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Evaluation of Some Maize Hybrids under Nitrogen Fertilization Levels

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Abstract: ***Genetic selection of maize hybrids is related to using high nitrogen levels, which require to a stronger N input to accomplish their yield potential. This study aimed to investigate the response of some maize hybrids to five nitrogen fertilizer levels (0, 75, 100, 125, 150 kg N fed^{-1}) at the Experimental and Research Center, Moshtohor Faculty of Agriculture, Benha University, Egypt, during 2013 and 2014 seasons. Results showed SC 30k8 W hybrid surpassed other hybrids in No. grains/row, ear weight, grain yield/plant and grain yield fed^{-1}. Application of 125kg N fed^{-1}gave the highest values of No. grains/row, ear grains weight, 100-grain weight, shelling%, grain yield/plant and grain yield fed^{-1}.Interaction of maize hybrids x N fertilizer levels had significant effect on plant height, No. grains/row, grain yield/plant and grain yield fed^{-1} in the combined analysis. Highly significant positive correlation values were detected between grain yield fed^{-1} and each of grains ear weight, shelling %, grain yield/plant, Number of grains/row, ear weight and 100-grain weight. It could be recommended that fertilizing SC 30k8 maize hybrid by 125 kg N fed^{-1} could achieve the highest grain yield and economic use of nitrogen fertilization in this location and similar areas.***

Keywords: Maize hybrids; N-levels; Grain yield and attributes; correlation coefficients

1. Introduction

Maize (*Zea mays* L.) is one of the most important cereal crop all over the worlds it ranks the third position among cereals crops after wheat and rice (FAO, 2010), and is still a major traditional food and feed crop in many regions which provide 15% of the protein and19% of the calories for the developing countries (Shakoor et al., 2007). Its grains are a key industrial raw material for very diverse purposes. Also, it is one of the plants that present greater N requirements to reach high grain yields, removing from the soil between 20 and 25kg of N per ton of grain produced (Muzilli Oliveira, 1992). In Egypt, great attention had been paid to increase its total production. This could be achieved by using high yielding hybrids and fertilization.

Maize hybrids had significant differences in grain yield and yield attributes (El-Wakil, 2002; Hamed, 2003; Mehasen and Al-Fageh, 2004; Nofal *et al.,* 2005; Mehasen and Saeed, 2006; Atta, 2007; Hassan et al., 2008; Mehasen and Ahmed, 2009; Mehasen and El-Gizawy, 2010;El-Badawy and Mehasen, 2011;EivaziandHabibi, 2013).

Nitrogen fertilizer is a key nutrient in the production of non-legume crops. It is a component in many biological compounds that plays a major role in photosynthetic activity and crop physiological capacity especially under arid and semi-arid regions (Cathcart and Swanton, 2003; EL-Sarag and Ismaeil, 2013) and its deficiency constitutes one of the major yield limiting factors for cereal production (Shah et al., 2003). Several researchers reported that nitrogen is the most limiting factor to increase maize grain yield and its components. They found that plant height, ear height, ear diameter, ear length (cm), No. of rows ear^{-1}, No. of grains row^{-1}, ear weight, ear grain weight, 100-grain weight, shelling percentage, grain yield plant^{-1}andgrain yield fed^{-1} of maize were increased by increasing nitrogen level(El-Banna, 2001;Ogola *et al.,* 2002;Vetsch and Randal, 2004;El-Sayed, 2006; Sharifi and Taghizadeh, 2009;Akmal *et al.,* 2010, Ali *et al.*, 2011;Moraditochaee *et al.,* 2012*,* Kandil, 2013 and Sime and Aune, 2014).

The coefficient of correlations help to measure the level of relationships between the traits and also establish the level at which these traits are mutually different (Bocanski*et al*, 2009; Nagabhushan *et al.*, 2011). The correlations also give reliable and useful information onnature, extent and direction of selection (Zeeshan *et al.*, 2013). In this concern, Atia *et al.,* (2001), Ashmawy (2003), Mehasen and Al-Fageh (2004); Mehasen and El-Gizawy (2010); El-Badawy and Mehasen (2011); Nzuve *et al.,* (2014) reported that grain yield fed^{-1} of corn was highly positively correlated with ear length, number of grains row, ear diameter, shelling%, grain yield plant^{-1} and 100-kernel weight but positively and significantly correlated with both of plant height and ear height.

This study aimed to investigate the effect of N fertilizer levels on grain yield and its correlation with yield attributes as well as determine the most important variables and their relative contribution to maize yield variability.

2. Materials and Methods

This investigation was conducted at the Agricultural Research and Experimental Center of the Faculty of Agriculture, Moshtohor, Kalubia Governorate, Benha University, Egypt, in 2013 and 2014 seasons, to study the effect of nitrogen fertilization levels on yield and yield attributes of some maize hybrids.

The soil type was clay with pH values of 7.89 and 7.80, organic matter was 1.85 and 1.96% and total N was 0.19 and 0.21% in the first and second growing seasons. The proceeded crop was clover in the two seasons. Each experiment included 35 treatments which were the combinations of seven maize hybrids; TWC 3W (three way cross Maged 3 white), TWC 7W(three way cross Maged 7white), SC 125W (Single cross 125 white), SC 30k8 W(Single cross 30k08 white), SC 30N11 Y(Single cross 30N11 yellow), SC 30G98 Y(Single cross 30G98 yellow) and SC 101Y(Single cross El-hosary 101 yellow) and five nitrogen levels (0, 75, 100, 125 and 150 kg N fed^{-1}) in the form of urea46%N. Nitrogen levels were applied in two split applications before the first and second irrigations. The experimental design was split plot design with three replications. Maize hybrids were arranged at random in the main plots and N-levels in the sub plots. Each sub plot was 10.5 m^2 (1/400 fed) consisting of 5 ridges, 3.5 m long and 70 cm width while, the distance between plants was 25 cm. Planting date was May29th and 17th in 2013and 2014 seasons, respectively. All other cultural practices were applied as recommended for this region in both season.

At harvest, ten plants were randomly taken from each sub plot to determine plant height (cm), ear height (cm), ear length (cm), ear diameter (cm), number of rows ear^{-1}, number of grains row^{-1}, ear weight(g), ear grains weight(g), 100-grain weight (g), shelling percentage and grain yield plant^{-1} (g). Grain yield (kg fed^{-1}) was determined based on the whole sub plot.

Data of the mentioned parameters were averaged across the hybrids at various nitrogen levels and then coefficients of correlation were worked out using excel worksheet (Gomez and Gomez, 1984; Iqbal et al. 2009). Means of all studied parameters were analyzed according to Steel and Torrie (1980).The combined analysis of variance for two seasons was conducted testing the error homogeneity. Means separation was determined using L.S.D test at 0.05 level of probability.

3. Results

Mean square values

Analysis of variances for all traits in each season as well as the combined analysis is presented in Table 1. Test of homogeneity revealed that the error variance for the two seasons were homogenous, therefore combined analysis was processed. Year's mean squares were significant for all the studied traits except for No. rows ear^{-1}. The hybrids mean squares were highly significant for all traits in both seasons as well as the combined data except No. of rows ear^{-1} in both seasons and the combined analysis. N fertilizer levels mean squares were highly significant for all studied traits in both seasons and combined analysis. The interaction between years and hybrids mean squares was not significant for all of the studied characters. The interaction between years and N levels mean squares were not significant for all of the studied characters except grain yield plant^{-1}. The interaction between years, hybrids and inoculation mean squares were not significant for all of the studied characters.

Varietal performance

The results in Table 2 showed that the 7 evaluated hybrids significantly varied in all traits under study in each season as well as the combined data except No. of rows ear^{-1}. This suggests that sufficient genetic variability exists in the genotypes selected for study. TWC 7 W and TWC 3 W hybrids gave the highest values of plant height, while, SC 30k8 W recorded the highest means of Ear diameter, No. grains/row and Ear weight in both seasons and combined analysis.

The 7 tested maize hybrids showed some significant differences in Grains weight ear $^{-1}$, 100-grain weight and shelling% in both seasons and combined analysis. Superiorities of these parameters (188.5g, 37.1g) were recorded by SC 30k8 W and TWC 7 Why brids in combined analysis. The highest values of shelling percentage was recorded by SC 30G98 Y (77.9, 79.2 and 78.6%), followed by SC 30N11 Y (77.8, 78.4 and 78.1%), without significant differences in the first, second seasons and the combined analysis, respectively.

SC 30k8 W maize hybrid significantly surpassed other hybrids in ear diameter, number of grains row^{-1}, ear weight, ear grains weight, grain yield plant^{-1} and grain yield fed^{-1} in both seasons and combined analysis. This hybrid gave the highest values of ear diameter (4.76, 4.88 and 4.82cm)followed by TWC 7 W hybrid (4.69, 4.75 and 4.72cm) , number of grains row^{-1} (48.0, 48.5 and 48.3 grain)followed by SC 125 W hybrid (46.8, 47.2 and 47.0 grain), ear weight(240.1, 242.4 and 241.2g)followed by SC 125 W hybrid (235.6, 237.0 and 236.3g), ear grains weight(187.0, 190.0 and 188.5g) followed by SC 125 W hybrid (183.0, 184.8 and 183.9g), grain yield plant^{-1}(243.7, 251.7 and 247.7g)followed by SC 125 W hybrid (230.8, 244.7 and 237.7g) and grain yield fed^{-1}(3882.2, 3912.5 and 3897.4kg)followed by SC 125 W hybrid(3841.2, 3848.5 and 3844.8 kg) in 2013, 2014 seasons and combined analysis, respectively.

Effect of N levels

Results illustrated in Table 3 show that the increase in N-level caused a significant increase in yield and yield attributes of maize in both seasons and the combined analysis by increasing N-level up to 125N fed^{-1}.The highest values of plant height, ear length, ear diameter, number of rows ear^{-1}, number of grains row^{-1}, ear weight, ear grains weight, 100-grain weight, shelling%, grain yield plant^{-1} and grain yield fed^{-1}in the first and second seasons as well as the combined analysis were obtained with fertilizer level of 125N fed^{-1}.

Increasing N-level from zero to 125 or 150 kg N fed^{-1} led to significant increases in 100-grain weight by 29.37 and 27.72%, in grain yield plant^{-1} by 88.03 and 79.76% and grain yield fed^{-1} by 39.16 and 38.43% in the first season, in 100-grain weight by 30.29 and 29.97%, in grain yield plant^{-1} by 94.50 and 85.69% and grain yield fed^{-1} by 37.75 and 36.58% in the second season and in 100-grain weight by 29.84 and 28.85%, in grain yield plant^{-1} by 91.31 and 82.70% and grain yield fed^{-1} by 38.45 and 37.50% in the combined analysis, respectively.

Effect of interaction

The interaction between maize hybrids and N fertilization levels (Table 4 a & b) had significant effect on plant height, number of grains row^{-1}, ear grains weight, shelling%, grain yield plant^{-1} and grain yield fed^{-1} in the combined analysis. The highest values of plant height (327.3 cm) and ear height (163.3 cm) were obtained by TWC 7 W and TWC 3 W hybrids when received 125 and 150 kg N fed^{-1}, respectively, while the lowest values of plant height (241.8 cm) was obtained by SC 101 Y hybrid under 0 N fed^{-1}.The highest mean values of number of grains row^{-1}, ear grains weight, grain yield plant^{-1} and grain yield fed^{-1} were 54.1 grain, 262.3g, 215.0g, 318.9g and 4244.1kg, respectively obtained by SC 30k8 W hybrid when received 125 kg N fed^{-1}.Whereas, the lowest values of number of grains row^{-1}, ear grains weight, grain yield plant^{-1} and grain yield fed^{-1} were 34.3grain, 121.1g, 123.2g and 2716.8kg, respectively obtained by SC 30G98 Y hybrid under 0 N fed^{-1}.The highest mean value of shelling percentage was 83.5%, obtained from SC 30G98 Y hybrid without significant SC 30N11 Y hybrid when received 125 kg N fed^{-1} without significant 150 kg N fed^{-1}, whereas the lowest value of shelling percentage was 69.8%, obtained from TWC 3 W hybrid under zero N fed^{-1}.

Simple phenotypic correlation

The simple correlation coefficients between each two traits were estimated in the combined analysis. The association between grain yield fed^{-1} and its related characters in maize plant gives very useful information for the plant breeder who wants to incorporate desirable characters. Table 5shows highly significant positive phenotypic correlation values between grain yield fed^{-1} and each of other traits in the combined analysis. Therefore, selection for each of higher ear length followed by grains ear weight, shelling%, grain yield plant^{-1}, No. grains row, ear diameter, ear weight and100-grain weight is more effective for obtaining new higher yielding hybrids. Highly significant and positive correlation values were detected between ear length and each of shelling%, grain yield plant^{-1}, No. grains row, ear diameter, grains ear weight and 100-grain weight, respectively. Also, there was positive and highly significant association between No. grains row and each of grains ear weight, grain yield plant^{-1}, shelling%, 100-grain weight and ear weight, respectively. Moreover, highly significant and positive correlation values were detected between grains ear weight and each of grain yield plant^{-1}, shelling% and 100-grain weight, respectively. Shelling percentage expressed highly significant and positive correlation with grain yield plant^{-1}. These results are in agreement with those obtained by Atia *et al* (2001), Ashmawy (2003), Mehasen and Al-Fageh (2004); El-Badawy (2006); Mehasen and El-Gizawy (2010); El-Badawy and Mehasen (2011).

4. Discussion

The significant differences recorded for the different traits among the studied hybrids implied that the maize hybrids included in this study had diverse genetic backgrounds (Nzuve *et al.*, 2014; Vashistha *et al.*, 2013; Reddy et al., 2012).

Effect of Varietal performance

The results showed that the 7 evaluated hybrids significantly varied in all traits under study in each season as well as the combined data except No. of rows ear^{-1}. These results are mainly due to the differences in the genetically make up among maize hybrids. The superiority of SC 30k8 W hybrid is reflected in its superiority over the other tested hybrids in ear length, ear diameter, number of grains row^{-1}, ear weight, ear grains weight and grain yield plant^{-1}.Maize hybrid SC 30k8 W gave higher mean values of the above mentioned parameters except shelling%. The results of varietal differences in yield and yield attributes of maize hybrids in this study are in agreement with those obtained by El-Wakil (2002); Hamed (2003); Mehasen and Al-Fageh (2004); Nofal *et al* (2005); Mehasen and Saeed (2006); Atta (2007); Hassan *et al* (2008); Mehasen and Ahmed (2009); Mehasen and El-Gizawy (2010); El-Badawy and Mehasen (2011) and Eivazi and Habibi (2013).

Effect of N levels

The illustrated results show that the increase in N-level caused a significant increase in yield and yield attributes of maize in both seasons and the combined analysis by increasing N-level up to 125kg N fed^{-1}. There were significant responses to nitrogen with characters asserting the vital need for nitrogen application to maize production in this soil. The increases in yield and components may be due to the increases indirectly affected by N general functions in plant. Russell (1973) stated that the higher the nitrogen supplies the more rapidly the synthesized carbohydrates which are converted to proteins and to protoplasm while the small proportion left available for cell wall material. Furthermore, the increase in grain yield fed^{-1} is attributed mainly to the increases in yield components. These results are in harmony with those of El-Banna (2001); Ogola *et al,* (2002); Vetsch and Randal (2004); El-Sayed (2006); Sharifi and Taghizadeh (2009); Akmal *et al,* (2010); Ali *et al*, (2011); Moraditochaee *et al,* (2012); Kandil (2013) and Sime and Aune (2014).

Effect of Correlation

Seed yield of a crop is the result of interaction of a number of interrelated characters. Therefore selection should be based on these component characters after assessing their correlation with yield. So, correlation between grain yield fed^{-1} and each of other traits in the combined analysis were presented to give assurance of this fact in this study. Therefore, selection for each of higher ear length followed by grains ear weight, shelling%, grain yield plant^{-1}, No. grains row^{-1}, ear diameter, ear weight and100-grain weight is more effective for obtaining new higher yielding hybrids. These results are in agreement with those obtained by Atia *et al* (2001), Ashmawy (2003), Mehasen and Al-Fageh (2004); El-Badawy (2006); Mehasen and El-Gizawy (2010); El-Badawy and Mehasen (2011).

5. Conclusion

It could be recommended that fertilizing SC 30k8 maize hybrid by 125 kg N fed^{-1} could achieve the highest grain yield and economic use of nitrogen fertilization in this location and similar areas.

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Table 1: Mean square values and significance for maize yield and yield attributes in 2013, 2014 seasons and their combined analysis

S.O.V.	d.f.	Plant height (cm)	No. rows ear^{-1}	No. grains row^{-1}	Ear grains weight (g)	100-grain weight (g)	Shelling %	Grain yield plant^{-1} (g)	Grain yield (kg fed^{-1})
2013									
Rep	2	102.200	0.800	0.600	10.886	1.552	0.622	177.323	11447.057**
Hybr.	6	7407.416**	1.663	73.498**	3062.476**	22.444**	2.946**	9208.161**	417185.876**
Error (a)	12	60.411	2.044	0.622	13.686	1.063	0.435	420.191	1353.057
Fert.	4	1773.771**	17.867**	697.690**	12622.55**	280.800**	474.849**	53198.63**	4624622.44**
HxF	24	5.777	0.378	2.046	19.714**	0.667	0.940**	199.472**	5315.277**
Err.(b)	56	4.226	1.676	1.810	5.369	1.014	0.322	66.822	1467.200
2014									
Rep	2	15.000	1.410	0.695	45.067*	0.800**	7.233*	311.508	29491.657
Hybr.	6	7177.530**	0.241	64.365**	3005.130**	11.143	9.214**	6652.497**	408554.298**
Error (a)	12	21.644	2.032	1.317	9.844	0.600	1.269	362.585	11389.213
Fert.	4	3679.833**	19.429**	706.867**	13019.51**	319.705**	486.236**	69536.31**	4386556.97**
HxF	24	30.078**	0.162	1.806	21.376**	0.433	2.543	142.093*	12343.767
Err.(b)	56	9.886	2.086	1.407	6.138	0.521	2.309	78.365	9914.752
Combined analysis									
Years	1	3408.171**	0.933	14.933**	312.076**	27.505**	13.134**	11204.04**	27979.886*
R(Y)	4	58.600	1.105	0.648	27.976	1.176	3.928**	244.415	20469.357*
Hybr.	6	14541.73**	1.283	137.630**	6065.630**	31.983**	10.998**	15611.7**	819038.522**
H(Y)	6	43.216	0.622	0.233	1.976	1.605	1.163	248.926	6701.652
Error (a)	24	41.028	2.038	0.970	11.765	0.832	0.852	391.388	6371.135
Fert.	4	5222.005**	37.171**	1404.421**	25640.46**	599.345**	960.293**	122132.8**	9007846.53**
F(Y)	4	231.600**	0.124	0.136	1.600	1.160	0.793	602.118**	3332.874
HxF	24	17.933**	0.338	3.749**	39.896**	0.673	2.413*	299.291**	12448.584**
HxFxY	24	17.922**	0.202	0.102	1.194	0.426	1.070	42.274	5210.460
Error (b)	112	7.056	1.881	1.608	5.754	0.768	1.316	72.594	5690.976

* and ** are significant at 5% and 1% level of probability.

Table 2: Varietal performance of some maize hybrids in in 2013, 2014 seasons and their combined analysis

Season	Hybrid	Plant height (cm)	No. Rows ear^{-1}	No. Grains row^{-1}	Ear grains Weight (g)	100-grain Weight (g)	Shelling %	Grain yield plant^{-1} (g)	Grain yield (kg fed^{-1})
2013	TWC 3 W	309.0	13.4	45.4	177.8	36.7	76.9	224.3	3747.3
	TWC 7 W	311.5	13.2	46.4	180.3	37.0	76.8	225.0	3777.0
	SC 125 W	294.9	13.3	46.8	183.0	36.2	77.3	230.8	3841.2
	SC 30k8 W	299.4	14.0	48.0	187.0	36.7	77.5	243.7	3882.2
	SC 30N11 Y	288.2	13.4	42.5	155.9	34.4	77.8	184.1	3557.9
	SC 30G98 Y	260.6	13.2	42.2	154.1	34.1	77.9	183.3	3429.7
	SC 101 Y	255.8	12.9	44.4	157.6	34.8	76.9	192.0	3585.0
	LSD at 0.05 %	6.2	NS	0.6	2.9	0.8	0.5	16.3	29.2
2014	TWC 3 W	319.9	13.2	45.8	179.7	36.9	77.0	234.2	3761.0
	TWC 7 W	320.3	13.2	46.8	182.8	37.3	77.4	239.6	3784.9
	SC 125 W	300.4	13.2	47.2	184.8	37.0	77.6	244.7	3848.5
	SC 30k8 W	304.2	13.4	48.5	190.0	37.1	78.1	251.7	3912.5
	SC 30N11 Y	295.6	13.2	43.3	158.8	35.1	78.4	210.2	3558.3
	SC 30G98 Y	271.4	13.0	42.8	156.8	35.5	79.2	197.6	3444.2
	SC 101 Y	264.0	13.3	45.0	159.9	36.1	77.2	207.4	3672.6
	LSD at 0.05 %	3.7	NS	0.9	2.5	0.6	0.9	15.1	84.8
combined analysis	TWC 3 W	314.5	13.3	45.6	178.8	36.8	76.9	229.3	3754.1
	TWC 7 W	315.9	13.2	46.6	181.5	37.1	77.1	232.3	3781.0
	SC 125 W	297.6	13.2	47.0	183.9	36.6	77.5	237.7	3844.8
	SC 30k8 W	301.8	13.7	48.3	188.5	36.9	77.8	247.7	3897.4
	SC 30N11 Y	291.9	13.3	42.9	157.4	34.7	78.1	197.2	3558.1
	SC 30G98 Y	266.0	13.1	42.5	155.5	34.8	78.6	190.4	3437.0
	SC 101 Y	259.9	13.1	44.7	158.8	35.5	77.0	199.7	3628.8
	LSD at 0.05 %	3.4	NS	0.5	1.8	0.5	0.5	10.5	42.5

Table 3: Effect of nitrogen fertilization levels on grain yield and its attributes of maize in 2013, 2014 seasons and combined analysis.

Season	N-Level kg fed^{-1}	Plant height (cm)	No. rows ear^{-1}	No. grains row^{-1}	Ear grains weight (g)	100-grain weight (g)	Shelling %	Grain yield plant^{-1} (g)	Grain yield (kg fed^{-1})
2013	0	272.7	12.1	37.2	135.6	30.3	70.2	140.3	2903.2
	75	288.6	12.8	41.7	159.0	34.0	75.3	186.1	3626.7
	100	291.7	13.4	45.8	172.8	36.3	77.9	217.0	3854.2
	125	295.0	14.3	50.6	194.5	39.2	81.7	263.8	4040.1
	150	294.4	14.2	50.3	192.3	38.7	81.4	252.2	4019.0
	LSD 0.05 %	1.3	0.8	0.8	1.4	0.6	0.3	5.0	23.6
2014	0	275.7	12.0	37.6	137.4	30.7	70.4	147.4	2954.4
	75	292.8	12.6	42.1	161.4	34.8	76.3	193.2	3634.9
	100	299.2	13.1	46.5	175.3	36.7	78.3	231.4	3864.4
	125	308.9	14.3	51.2	197.3	40.0	82.1	286.7	4069.7
	150	306.2	14.1	50.8	195.0	39.9	82.0	273.7	4035.2
	LSD 0.05 %	1.9	0.9	0.7	1.5	0.4	0.9	5.4	61.5
combined analysis	0	274.2	12.0	37.4	136.5	30.5	70.3	143.9	2928.8
	75	290.7	12.7	41.9	160.2	34.4	75.8	189.6	3630.8
	100	295.5	13.2	46.1	174.0	36.5	78.1	224.2	3859.3
	125	301.9	14.2	50.9	195.9	39.6	81.9	275.3	4054.9
	150	300.3	14.1	50.5	193.6	39.3	81.7	262.9	4027.1
	LSD 0.05 %	1.1	0.6	0.5	1.0	0.4	0.5	3.7	32.6

Table 4a: Effect of maize hybrids and N fertilization levels interaction on grain yield and some of its attributes in combined analysis

Hybrids	Plant height (cm)					No. grains row^{-1}					Ear grains weight(g)				
	N levels kg fed^{-1}														
	0	75	100	125	150	0	75	100	125	150	0	75	100	125	150
TWC 3 W	295.8	311.5	316.3	325.3	323.5	38.5	42.1	46.3	50.6	50.6	142.1	168.5	182.0	202.3	199.0
TWC 7 W	296.0	312.6	318.5	327.3	325.1	39.0	43.0	47.1	52.1	51.8	144.8	171.3	184.8	204.6	202.1
SC 125 W	281.5	295.6	301.0	305.5	304.6	39.6	43.5	47.6	52.5	52.0	147.3	172.1	186.0	207.3	206.8
SC 30k8 W	287.0	300.8	305.3	309.1	306.8	39.8	44.1	49.5	54.1	53.8	150.3	176.5	189.3	215.0	211.5
SC 30N11 Y	270.3	290.8	296.6	301.1	300.5	35.3	40.5	44.3	47.5	47.0	120.8	142.1	158.8	183.3	181.8
SC 30G98 Y	247.0	264.3	267.6	276.6	274.5	34.3	40.0	43.0	48.0	47.3	121.1	140.3	157.5	180.8	177.6
SC 101 Y	241.8	259.1	263.0	268.6	267.0	35.3	40.1	45.1	51.6	51.3	129.0	150.6	159.8	177.8	176.6
LSD at 0.05 %	3.0					1.4					2.7				

Table 4b: Effect of maize hybrids and N fertilization levels interaction on grain yield and some of its attributes in combined analysis

Hybrids	Shelling %					Grain yield plant^{-1}(g)					Grain yield (kg fed^{-1})				
	N levels kg fed^{-1}														
	0	75	100	125	150	0	75	100	125	150	0	75	100	125	150
TWC 3 W	69.8	75.4	77.9	81.1	80.4	149.3	202.2	239.6	286.6	268.7	2923.3	3706.0	3923.3	4124.8	4093.3
TWC 7 W	70.0	75.3	78.4	81.1	80.7	152.1	202.7	237.1	290.0	279.7	2943.3	3718.5	3981.5	4139.1	4122.5
SC 125 W	70.4	75.2	78.0	81.9	81.9	154.8	212.4	244.9	290.3	286.2	3026.6	3830.0	4014.8	4183.8	4169.0
SC 30k8 W	71.1	75.4	78.2	81.9	82.3	162.8	211.8	252.5	318.9	292.6	3088.0	3859.8	4086.6	4244.1	4208.3
SC 30N11 Y	70.6	75.7	78.0	83.1	83.0	125.0	166.0	198.7	253.7	242.5	2825.0	3436.6	3689.0	3930.0	3910.0
SC 30G98 Y	70.5	78.1	78.1	83.5	82.6	123.2	156.7	194.3	241.1	236.9	2716.8	3323.1	3578.3	3803.3	3763.3
SC 101 Y	69.9	75.5	78.2	80.6	80.9	139.8	175.8	202.6	246.1	234.1	2978.5	3541.5	3741.6	3959.1	3923.3
LSD at 0.05 %	1.3					9.7					86.2				

Table 5: Correlation coefficient between yield and yield attributes of some maize hybrids in combined analysis over the two studied seasons (2013, 2014)

Yield components	1	2	3	4	5	6	7	8	9	10	11
Grain yield (kgfed^{-1})	0.597**	0.348**	0.946**	0.864**	0.530**	0.911**	0.843**	0.928**	0.841**	0.918**	0.916**
1- Plant height (cm)	1.000	0.892**	0.565**	0.462**	0.280**	0.561**	0.771**	0.703**	0.366**	0.583**	0.646**
2- Ear height (cm)		1.000	0.286**	0.168*	0.137*	0.330**	0.644**	0.511**	0.095	0.342**	0.419**
3- Ear length (cm)			1.000	0.896**	0.552**	0.913**	0.773**	0.893**	0.885**	0.932**	0.915**
4- Ear diameter (cm)				1.000	0.536**	0.855**	0.703**	0.821**	0.827**	0.844**	0.848**
5- No. of rows ear^{-1}					1.000	0.542**	0.442**	0.539**	0.575**	0.546**	0.550**
6- No. of grains row^{-1}						1.000	0.846**	0.937**	0.847**	0.926**	0.937**
7- Ear weight (g)							1.000	0.956**	0.584**	0.819**	0.892**
8- Grains ear weight (g)								1.000	0.794**	0.926**	0.967**
9- 100-grain weight (g)									1.000	0.872**	0.830**
10- Shelling%										1.000	0.933**
11- Yield of plant^{-1} (g)											1.000

* , ** significant at 5% and 1% level of probability.