**4.38***	**-11.26****	**-4.31**	**-7.76****	**-9.60****	**-2.31**	**-5.94***	**-10.03***	**-3.39**	**-6.68**	**-8.77***	**-1.72**	**-5.22**
CLM343x CIMMYT 14	**4.97***	**4.29***	**4.63***	**6.29****	**5.59****	**5.94****	**-1.15**	**-2.49**	**-1.83**	**0.70**	**-0.46**	**0.12**	**-16.61****	**-11.86****	**-14.21****	**-15.44****	**-10.34***	**-12.87****
CLM19x CIMMYT 14	**4.35***	**-0.61**	**1.85**	**5.66****	**0.62**	**3.13**	**2.99**	**4.76**	**3.88**	**4.92**	**6.94***	**5.94***	**-13.15****	**-6.10**	**-9.59***	**-11.93****	**-4.48**	**-8.17**
M24x CIMMYT 14	**6.21****	**1.23**	**3.70**	**7.55****	**2.48**	**5.00****	**3.91**	**3.63**	**3.77**	**5.85***	**5.79**	**5.82***	**-16.96****	**-11.86****	**-14.38****	**-15.79****	**-10.34***	**-13.04****
M25x CIMMYT 14	**3.11**	**-3.07**	**0.00**	**4.40***	**-1.86**	**1.25**	**3.91**	**4.31**	**4.11**	**5.85***	**6.48***	**6.17***	**-12.80****	**-2.03**	**-7.36**	**-11.58****	**-0.34**	**-5.91**
M30x CIMMYT 14	**4.35***	**0.61**	**2.47**	**5.66****	**1.86**	**3.75**	**-5.29**	**0.23**	**-2.51**	**-3.51**	**2.31**	**-0.58**	**-9.34***	**-3.05**	**-6.16**	**-8.07**	**-1.38**	**-4.70**
M34x CIMMYT 14	**7.45****	**-1.84**	**2.78**	**8.81****	**-0.62**	**4.06***	**-7.36****	**5.22**	**-1.03**	**-5.62***	**7.41***	**0.93**	**-8.82***	**-1.69**	**-5.22**	**-7.54**	**0.00**	**-3.74**
M36x CIMMYT 14	**1.86**	**0.00**	**0.93**	**3.14**	**1.24**	**2.19**	**5.29**	**9.30****	**7.31***	**7.26****	**11.57****	**9.43****	**-14.19****	**-3.39**	**-8.73***	**-12.98****	**-1.72**	**-7.30**
M57x CIMMYT 14	**1.86**	**-4.29***	**-1.23**	**3.14**	**-3.11**	**0.00**	**-0.69**	**-10.88****	**-5.82***	**1.17**	**-9.03****	**-3.96**	**-13.49****	**-11.86****	**-12.67****	**-12.28****	**-10.34***	**-11.30****

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

Table 6. Standard heterosis for ear diameter, shelling % and grain yield (ton fed^{-1}) relative to S.C. 128 and S.C. 2031 under both nitrogen levels as well as combined data.

Genotypes	Ear diameter (cm)						Shelling %						Grain yield (ton fed^{-1})					
	Relative to S.C. 128			Relative to S.C. 2031			Relative to S.C. 128			Relative to S.C. 2031			Relative to S.C. 128			Relative to S.C. 2031		
	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.	N1	N2	Comb.
M7x M8	-11.43*	1.37	-4.90	-10.14	1.37	-4.23	0.91	-0.55	0.18	2.00	1.12	1.56	5.56	-7.82	-1.60	-7.71*	-7.97	-7.84*
M15x M8	-7.14	4.11	-1.40	-5.80	4.11	-0.70	2.53	0.98	1.76	3.64*	2.68	3.16*	16.09**	2.16	8.64*	1.51	1.99	1.75
CLM343x M8	2.86	0.00	1.40	4.35	0.00	2.11	-1.07	2.16	0.55	0.00	3.88**	1.94	14.56**	-1.33	6.06	0.17	-1.50	-0.67
CLM19x M8	-3.57	4.11	0.35	-2.17	4.11	1.06	1.50	0.51	1.01	2.60	2.20	2.40	16.28**	-7.32*	3.65	1.68	-7.48	-2.92
M24x M8	-3.57	5.48	1.05	-2.17	5.48	1.76	-1.90	-1.26	-1.58	-0.84	0.40	-0.22	16.48**	5.82	10.77*	1.84	5.65	3.75
M25x M8	-8.57	2.74	-2.80	-7.25	2.74	-2.11	-0.87	-0.55	-0.71	0.20	1.12	0.66	15.71**	3.16	8.99*	1.17	2.99	2.09
M30x M8	8.57	5.48	6.99	10.14	5.48	7.75	3.28*	0.35	1.81	4.40**	2.04	3.22*	20.31**	9.15*	14.34**	5.19	8.97*	7.09
M34x M8	14.29**	6.85	10.49*	15.94**	6.85*	11.27*	3.56*	1.69	2.62	4.68**	3.40*	4.04**	22.99**	12.48**	17.36**	7.54*	12.29**	9.92*
M36x M8	-14.29**	0.00	-6.99	-13.04*	0.00	-6.34	-1.86	1.69	-0.08	-0.80	3.40*	1.30	14.56**	5.49	9.71*	0.17	5.32	2.75
M57x M8	-3.57	1.37	-1.05	-2.17	1.37	-0.35	0.16	-0.86	-0.35	1.24	0.80	1.02	-1.34	-2.33	-1.87	-13.74**	-2.49	-8.09*
M7x CIMMYT 14	4.29	3.42	3.85	5.80	3.42	4.58	1.07	0.04	0.55	2.16	1.72	1.94	21.07**	6.16	13.09**	5.86	5.98	5.92
M15x CIMMYT 14	3.57	2.74	3.15	5.07	2.74	3.87	-3.28*	-1.53	-2.41	-2.24	0.12	-1.06	6.13	2.50	4.19	-7.20	2.33	-2.42
CLM343xCIMMYT 14	-7.14	1.37	-2.80	-5.80	1.37	-2.11	-3.88	-0.24	-2.05	-2.84	1.44	-0.70	-21.07**	-21.46**	-21.28**	-30.99**	-21.59**	-26.27**
CLM19x CIMMYT 14	10.00	8.22	9.09*	11.59*	8.22*	9.86*	0.44	0.59	0.51	1.52	2.28	1.90	9.77*	-6.49	1.07	-4.02	-6.64	-5.34
M24x CIMMYT 14	4.29	2.74	3.50	5.80	2.74	4.23	-0.67	-1.10	-0.89	0.40	0.56	0.48	2.11	-8.15*	-3.38	-10.72**	-8.31*	-9.51*
M25x CIMMYT 14	5.71	5.48	5.59	7.25	5.48	6.34	2.73	1.65	2.19	3.84*	3.36*	3.60*	3.26	-6.32	-1.87	-9.72**	-6.48	-8.09*
M30x CIMMYT 14	17.86**	16.44**	17.13**	19.57**	16.44**	17.96**	0.79	0.75	0.77	1.88	2.44	2.16	22.41**	7.32*	14.34**	7.04	7.14	7.09
M34x CIMMYT 14	-1.43	0.00	-0.70	0.00	0.00	0.00	-8.03**	-2.00	-5.01**	-7.04**	-0.36	-3.70*	-9.77*	4.49	-2.14	-21.11**	4.32	-8.34*
M36x CIMMYT 14	5.71	2.74	4.20	7.25	2.74	4.93	-0.99	-0.90	-0.95	0.08	0.76	0.42	-1.72	3.99	1.34	-14.07**	3.82	-5.09
M57x CIMMYT 14	-1.43	-1.37	-1.40	0.00	-1.37	-0.70	0.87	-2.99	-1.06	1.96	-1.36	0.30	11.49**	-16.31**	-3.38	-2.51	-16.45**	-9.51*

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

However, the most desirable heterotic effects were detected for the cross M34xM8 recording 22.99**, 12.49** and 17.36** relative to SC 128 and 7.54*, 12.29** and 9.92** relative to SC 2031 under N1, N2 nitrogen level as well as combined data, respectively (Table, 6). Similar results were reported by **Kahriman *et al*. (2016), Youstina Sedhom *et al*. (2017), Omnya Turkey *et al*. (2018), El-Hosary (2020 a and b)** and **Sedhom *et al*. (2021**).

From such results it could be concluded that the crosses M25xM8, M30xM8, M34xM8 and M30xCIMMYT14 are promising and could be used possibility for improving grain yield of maize.

References

Ahmed, S., S. Begum, M.A.Islam, M. Ratna and M.R. Karim (2017). Combining ability estimates in maize (Z*ea mays* l.) Through line × tester analysis. Bangladesh J. Agril. Res. 42(3): 425-436.

Andayani, N.N., M. Aqil, R. Efendi and M. Azrai (2018). Line × tester analysis across equatorial environments to study combining ability of Indonesian maize inbred. Asian J Agri & Biol. 6 (2): 213-220.

Bayoumi, R.A., S.M. Shoker, G.Y. Hamam and A.A.A. El-Hosary (2018). Determination of Combining Ability for Some New Yellow Maize Inbred Lines Using Line X Tester Model. Annals of Agric. Sci., Moshtohor, 56(2): 305 –316.

El-Badawy, M. El. M. (2013). Heterosis and combining ability in maize using diallel crosses among seven new inbred lines. Asian J. Crop Sci., 5(1): 1-13

El-Gazzar, I.A.I. (2021). Combining ability of new yellow maize inbred lines and superiority of their hybrids to check cultivars. J. of Plant Production, Mansoura Univ., Vol 12 (5):585 – 589. DOI: 10.21608/JPP.2021.178934

El-Hosary, A.A.A. (2020a). Estimation of genetic variability using line X tester technic in yellow maize and stability analysis for superior hybrids using different stability procedures. J. of Plant Production, Mansoura Univ., Vol. 11 (9):847-854. https://doi.org/10.21608/jpp.2020.118047

El-Hosary, A.A.A. (2020b). Estimation of genetic variability using line x Tester Technic in Yellow Maize and Stability Analysis for Superior hybrids using different stability procedures. J. of Plant Production, Mansoura Univ., Vol. 11 (9):847-854. https://doi.org/10.21608/jpp.2020.118047

El-Naggar, A.M.M., R. Shabana, M.M. M. Attal and T.H. Al-Khalil (2015). Regression of Grain Yield of Maize Inbred Lines and Their Diallel Crosses on Elevated Levels of Soil-Nitrogen. International Journal of Plant & Soil Sci. 4(6): 499-512.

FAOSTAT, 2020. Food & Agriculture Organization of the United Nations Statistics Division. Rome. Italy. http://www.fao.org/faostat/en/#data.

Kahriman, F., **C.O. Egesel, G.E. Orhun and B. Alaca (2016).** Comparison of graphical analyses for maize genetic experiments: Application of biplots and polar plot to line × tester design. Chilean J. of Agric. Res. 76(3): 286- 293. http://dx.doi.org/10.4067/S0718-58392016000300004

Kamara, M.M. and M.R. Rehan (2015). Combining ability in maize under two nitrogen levels and assessing genetic diversity using RAPD marker. J. Plant Production, Mansoura Univ., Vol. 6 (12): 2051 – 2067.

Kamara, M.M., El-Degwy, I.S. and Koyama, H. (2014). Estimation combining ability of some maize inbred lines using line × tester mating design under two nitrogen levels. Australian J. of Crop Sci. AJCS 8(9):1336-1342.

Kempthorne, O. 1957. An Introduction to Genetics Statistics, 1st eds, pp. 457-71. John wiley and sons, New York.

Mahesh, N., M.C. Wali, M.V.C. Gowda, B.N. Motagi and N.F. Uppinal (2013). Genetic analysis of grain yield, starch, protein and oil content in single cross hybrids of maize. Karnataka J. Agric. Sci., 26(2(: 185- 189.

Meseka, S.K., A. Menkir, A.E.S. Ibrahim and S.O. Ajala (2013). Genetic analysis of maize inbred lines for tolerance to drought and low nitrogen. JONARES, Vol. 1: 29-36.

Neveen Hamouda, M., A.A. El-Hosary, S.A. Sehom, G.Y. Hamam, T.A.E. Saafan and A.A.A. El-Hosary (2021). Genetical analysis for substantial traits in new yellow maize crosses using line X tester model. Annals of Agric. Sci., Moshtohor. 59(1): 17 – 30.

Noelle, M.A.H., K. Richard, G. Vernon, Y. A. Martin, M.N. Laouali, T.N. Lilane and N. Godswill (2017). Combining Ability and Gene Action of Tropical Maize (Zea mays L.) Inbred Lines under Low and High Nitrogen Conditions. Journal of Agricultural Science; Vol. 9 (4): 222-235.

Ogunniyan, D.J., D.K. Ojo, S.A. Olakojo and O.A. Talabi (2019). Diallel analysis of maize inbred lines for agronomic traits in nitrogen stress and optimal conditions. Ghana Jnl. Agric. Sci. 54, (1) 10 – 23.

Omnya Turkey, H., **S.A. Sedhom, M.EL.M. El-Badawy, and A.A.A. El-Hosary (2018).** Combining ability analysis using diallel crosses among seven inbred lines of corn under two sowing dates. Annals of Agric. Sci., Moshtohor, 56(2): 293- 304.

Patil, M.S., B.N. Motagi and R.M. Kachapur (2020). Heterosis and Combining Ability Studies in Maize (*Zea mays* L.) for Drought Tolerance, TLB Disease Resistance and Productivity in Northern Dry Tract of Karnataka. Int. J. Curr. Microbiol. App. Sci (2020) 9(10): 1054-1064. https://doi.org/10.20546/ijcmas.2020.910.126.

Sedhom, S.A., **M.E. El-Badawy, A.A.A. El-Hosary, M.S.Abd El-Latif, A.M.S. Rady, M.M.A. Moustafa, S.A. Mahmoud, O.A.M. BAdr, S.A. Abo-MArzoka, K.A. Baiumy and M.M. El-Nahas (2021).** Molecular markers and GGE biplot analysis for selecting higher-yield and drought-tolerant maize hybrids. Agronomy Journal, 113 (5): 3871 -3885. https://**doi**.org/**10.1002/agj2**.**20778**

Sedhom, S.A.; M.H. Tag El Din, M.E. El Badawy and M.A. El Bakey (2012). Breeding for grain yield, yield components and quality traits in yellow maize (*Zea mays*, L.). Proc. 13th Int. Conf. Agron. Fac. Of Agric. Benha Univ., Egypt, 9- 10 September, 332- 351.

Steel, R.G.D., Torrie, J.H. and Dicky, D.A. (1997) Principles and Procedures of Statistics, A Biometrical Approach. 3rd Edition, McGraw Hill, Inc. Book Co., New York, 352-358.

Youstina, Sedhom, A.S., M.M.A. Ali, H.A. Awaad and H.A. Rabie (2016). Heterosis and factor analysis for some important traits in new maize hybrids. Zagazig J. of Field Crop Sci., 43(3): 711-728.

التفوق المحصولى والقدرة على التآلف لبعض الهجن الجديدة من الذرة الشامية تحت مستويين من التسميد النيتروجينى

محمد طه حسين أمام، سيدهم أسعد سيدهم، جابر عبد اللطيف سارى، أحمد سعد ابراهيم

قسم المحاصيل- كلية الزراعة – جامعة بنها

أجريت هذه الدراسة يهدف تقييم عشرون هجينا قميا ناتجة من التهجين بين عشرة سلالات نقية جديدة مع سلالتين كشافتين من الذرة الشامية تحت مستويين من التسميد النيتروجينى (80، 120 كجم ن/ فدان)، حيث تم تقييم العشرون هجينا قميا مع هجنين للمقارنة (هـ ف. 128، هـ.ف 2031) تحت مستويين من التسميد النيتروجينى فى تصميم قطاعات كاملة العشوائية باستخدام ثلاثة مكررات. وتم تسجيل الصفات التالية: عدد الأيام حتى خروج 50% من النورة المذكرة، ارتفاع الكوز، طول الكوز، معدل التفريط، محصول الحبوب (طن/ فدن). وتم تقدير القدرة العامة والخاصة وقوة الهجين للصفات المختلفة. واظهرت النتائج ان تباين معاملات التسميد النيتروجين كانت معنوية لجميع الصفات وكان تباين التراكيب الوراثية ومكوناتها وكذلك تفاعها مع مستويات التسميد النيتروجينى معنويا لجميع الصفات تحت الدراسة. واعطى الهجين القمى M30 x M8 أفضل متوسط لميعاد خروج 50% من النورة المذكرة بينما اعطى الهجين M34xM8 افضل القيم لصفتى طول الكوز ومحصول الحبوب للفدان. وكان تباين القدرة الخاصة على التألف اعلى منه للقدرة العامة على التألف لجميع الصفات تحت الدراسة موضحا اهمية التباين الوراثي غيرالمضيف فى وراثة هذه الصفات. وكانت السلالة M25 هى الأفضل بالنسبة لتأثيرات القدرة العامة على التألف لصفة عدد الأيام حتى تفتح 50% من النورة المذكرة وكذلك السلالة M30 بالنسبة لصفة محصول الحبوب للفدان. وأمكن الحصول على أفضل تأثيرات للقدرة الخاصة على التالف لصفة محصول حبوب للفدان مع الهجين M7 x CIMYYT 14. واعطى الهجين M34xM8 افضل تأثيرات لقوة الهجين لصفة محصول الحبوب للفدان نسبة الى هجن المقارنة تحت كلا من مستويات التميد النيتروجينى والتحليلي التجميعى.