

RESULTS AND DISCUSSION

1- Effect of genotypes, N fertilizer rates and their interactions on growth characters of maize.

1.1- Tasseling date:

Results in **Table (4)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on tasseling date of maize plants in 2005 and 2006 seasons.

1.1.1- Effect of genotypes.

Results indicated that genotypes possessed significant differences in tasseling date in both seasons. In the first season the local variety Nabe El-Gamal as well as the composite variety Giza 2 were the earliest varieties in tasseling and recorded significant differences when compared with the 4 hybrids. Also D.C. Dahab followed the 2 open-Pollinated varieties in early tasseling with significant differences with the other 3 hybrids. On the other hand, S.C. 30k8 was the latest variety in tasseling with significant differences compared with T.W.C. 323. In the second season, the local variety Nab El-Gamal significantly surpassed the other 5 genotypes in early tasseling and was followed by Giza 2 and D.C. Dahab which were significantly earlier in tasseling compared with T.W.C. 323, S.C. 3084 and S.C. 30k8 as one group.

From the results it could be concluded that the 6 tested genotypes could be arranged into 3 groups in regard to tasseling date as follows:

- early tasseling variety: Nab El-Gamal.
- medium tasseling varieties: Giza 2 and D.C. Dahab.

- Late tasseling varieties: S.C. 3084, S.C. 30k8 and T.W.C.323.

These results are mainly due to differences in the genetical constitution of the tested genotypes. Several investigators reported marked differences in tasseling date of maize varieties (Mabrouk and Aly, 1998; El-Wakil, 2002; Fatma Nofal et al, 2005a; El-Mekser and Seiam, 2008 and Hassan et al, 2008). 1.1.2- Effect of N rates.

Date presented in **Table (4)** indicated the N fertilizer rates (mineral or mineral +organic) significantly affected tasseling date of maize in both seasons. In 2005 season, the earliest tasseling was achieved by the highest N levels (120kgN/fed and 80kgN + 40 t / FYM/fed as well). On the other hand, the latest tasseling was recorded with the check treatment.

In 2006 season, applying 80kgN+ 40t FYM/fed induced early tasseling by 3.19 days compared with the check treatment. In 2006 season, the same N rate enhanced early tasseling by 2.88 days compared with the control of treatment.

The results show also that any increase in mineral N level or a combination of mineral and organic N resulted in a significant earliness in tasseling date. It is worthy to note that a combination of mineral and organic N was more effective in enhancing tasseling than single mineral N application. It could be concluded that N induced earlier tasseling in maize as a result of positive effect on the maturity of sexual organs through increasing meristematic activity in plants. Similar results were also reported by Shafshak et al (1994b); Abdullah (1995); El-Habbak and Shams El-Din (1996); El-Moursy et al (1998);

Faisal and Shalaby (1998); Fatma Nofal (1999); Soliman *et al* (2001) and El-Mekser and Seiam (2008).

1.1.3- Interaction effect.

The effect of the interaction between Maize genotypes and N fertilizer rates was not significant on tasseling (**Table**, **4**). This result indicates that each experimental factor acted independently in affecting this trait in both seasons.

Table (4): Tasseling date of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

2006 sea	isons.							
			20	05 seaso	n			
N Fertilizer rates			C	Senotypes				
N Fertilizer Tates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means	
Zero	65.13	66.23	62.95	64.68	60.75	59.73	63.24	
60 kg N/fed	64.25	65.28	61.93	63.60	59.75	59.15	62.33	
90 kg N/fed	63.45	64.25	60.68	62.45	59.03	58.30	61.36	
120 kg N/fed	62.15	63.13	59.63	61.65	58.48	57.58	60.43	
40 kg N/fed+20 (t/FYM)	64.25	65.25	60.63	63.45	59.18	58.88	61.94	
60 kg N/fed+30 (t/FYM)	63.30	63.95	61.20	62.23	58.93	57.95	61.26	
80 kg N/fed+40 (t/FYM)	62.18	62.50	59.53	60.68	57.93	57.50	60.05	
Means	63.53	64.37	60.93	62.68	59.15	58.44	61.52	
Means			2	006 seaso	n			
	Genotypes							
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means	
7	65.18	64.63	61.00	64.23	61.43	56.93	62.23	
Zero	64.53	64.20	59.98	62.73	60.78	56.03	61.37	
60 kg N/fed	63.70	63.43	58.80	61.68	59.23	55.48	60.38	
90 kg N/fed	62.55	62.70	57.95	60.78	58.20	54.75	59.49	
120 kg N/fed	64.13	63.70	59.95	62.65	60.58	55.75	61.13	
40 kg N/fed+20 (t/FYM)	63.50	63.23	58.40	61.93	58.85	55.33	60.20	
60 kg N/fed+30 (t/FYM)	62.55	62.63	57.85	60.60	57.83	54.63	59.3	
80 kg N/fed+40 (t/FYM) Means	63.73	63.50	59.13	62.08	59.55	55.55	60.59	

First season(2005)		Second season(2006)	
	1.35	L.S.D. at 5% genotypes =	2.09
	0.32	L.S.D. at 5% Fertilizer =	0.34
L.S.D. at 5% G.XF. =	N.S	L.S.D. at 5% G.XF. =	N.S

1.2- Silking date:

Results in **Table (5)** show the effects of maize genotypes, N fertilizer rates and their interactions on silking date of maize plants in 2005 and 2006 seasons.

1.2.1- Effect of genotypes.

Data in **Table** (5) show clearly that in 2005 season the two open pollinated varieties Nab El-Gamal and Giza 2 were significantly earlier in silking compared with the four hybrids. The D.C. Dahab followed these 2 varieties and was significantly earlier in silking than the T.W.C. and the two single crosses. It was also evident that the two single crosses as well as the three way cross were the latest varieties in silking and behaved as one group without significant differences among them.

In 2006 season, about the same trend was observed and the local variety Nab El-Gamal was the earliest in silking, followed by D.C. Dahab, Giza 2 and T.W.C. 323 as a group with medium earliness, and then the two single crosses S.C. 3084 and S.C. 30k8 with the latest silking date. The differences in silking date among the three groups were almost significant.

These differences are merely due to the genetical differences among the evaluated genotypes.

The present results are in agreement with those obtained by Mabrouk and Aly (1998); El-Wakil (2002); Fatma Nofal et al (2005a); El-Mekser and Seiam (2008) and Hassan et al (2008).

Table (5): Silking date of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

			2	005 seas	on				
N Fertilizer rates	Genotypes								
N Fertilizer rates	S.C	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
	3084 69.55	69.25	67.70	68.55	64.28	63.58	67.15		
Zero	67.68	68.18	65.93	67.48	63.48	62.55	65.88		
60 kg N/fed	199125 31200000	66.98	64.43	66.60	62.78	61.50	64.82		
90 kg N/fed	66.65		62.95	65.43	61.98	60.68	63.70		
120 kg N/fed	65.28	65.88		67.20	63.13	62.43	65.53		
40 kg N/fed+20 (t/FYM)	67.08	68.10	65.28	66.25	62.60	61.28	64.66		
60 kg N/fed+30 (t/FYM)	66.40	67.03	64.40		61.48	60.68	63.36		
80 kg N/fed+40 (t/FYM)	65.15	65.35	62.63	64.88			65.01		
Means	66.83	67.25	64.76	66.63	62.81	61.81	05.01		
			2	006 seas	on				
N Fertilizer rates		Genotypes							
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means		
	3084	30K8	Dahab	323		Gamal	(7.00		
Zero	68.45	67.75	65.23	67.33	65.43	61.10	65.88		
60 kg N/fed	67.60	67.00	63.75	66.13	64.45	60.50	64.90		
90 kg N/fed	66.30	66.43	62.98	64.88	63.20	59.88	63.94		
120 kg N/fed	65.08	65.78	61.75	64.15	62.63	58.98	63.06		
40 kg N/fed+20 (t/FYM)	66.98	66.80	63.38	65.85	64.05	60.45	64.58		
60 kg N/fed+30 (t/FYM)	65.90	66.28	62.65	64.73	63.15	59.70	63.73		
80 kg N/fed+40 (t/FYM)	65.33	65.55	60.90	56.30	61.78	58.63	61.41		
Means	66.52	66.51	62.95	64.19	63.53	59.89	63.93		

First season(2005)			Second season(2006)		
	=	1.67	L.S.D. at 5% Genotypes	=	2.20
L.S.D. at 5% Genotypes L.S.D. at 5% Fertilizer	=	0.28	L.S.D. at 5% Fertilizer	=	1.39
L.S.D. at 5% G.XF.	=	0.69	L.S.D. at 5% G.XF.	=	N.S

1.2.2- Effect of N rates.

Data presented in **Table (5)** showed that the application of N either as mineral or a mixture of mineral and organic N significantly accelerated silking of maize plants in both seasons. The best treatment in encouraging early silking were achieved by

applying 80kg mineral N+ 40 t FYM/fed in the first and second seasons. These 2 treatments accelerated silking by 3.79 and 3.45 days in the first and 4.47 and 2.82 days in the second season, respectively.

It is worthy to note that any increase in N rate induced significant effect on silking date. The effect of N on the vegetative growth and maturity was reflected in inducing early silking of maize plants.

Similar results were also obtained by Shafshak et al (1994b); Abdullah (1995); El-Habbak and Shams El-Din (1996); El-Moursy et al (1998); Faisal and Shalaby (1998); Fatma Nofal (1999); Soliman et al (2001) and El-Mekser and Seiam (2008).

1.2.3- Interaction effect.

The interaction effect between maize genotypes and N fertilizer rates was significant on silking date in the first season only (**Table 6**). The earliest silking date in 2005 season (60.68 days) was recorded by Nab El-Gamal cultivar under 120 kg N fed⁻¹ or 80 kg N+ 40(t/FYM) fed⁻¹, while the latest silking was after (69.55 days) and was recorded by S.C.3084 under zero N in the first season. Similar results were also obtained by **El-Wakil** (2002).

1.3-Plant height (at 80 days):

Results in **Table (6)** show means of plant height of maize at 80 days after planting as affected by genotypes, N fertilizer rates (mineral & organic) and their interaction in 2005 and 2006 seasons.

1.3.1- Effect of genotypes.

Results presented in **Table (6)** indicate significant differences in plant height among the 6 tested genotypes in both seasons. About the same trend with the trait was recorded in both seasons where the varieties could be arranged into 3 distinct groups in their height.

It is quite evident that the tallest plants were those of the local variety Nab El-Gamal which significantly surpassed all other varieties except Giza 2 (in first season), and the shortest plants were those of D.C. Dahab with significant differences compared with the 5 other genotypes in both seasons. The four other genotypes namely S.C 3084, S.C. 30k8, T.W.C. 323 and Giza 2 possessed no significant differences in plant height in both seasons.

These results and mainly due to the differences in the genetical constitution of the genotypes. These results are in accordance with those obtained by Shafshak et al (1994a); El-Hariri et al (1996); El-Wakil (2002); Oraby et al (2003); Fatma Nofal et al (2005a); Mehasen and Saeed (2006); El-Mekser and Seiam (2008) and Hassan et al (2008).

1.3.2- Effect of N rates.

Nitrogen fertilizer treatments had a significant effect on maize plant height in the two seasons (**Table, 6**). Applying 80 kg N+40(t/FYM) fed⁻¹ in the first season significantly increased maize plant height by 19.57, 14.54, 9.72, 4.14, 10.13 and 4.78%, compared with the zero N, 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM) and 60 kg N+30(t/FYM) fed⁻¹, respectively. In

second season, the corresponding increases in plant height were 14.10, 9.54, 7.47, 2.87, 5.03 and 3.78%, respectively. It is clear in both seasons that every increase in N rate either mineral or mineral + organic resulted in a significant increase in plant height.

Table (6): Plant height (cm) of maize as affected by genotypes, N fertilizer rates and their interactions at 80 days in 2005 and 2006 seasons.

				2005 seaso	n		- Je stocklings
N Fertilizer rates				Genotype	S		
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means
Zero	241.53	235.38	211.93	236.0	243.73	254.83	237.23
60 kg N/fed	248.48	242.80	223.10	254.23	259.55	257.63	247 62
90 kg N/fed	258.00	265.83	228.70	264.63	265.23	268.68	247.63
120 kg N/fed	271.38	273.90	244.03	277.53	279.93	287.50	258.51
40 kg N/fed+20 (t/FYM)	259.10	257.90	229.88	257.80	265.58	275.13	272.38 257.56
60 kg N/fed+30 (t/FYM)	266.68	277.75	238.63	275.55	272.80	292.88	
80 kg N/fed+40 (t/FYM)	281.05	294.48	250.95	283.18	281.75	310.58	270.71
Means	260.89	264.00	232.46	264.13	266.94	278.17	283.66 261.10
				2006 season	-	270.17	201.10
N Fertilizer rates				Genotypes			
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
7	3084	30K8	Dahab	323		Gamal	Means
Zero	261.20	257.33	231.88	257.90	250.18	301.63	260.02
60 kg N/fed	273.80	271.50	237.78	267.65	261.13	313.15	270.83
90 kg N/fed	278.80	275.55	243.80	273.60	268.05	316.58	276.06
120 kg N/fed	292.53	280.28	250.00	286.38	290.78	330.55	288.42
40 kg N/fed+20 (t/FYM)	281.38	275.08	242.38	274.60	299.80	321.65	282.48
60 kg N/fed+30 (t/FYM)	282.65	281.43	247.95	275.45	303.18	324.58	285.87
80 kg N/fed+40 (t/FYM)	299.13	287.30	264.60	295.80	299.33	334.00	296.69
Means	281.35	275.49	245.48	275.91	281.78	320.30	280.05

First season(2005)

L.S.D. at 5% Genotypes = 13.93 L.S.D. at 5% Fertilizer = 4.42 L.S.D. at 5% G.XF. = 10.83

Second season(2006)

L.S.D. at 5% Genotypes = 14.57 L.S.D. at 5% Fertilizer = 6.92 L.S.D. at 5% G.XF. = NS The increase in maize plant height with the increase in nitrogen application may be attributed to the increase in meristimatic activity which induced by nitrogen application which in turn stimulates the increase in number and size of cells in maize stem. Shafshak et al (1994b); Abdullah (1995); Abdrabou (1996); Atta Allah (1998); Fatma Nofal (1999); El-Bana and Gomaa (2000); Farghly (2001); Abd El-All (2002); Saleh and Nawar (2003); Suleiman (2004); Fatma Nofal et al (2005 a); Bader and Othman (2006); El-Maihy (2007) and Siam et al (2008), reported similar results.

1.3.3- Interaction effect.

The interaction effect between maize genotypes and N fertilizer rates was significant on plant height in the first season only (Table 6). The tallest maize plants (310.58 cm) were obtained by Nab El-Gamal cultivar under 80 kg N + 40(t/FYM) fed⁻¹. Whereas, the shortest plants of maize (211.93cm) were obtained from D.C. Dahab under zero N in the first season. Such results agree with those reported by El-Wakil (2002) and El-Aref et al (2004).

1.4- Stem diameter (at 80 days):

Data in **Table (7)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on stem diameter of maize plant at 80 days after planting in 2005 and 2006 seasons.

1.4.1- Effect of genotypes.

The results presented in **Table (7)** indicated significant differences among the 6 evaluated genotypes in stem diameter.

In 2005 season, T.W.C. 323 recorded the greatest diameter, being 2.24 cm which significantly surpassed the other 5 genotypes. On the other hand, D.C. Dahab recorded the lowest diameter, being 1.79 cm which was significantly lower than the other 5 genotypes.

The four other genotypes, namely Nab- El Gamal, S.C. 3084, S.C 30k8 and Giza 2 were in-between with medium values of stem diameter and behaved as one group in this trait without significant differences among them.

In 2006 season, the 6 genotypes behaved in the same manner with one exception with S.C. 30k8 which recorded the greatest value of stem diameter being 2.51 cm followed by the T.W.C. 323 with a stem diameter of 2.50 cm, and both genotypes surpassed significantly the other 4 genotypes.

It could be concluded that genotypes showed marked differences in stem diameter due to the differences in their genetical make up.

These results are in accordance with those obtained by El-Hariri et al (1996); El-Wakil (2002); Ahmed and Mekki (2005) and Mehasen and Saeed (2006).

1.4.2- Effect of N rates.

Concerning N rates, results in **Table** (7) show that stem diameter was significantly increased by the applied N fertilizer rates (mineral & organic) compared with the untreated plots in 2005 and 2006 seasons. Application of N rate at 80 kg N+40(t/FYM) fed⁻¹ in the first season significantly increased maize stem diameter by 21.31, 16.84, 13.84, 2.77, 11.55 and

7.76%, compared with the check treatment, 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM) and 60 kg N+30(t/FYM) fed⁻¹, respectively. In the second season, the corresponding increases were 36.54, 19.55, 11.61, 2.28, 12.08 and 8.46%, respectively.

It is worthy to note that stem diameter showed significant response to any increment in N rate, and higher response was observed when N was applied as mineral mixed with organic N. The good effect of organic N by means of FYM application may be due to the nutritive elements in the manure rather than organic N. These results are expected since N increases the vegetative growth of maize plants.

Abdullah (1995); El-Moursy et al (1998); El-Douby et al (2001) Toaima and Saleh (2003); Mehasen and Saeed (2006) and El-Maihy (2007), reported similar results.

1.4.3- Interaction effect.

The effect of the interaction between maize genotypes and N rates on stem diameter was significant in the second season only (**Table**, **7**). The highest value of stem diameter (2.87 cm) was obtained by S.C.30k8 and T.W.C.323 under 80 kg N + 40(t/FYM) fed⁻¹. Whereas, the lowest value (1.84 cm) was obtained by S.C. 30k8 under zero N in the second season. The results agree with those reported by **Mehasen and Saeed (2006)**.

Table (7): Stem diameter (cm) of maize as affected by genotypes, N fertilizer rates and their interactions at 80 days in 2005 and 2006 seasons.

	2005 season								
N Fertilizer rates	Genotypes								
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	1.87	1.80	1.62	2.02	1.80	1.87	1.83		
60 kg N/fed	1.90	1.87	1.68	2.14	1.85	1.97	1.90		
90 kg N/fed	1.95	1.92	1.72	2.10	1.91	2.02	1.95		
120 kg N/fed	2.20	2.07	1.94	2.39	2.61	2.23	2.16		
40 kg N/fed+20 (t/FYM)	2.00	1.97	1.74	2.23	1.96	2.02	1.99		
60 kg N/fed+30 (t/FYM)	2.10	2.06	1.82	2.30	1.99	2.12	2.06		
80 kg N/fed+40 (t/FYM)	2.24	2.16	2.04	2.42	2.22	2.25	2.22		
Means	2.04	1.98	1.79	2.24	1.98	2.07	2.02		
	2006 season								
N Fertilizer rates				Genotyp	es				
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	1.92	1.84	1.90	2.00	2.07	2.12	1.97		
60 kg N/fed	2.20	2.34	2.08	2.35	2.25	2.25	2.25		
90 kg N/fed	2.34	2.54	2.20	2.61	2.39	2.35	2.41		
120 kg N/fed	2.61	2.76	2.53	2.80	2.54	2.56	2.63		
40 kg N/fed+20 (t/FYM)	2.42	2.55	2.29	2.40	2.37	2.36	2.40		
60 kg N/fed+30 (t/FYM)	2.54	2.65	2.34	2.47	2.46	2.41	2.48		
80 kg N/fed+40 (t/FYM)	2.62	2.87	2.57	2.87	2.55	2.66	2.69		
Means	2.38	2.51	2.27	2.50	2.38	2.39	2.40		

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	0.13	T C D A COV CO	.09
L.S.D. at 5% Fertilizer =	0.05	I CD 4 50/ D ins	.07
L.S.D. at 5% G.XF. $=$	NS	T C D -4 COV CONTO	.16

1.5- Number of green leaves plant (at 80 days):

The effects of maize genotypes, N fertilizer rates (mineral & organic) and their interactions on number of maize green leaves per plant at 80 days after planting during 2005 and 2006 seasons are presented in **Table (8)**.

1.5.1- Effect of genotypes.

Results in Table (8) showed that the 6 genotypes significantly varied in number of functioning leaves after 80 days from planting in both seasons.

In 2005, the greatest number of leaves/plant was produced by S.C. 3084, followed by the S.C. k8, D.C. Dahab and T.W.C. 323. These four crosses were superior in this trait without significant differences among them. The composite variety Giza 2 produced lower number of leaves/plant, being 10.92 leaves, which was significantly lower than the 4 hybrids. The open-pollinated variety Nab El-Gamal was inferior when compared with the 5 other genotypes and produced the lowest number of leaves (7.76) which was significantly different compared with the rest varieties.

In 2006 season, a similar trend was observed where the four hybrids were superior in this trait followed by the composite variety Giza 2, and the local open-pollinated variety Nab El-Gamal was the lowest and inferior in this character.

This marked differences in such an important trait indicate the superiority of hybrid maize over the open-pollinated varieties, and are mainly due to the genetical differences of the tested genotypes.

Similar results were also reported by Mabrouk and Aly (1998) and El-Wakil (2002).

1.5.2- Effect of N rates.

The average values of green leaves plant⁻¹ was significantly increased by increasing N rate up to 80 kg N+40(t/FYM) fed⁻¹ in the first and second seasons (**Table**, **8**). The highest number of green leaves plant⁻¹ was 12.73 and 12.39 leaves, in the first season and 12.49 and 12.09 leaves, in the second season obtained by adding 80 kg N+40(t/FYM) and 120 kg N fed⁻¹, respectively and without significances between the two rates. On the other hand, the lowest number of green leaves plant⁻¹ was 10.62 and 9.47 leaves at zero N in the first and second seasons, respectively. It was also observed that any increment in N application significantly increased number of functioning leaves/plant.

The present results indicate a favorable effect of N application on number of green leaves plant⁻¹. It is worthy to note that this character was encouraged by N application and was negatively affected under N deficiency of the check treatment. Similar results were also reported by Abdullah (1995); El-Habbak and Shams El-Din (1996); Bader et al., (1997); Faisal and Shalaby (1998); Mabrouk and Aly (1998) and El-Maihy (2007).

1.5.3- Interaction effect.

The results showed significant interaction between maize genotypes and N fertilizer rates on number of green leaves plant in both seasons **Table (8)**. The highest number of green leaves plant (14.04 and 13.55 green leaves) in the first and second seasons, respectively which was obtained from T.W.C.323 under

80 kg N+40(t/FYM) fed⁻¹. Whereas, the lowest number of green leaves plant⁻¹ was (6.76 and 5.13 green leaves) and was obtained from Nab El-Gamal cultivar under zero N in the first and second season, respectively.

Table(8): Number of green leaves plant⁻¹ of maize as affected by genotypes, N fertilizer rates and their interactions at 80 days in 2005 and 2006 seasons.

				2005 seas	son				
	Genotypes								
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	12.30	11.93	11.97	11.36	9.40	6.76	10.62		
60 kg N/fed	12.68	12.62	12.45	12.05	10.06	7.31	11.19		
90 kg N/fed	13.10	13.04	12.76	12.60	10.81	7.84	11.69		
120 kg N/fed	13.49	13.56	13.28	13.57	12.20	8.26	12.39		
40 kg N/fed+20 (t/FYM)	12.78	12.69	12.51	12.15	10.23	7.40	11.29		
60 kg N/fed+30 (t/FYM)	13.29	13.05	13.04	12.98	11.18	7.94	11.91		
80 kg N/fed+40 (t/FYM)	13.69	13.78	13.44	14.04	12.58	8.84	12.73		
Means	13.04	12.95	12.78	12.68	10.92	7.76	11.69		
				2006 sea	son				
				Genoty	oes				
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
7	10.83	11.11	10.62	10.74	8.40	5.13	9.47		
Zero	11.16	12.03	11.24	11.45	9.42	5.88	10.20		
60 kg N/fed	11.75	12.64	11.55	12.01	10.41	6.38	10.79		
90 kg N/fed 120 kg N/fed	12.48	13.14	12.83	13.31	12.10	6.68	12.09		
40 kg N/fed+20 (t/FYM)	11.15	12.15	11.32	11.52	9.75	6.13	10.34		
60 kg N/fed+30 (t/FYM)	11.85	12.71	11.90	12.29	10.84	7.01	11.10		
80 kg N/fed+40 (t/FYM)	12.96	13.49	13.10	13.55	12.38	9.44	12.49		
Means	11.74	12.47	11.79	12.13	10.47	6.95	10.92		

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	0.46	L.S.D. at 5% Genotypes =	1.14
L.S.D. at 5% Fertilizer =	0.20	L.S.D. at 5% Fertilizer =	0.29
L.S.D. at 5% G.XF. =	0.50	L.S.D. at 5% G.XF. $=$	0.70

1.6- Leaf area of topmost ear (at 80 days):

Results in **Table (9)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on leaf area of topmost ear maize at 80 days after planting.

1.6.1- Effect of genotypes.

The mean value of leaf area of topmost ear in maize was significantly affected by maize genotypes in the second season only (Table, 9). T.W.C.323 surpassed significantly the others maize genotypes under study in the mean values of leaf area of topmost in the second season. T.W.C.323 gave the highest value of leaf area of topmost ear (551.81 cm²), while Nab El-Gamal cultivar gave the lowest value of leaf area of topmost ear (434.16 cm²) in the second season but without significant differences compared with Giza 2, S.C.3084, S.C.30k8 and D.C.Dahab. The differences between the six maize genotypes under studies in the second season could be due to the variation in the genetical make up and their interaction with the environmental conditions prevailing during their growth. These results agree with those obtained by El-Sheikh (1999); Oraby et al (2003); Nawar and Khalil (2004) and Abd El-Maksoud and Sarhan (2008).

1.6.2- Effect of N rates.

Concerning N rates, results in **Table (9)** show that leaf area of topmost ear was significantly increased by the applied N rates compared with the untreated plots in 2005 and 2006 seasons. Application of the N rate 80 kg N+40(t/FYM) fed⁻¹ in the first season significantly increased leaf area of topmost ear by 70.90, 43.98, 31.96, 8.85, 28.30 and 18.61% compared with the control,

60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM) and 60 kg N+30(t/FYM) fed⁻¹, respectively. In the second season, the corresponding increases were 52.96, 32.26, 25.39, 3.61, 21.26 and 12.80%, respectively.

Table (9): Leaf area of topmost ear (cm²) of maize as affected by genotypes, N fertilizer rates and their interactions at 80 days in 2005 and 2006 seasons.

0.000									
			20	05 seaso	n				
N. Etilizon matos		Genotypes							
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means		
	3084	30K8	Dahab	323		Gamal	242.74		
Zero	328.48	394.00	315.58	374.78	325.23	324.38	343.74		
60 kg N/fed	383.95	466.75	372.90	400.38	379.88	444.23	408.01		
90 kg N/fed	418.60	497.93	430.90	439.88	427.50	456.30	445.18		
120 kg N/fed	512.55	548.00	528.63	564.73	539.15	545.23	539.71		
40 kg N/fed+20 (t/FYM)	441.33	505.60	435.15	474.60	429.28	461.33	457.88		
60 kg N/fed+30 (t/FYM)	487.35	545.88	474.75	528.30	457.38	478.05	495.28		
80 kg N/fed+40 (t/FYM)	545.18	625.58	604.83	596.50	568.95	583.88	587.48		
Means	445.35	511.96	451.82	482.74	446.76	470.48	468.19		
Wieans			20	006 seaso	n				
			(Genotype	es				
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means		
	3084	30K8	Dahab	323		Gamal			
7	356.03	402.35	373.45	421.53	376.78	330.03	376.69		
Zero	442.75	424.15	419.55	496.88	444.20	386.43	435.66		
60 kg N/fed	478.83	451.50	434.80	535.28	440.15	416.58	459.52		
90 kg N/fed	534.60	552.15	570.85	642.45	542.38	494.18	556.10		
120 kg N/fed 40 kg N/fed+20 (t/FYM)	471.68	455.20	471.83	529.30	503.65	419.35	475.17		
40 kg N/leu+20 (UF 1M)	483.38	486.15	520.18	571.08	528.40	475.58	510.79		
60 kg N/fed+30 (t/FYM)	562.28	550.45	601.45	666.15	559.95	517.00	576.21		
80 kg N/fed+40 (t/FYM)	475.65	474.56	484.59	551.81	485.07	434.16	484.31		
Means	475.05	170							

E: coccon (2005)		Second season(2000)				
First season(2005) L.S.D. at 5%Genotypes =	NS	L.S.D. at 5% Genotypes	=	51.03		
		L.S.D. at 5% Fertilizer	=	21.86		
L.S.D. at 5% Fertilizer = L.S.D. at 5% G.XF. =	NS	L.S.D. at 5% G.XF.	=	NS		
L.S.D. at 5 /0 G.2kt.	G V 1550					

The present result is a good evident for the role of nitrogen on the vegetative growth of maize in terms of a marked increase in leaf area. It was observed from the results in **Table (9)** that any increase in N level caused an increase in this trait. Also it is worthy to note that a combination of organic and mineral N was more effective than the application of mineral N alone. This result is mainly due to the different macro and micronutrients in the FYM and the role of manure in the biological and physical conditions of the soil.

Shafshak et al (1994b), El-Habbak and Shams El-Din (1996), Shams (2000), Abd El-All (2002), Gomaa and El-Douby (2002), Toaima and Saleh (2003), Bader and Othman (2006) and El-Maihy (2007) reported similar results.

1.6.3- Interaction effect.

The effect of the interaction between maize genotypes and N rates on leaf area of topmost ear was not significant in the first and second seasons (Table, 9).

1.7- Leaf area index (at 80 days):

Leaf area index (LAI) at 80 days after planting in 2005 and 2006 seasons as affected by maize genotypes, N fertilizer rates (mineral & organic) and their interaction are presented in **Table** (10).

1.7.1- Effect of genotypes.

Results presented in **Table (10)** show marked differences in LAI among the 6 evaluated maize genotypes in both seasons of experimentation.

In 2005 season, S.C. 30k8 recorded the greatest LAI, being 3.81 followed by T.W.C. 323 without significant difference. The third rank of LAI was recorded by S.C. 3084 and D.C. Dahab with significant differences compared with the two open-pollinated varieties, Giza 2, and Nab El-Gamal. On the other hand, Nab El-Gamal was the worst variety concerning LAI, recording 2.11 which was significantly inferior compared with the other 5 genotypes.

In 2006 season, slight differences were observed and the T.W.C. was the best genotype with the greatest LAI, being 3.86 and was significantly superior compared with S.C. 3084, Giza 2 and Nab El-Gamal.

On the other hand, the open-pollinated variety Nab El-Gamal was inferior with the lowest LAI (1.80) which was significantly lower compared with the rest 5 genotypes. The present results indicate clearly the superiority of hybrid maize varieties compared with the open-pollinated ones.

The differences among the six maize genotypes under study could be due to the variation in the genetical make up and their interaction with the environmental conditions prevailing during their growth. These results agree with those obtained by El-Sheikh (1999); Oraby et al (2003); Nawar and Khalil (2004) and Abd El-Maksoud and Sarhan (2008).

1.7.2- Effect of N rates.

Concerning the effect of N fertilizer rates (mineral & organic) on LAI (**Table**, **10**), results showed that the increase in N fertilizer rates significantly increased LAI in the two seasons.

The application of 80 kg N+40(t/FYM) fed⁻¹ significantly surpassed all other N treatments under study in affecting LAI in both seasons. This treatment induced significant increases in LAI of 104.78, 64.61, 44.10, 12.04, 45.08 and 26.25% compared with zero, 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM) and 60 kg N+30(t/FYM) fed⁻¹, respectively, in the first season. The corresponding increases in the second season were 100.00, 61.08, 45.26, 6.97, 44.25 and 27.38%, respectively.

The results in Table (10) showed clearly that LAI significantly responded to the increase in N rate in both seasons, indicating the vital role of this element in building the vegetative parts of maize plants. Also, the superiority of combining mineral N with organic N by means of FYM is greatly evident. The best result of LAI was achieved by the combination of both forms of N and the application of FYM as a soil amendment. These results are in agreement with those obtained by El-Nagar (2002); Suleiman (2004) and Valero et al (2005).

1.7.3- Interaction effect.

The effect of the interaction between maize genotypes and N rates on LAI was not significant in the first and second seasons (Table, 10). This result indicated that the experimental factors acted independently in affecting this trait.

Table (10): Leaf area index (LAI) of maize plants as affected by genotypes, N fertilizer rates and their interactions at 80 days in 2005 and 2006 seasons.

			2	2005 seas	on				
N Fertilizer rates	Genotypes								
N Fertinzer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	2.30	2.67	2.16	2.43	1.74	1.25	2.09		
60 kg N/fed	2.79	3.36	2.65	2.76	2.18	1.86	2.60		
90 kg N/fed	3.13	3.71	3.14	3.17	2.64	2.04	2.97		
120 kg N/fed	3.95	4.25	4.01	4.38	3.75	2.57	3.82		
40 kg N/fed+20 (t/FYM)	3.22	3.66	3.10	3.29	2.51	1.95	2.95		
60 kg N/fed+30 (t/FYM)	3.70	4.08	3.53	3.92	2.92	2.17	3.39		
80 kg N/fed+40 (t/FYM)	4.27	4.93	4.66	4.78	4.08	2.94	4.28		
Means	3.34	3.81	3.32	3.53	2.83	2.11	3.16		
				2006 sea	son	11			
N Fertilizer rates				Genotypes					
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	2.21	2.59	2.25	2.58	1.81	0.97	2.07		
60 kg N/fed	2.85	2.93	2.69	3.25	2.39	1.29	2.57		
90 kg N/fed	3.22	3.26	2.86	3.67	2.60	1.51	2.85		
120 kg N/fed	3.80	4.15	4.18	4.88	3.75	2.46	3.87		
40 kg N/fed+20 (t/FYM)	3.00	3.40	3.05	3.44	2.79	1.53	2.87		
60 kg N/fed+30 (t/FYM)	3.27	3.54	3.53	4.02	3.25	1.91	3.25		
80 kg N/fed+40 (t/FYM)	4.18	4.25	4.51	5.15	3.93	2.80	4.14		
Means	3.22	3.45	3.30	3.86	2.93	1.80	3.09		

First season(2005)			Second season(2006)		
L.S.D. at 5% Genotypes	=	0.52	L.S.D. at 5% Genotypes	=	0.46
	=	0.17	L.S.D. at 5% Fertilizer	=	0.17
	=	NS	L.S.D. at 5% G.XF.	=	NS

1.8- Number of ears plant (at 80 days):

Results in **Table (11)** show the number of ears plant⁻¹ as affected by genotypes, N fertilizer rates (mineral & organic) and their interaction in 2007 and 2008 seasons.

1.8.1- Effect of genotypes.

The results in **Table (11)** showed marked differences in number of ears/plant in both seasons.

In 2005 season, all hybrids as well as the composite variety Giza significantly surpassed the open-pollinated variety Nab El-Gamal in this trait. It was also observed that no significant differences were recorded among the 5 genotypes including the 4 hybrids and the composite variety.

In 2006 season, different results were observed where the three genotypes D.C. Dahab, T.W.C. 323 and S.C. 30k8 were significantly higher in number of ears/plant compared with S.C. 30k4, Giza 2 and Nab El-Gamal. The 6 genotypes could be classified into 2 distinct groups, the first including D.C. Dahab, T.W.C. 323 and S.C. 30k8 with greater number of ears/plant and the second group including the 2 open-pollinated varieties in addition to S.C. 30k4, with lower number of ears/plant.

The different results of the two seasons may be due to the differences with climatic condition prevailing during tasseling and silking.

Similar results were obtained by Shafshak et al (1994a); El-Sheikh (1999); Ahmed and Mekki (2005) and Atta (2007) who reported marked differences in number of ear/plant.

1.8.2- Effect of N rates.

Number of ears maize plant⁻¹ significantly increased with the increase in N rates up to 120 kg N/fed. Increasing nitrogen treatments from 0 to 60 kg N, 90 kg N, 120 kg N, 40 kg

N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ caused significant increase in number of ears plant⁻¹ of 4.54, 11.36, 18.18, 10.22, 14.77 and 22.72% in the first season respectively, and 8.33, 15.47, 29.76, 14.28, 21.42 and 33.33% in the second season, respectively.

It was clear from the results in Table (11) that number of ears/plant increased with every increment in N level and the higher numbers were recorded with the combined application of mineral and combined N.

These results are in agreement with those obtained by Ashoub et al (1996); Toaima and Saleh (2003); Fatma Nofal et al (2005 b); Mehasen and Saeed (2006) and El-Maihy (2007).

1.8.3- Interaction effect.

The effect of the interaction between maize genotypes and N rates on No. of ears plant⁻¹ was significant in the second season only (**Table, 11**). The highest value of No. of ears plant⁻¹ (1.2 ear) was obtained by T.W.C. 323 under 80 kg N + 40(t/FYM) fed⁻¹. Whereas, the lowest value (0.74 ear) was obtained by Giza 2 under zero N in the second season.

Table (11): Number of ears plant⁻¹ of maize as affected by genotypes, N fertilizer rates and their interactions at 80 days in 2005 and 2006 seasons.

				2005 sea	son					
N Fertilizer rates	Genotypes									
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	0.87	0.90	0.92	0.94	0.88	0.76	0.88			
60 kg N/fed	0.95	0.94	0.95	0.97	0.94	0.80	0.92			
90 kg N/fed	1.00	1.02	1.00	1.01	0.98	0.85	0.98			
120 kg N/fed	1.04	1.07	1.09	1.08	1.05	0.94	1.04			
40 kg N/fed+20 (t/FYM)	1.02	1.00	1.01	0.98	0.97	0.84	0.97			
60 kg N/fed+30 (t/FYM)	1.04	1.03	1.06	1.03	1.01	0.90	1.01			
80 kg N/fed+40 (t/FYM)	1.08	1.09	1.10	1.11	1.12	1.01	1.08			
Means	1.00	1.01	1.02	1.02	0.99	0.89	0.98			
	2006 season									
N Fertilizer rates	Genotypes									
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	0.79	0.96	0.89	0.87	0.74	0.82	0.84			
60 kg N/fed	0.86	0.98	0.99	0.94	0.85	0.87	0.91			
90 kg N/fed	0.91	1.02	1.04	1.04	0.89	0.91	0.97			
120 kg N/fed	1.13	1.05	1.16	1.13	1.10	1.00	1.09			
40 kg N/fed+20 (t/FYM)	0.88	1.02	1.03	1.04	0.87	0.91	0.96			
60 kg N/fed+30 (t/FYM)	0.98	1.04	1.08	1.10	0.96	0.97	1.02			
80 kg N/fed+40 (t/FYM)	1.12	1.09	1.17	1.20	1.14	1.02	1.12			
Means	0.95	1.02	1.05	1.04	0.93	0.93	0.99			

First season(2005)			Second season(2006)	
L.S.D. at 5% Genotypes	=	0.07	L.S.D. at 5%Genotypes		0.06
	=	0.02	L.S.D. at 5% Fertilizer		0.03
L.S.D. at 5% G.XF.	=	NS	L.S.D. at 5% G.XF.	=	0.07

2- Effect of genotypes, N fertilizer rates and their interactions on yield and yield components of maize.

2.1- Ear length:

Results in **Table (12)** show the mean values of ear length of maize as affected by maize genotypes, N fertilizer rates (mineral & organic) and their interaction in 2005 and 2006 seasons.

2.1.1- Effect of genotypes.

The results in **Table (12)** show that the evaluated genotypes significantly varied in ear length in both seasons.

In 2005, T.W.C. 323 recorded the highest value in ear length (19.42 cm), and was significantly higher in this trait compared with S.C. 3084, D.C. Dahab, Giza 2 and Nab El-Gamal. On the other hand, in that season the open-pollinated variety Nab-El Gamal recorded the lowest value, being 15.81cm which was significantly lower compared with S.C. 3084, S.C. 30k8, T.W.C. 323 and Giza 2.

In 2006 season, slight differences in the arrangement of the 6 genotypes were observed, and the genotypes could be arranged in the following descending order:

T.W.C. 323 (18.50 cm), S.C. 30k8 (18.44 cm), S.C. 3084 (17.99 cm), Giza 2 (17.55 cm), Nab El-Gamal (17.35cm) and D.C. Dahab (17.01cm). It was observed in 2006 season that the 6 genotypes would be considered as 2 groups in their ear length, the first group includes the 2 single crosses + the T.W.C., with

greater ear length, and the second group includes the D.C. Dahab+ the 2 open-pollinated varieties.

The present results could be considered as a clear argument for the superiority of single crosses as well as the T.W.C of maize compared with double crosses and open-pollinated varieties.

These results agree with those obtained by El-Hariri et al (1996); El-Bana (2001); El-Hasawy (2001); Hamed (2003); El-Aref et al (2004); Mehasen and Saeed (2006) and Atta (2007), who found that maize varieties significantly varied in ear length.

2.1.2- Effect of N rates.

Results presented in **Table (12)** show that N rates (mineral & organic) induced a significant increase on maize ear length in both seasons. In 2005 season, the application of 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ significantly increased ear length by 5.67, 10.59, 18.57, 6.98, 12.84 and 20.69%, respectively as compared with the control treatment. The corresponding increases in 2006 season were 6.26, 12.10, 18.30, 8.15, 15.04 and 21.56%, respectively. The obtained results are a good manifestation for the role of nitrogen as an essential element in building tissues of maize ears.

The results show clearly the advantages of combing mineral and organic nitrogen compared with single application of mineral N fertilizers. The increase in ear length is mainly due to positive effect of nitrogen on the growth of maize which in turn is reflected on the yield components. The results reported by

In 2006 season, slight differences were observed in the arrangement of the 6 genotypes, and S.C. 30k8 had also the greatest ear diameter (4.71cm), followed by S.C. 3084 (4.61cm) and Giza 2 (4.60cm) without significant differences among the 3 genotypes. On the other hand, T.W.C 323 recorded the lowest ear diameter (4.30cm) without significant difference compared with the open-pollinated variety Nab El-Gamal.

The differences between maize genotypes were mainly due to the differences in the genetical constituents. These results agree with those obtained by Mabrouk and Aly (1998); Khalil (2001); El-Wakil (2002); Hamed (2003); El-Aref et al. (2004); Fatma Nofal et al (2005a) and Atta (2007).

2.2.2- Effect of N rates.

Results presented in **Table (13)** show that increasing N rates caused significant increase for ear diameter in the two growing seasons. In 2005 season, applying N rates of 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ significantly increased ear diameter by 5.20, 9.92, 17.49, 6.14, 11.82 and 19.38%, respectively as compared with the control treatment. The corresponding increases in 2006 season, were 5.60, 10.24, 16.58, 6.58, 11.95 and 19.75%, respectively.

It is clear that the increase in ear diameter was recorded with each increment in N rate in both seasons. The present results show the vital role of N on the yield components of maize plant. The results showed also, that the combined application of mineral + organic N (by means of FYM) gave the best results of

ear diameter compared with the single application of mineral fertilizer. The results obtained by Shafshak et al (1994b); Ashoub et al (1996); Atta Allah (1998); Shams (2000); El-Douby et al (2001); Abd El-All (2002); Saleh and Nawar (2003); Zohray and Farghaly (2003); Abdel-Hameed (2005); Ash-Shormillesy (2005) and El-Maihy (2007) are in general agreement with the present results.

Table (13): Ear diameter (cm) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

	2005 season									
N Fertilizer rates		Genotypes								
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	4.15	4.51	4.31	4.18	4.14	4.09	4.23			
60 kg N/fed	4.54	4.71	4.54	4.34	4.34	4.21	4.45			
90 kg N/fed	4.89	4.94	4.70	4.49	4.58	4.33	4.65			
120 kg N/fed	5.15	5.24	5.22	4.78	4.85	4.57	4.97			
40 kg N/fed+20 (t/FYM)	4.56	4.79	4.61	4.35	4.39	4.24	4.49			
60 kg N/fed+30 (t/FYM)	4.96	5.03	4.92	4.51	4.61	4.36	4.73			
80 kg N/fed+40 (t/FYM)	5.17	5.29	5.31	4.90	5.03	4.58	5.05			
Means	4.77	4.93	4.80	4.51	4.56	4.34	4.65			
	2006 season									
N Fertilizer rates	Genotypes									
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	4.26	4.30	3.91	3.90	4.21	4.04	4.10			
60 kg N/fed	4.42	4.50	4.28	4.13	4.32	4.31	4.33			
90 kg N/fed	4.56	4.73	4.49	4.35	4.55	4.43	4.52			
120 kg N/fed	4.89	4.98	4.79	4.52	4.97	4.54	4.78			
40 kg N/fed+20 (t/FYM)	4.45	4.53	4.37	4.22	4.36	4.33	4.37			
60 kg N/fed+30 (t/FYM)	4.65	4.76	4.59	4.38	4.68	4.47	4.59			
80 kg N/fed+40 (t/FYM)	5.01	5.17	4.98	4.61	5.10	4.59	4.91			
Means	4.61	4.71	4.49	4.30	4.60	4.39	4.51			

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	0.19	L.S.D. at 5% Genotypes =	0.15
L.S.D. at 5% Fertilizer =	0.05	L.S.D. at 5% Fertilizer =	0.07
L.S.D. at 5% G.XF. =	0.13	L.S.D. at 5% G.XF. =	NS

2.2.3- Interaction effect.

The effect of the interaction between maize genotypes and N rates on ear diameter was significant in the first season only (Table, 13). The highest value of ear diameter (5.31 cm) was obtained by D.C. Dahab or S.C.30k8 under 80 kg N+ 40(t/FYM) fed⁻¹. Whereas, the lowest value (4.09 cm) was obtained by Nab El-Gamal under zero N in the first season. These results agree with those obtained by El-Aref et al (2004) and Fatma Nofal et al (2005a).

2.3- Number of rows ear⁻¹:

Results in **Table (14)** show the means of number of rows per ear as affected by genotypes, N fertilizer rates (mineral & organic) and their interaction in 2005 and 2006 seasons.

2.3.1- Effect of genotypes.

The results in **Table (14)** showed marked differences in number of rows/ear among the 6 genotypes in both seasons.

In 2005 season, the greatest number of rows/ear was recorded by S.C.3084, followed by D.C. Dahab, Giza 2 and S.C. 30k8, without significant differences and could be considered as one group. T.W.C. 323 followed this group with 12.33 rows/ear, and the lowest number of rows, being 10.19 was recorded by Nab El-Gamal which was significantly lower than the other 5 genotypes.

In 2006 season, slight differences were observed in the arrangement of the genotypes and D.C. Dahab with 14.40 rows/ear recorded the greatest value followed by S.C. 30k8 (with 14.00 rows) without significant difference and are considered as

the first group. Then S.C. 3084 recorded 13.85 rows/ear and Giza 2 with 13.51 rows/ear, followed as the second group. T.W.C. 323 was the fifth genotype with 12.23 rows/ear which was significantly lower compared with the first and second groups, but surpassed significantly the open-pollinated variety Nab El-Gamal with only 10.61 rows/ear.

It could be concluded that great variations were observed among the 6 genotypes in this character. The differences between maize genotypes were mainly due to genetical constituents.

These results agree with those obtained by Mabrouk and Aly (1998); Hamed (2003); El-Aref et al (2004) and Abd El-Maksoud and Sarhan (2008) who reported marked differences in this character among maize varieties.

2.3.2- Effect of N rates.

Results presented in **Table (14)** show that N application caused significant increase in No. of rows ear⁻¹ of maize in the two growing seasons. In 2005 season, applying N rates of 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ significantly increased No. of rows ear⁻¹ by 4.40, 7.56, 15.79, 6.89, 9.97 and 15.79%, respectively as compared with the control treatment. The corresponding increases in 2006 season, were 4.97, 8.87, 14.43, 5.64, 11.03 and 16.18%.

The results reported by Abdrabou (1996); Faisal and Shalaby (1998); Farghly (2001); Gomaa and El-Douby (2002); Toaima and Saleh (2003); Abdel-Hameed (2005);

2.4.3- Interaction effect.

No. of grains row⁻¹ of maize was significantly affected by the interaction between genotypes and N rates in second season as shown in **Table (15)**. The highest value of No. of grains row⁻¹ (49.35 grain) was obtained by S.C.30k8 under 80 kg N+ 40(t/FYM) fed⁻¹. Whereas, the lowest value (30.00 grains) was obtained by Nab El-Gamal cultivar under zero N in the second season.

2.5- Ear weight:

Results in **Table (16)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on maize ear weight in 2005 and 2006 seasons.

2.5.1- Effect of genotypes.

The results in the Table (16) showed significant differences in ear weight among the 6 genotypes.

In 2005 season, S.C. 30k8 significantly surpassed the other genotypes in ear weight, whereas the open-pollinated variety Nab El-Gamal was the worst variety in this trait and was significantly inferior compared with the other 5 genotypes.

In that season, the 6 genotypes could be arranged in a descending order in regard to ear weight as follows: S.C.30k8, S.C. 3084, T.W.C. 323, Giza 2, D.C. Dahab, and Nab El-Gamal. All differences among the tested genotypes were significant with one exception between D.C. Dahab and the composite variety Giza 2.

In 2006 season, similar results were obtained with a slight difference where D.C. Dahab was in the fourth position and Giza 2 in the fifth position showing an exchange in their positions, but without significant differences as shown in the first season.

It could be concluded, that single crosses were superior in ear weight and the local open-pollinated variety Nab El-Gamal was inferior in this trait. The advantage of growing single crosses is clearly illustrated. The present results are mainly due to the marked differences in the genetical constitution of the genotypes. Also the increase in ear length, ear diameter, number of rows/ear and number of grains/row of single crosses contributed markedly in an increase in ear weight.

These results agree with those obtained by Shafshak et al (1994b); Selim et al (1998); El-Hasawy (2001); Khalil (2001); Mehasen and Saeed (2006) and Atta (2007).

2.5.2- Effect of N rates.

Results presented in Table (16) show clearly that ear weight of maize significantly increased with each increase in N rates in 2005 and 2006 seasons. Application of N rate at 80 kg N+40(t/FYM) fed⁻¹ in the first season significantly increased maize ear weight by 60.44, 18.94, 7.64, 1.15, 17.31 and 5.66%, compared with the zero, 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM) and 60 Kg N +30(t/FYM) fed⁻¹, respectively. In the second season, the corresponding increases were 53.73, 15.39, 7.29, 1.38, 13.49 and 5.49%, respectively.

Such obtained increase in ear weight due to N application is mainly due to the increase in ear length, ear diameter, number of grains per ear and 100-grain weight resulting from a good supply of adequate nitrogen fertilizer.

Similar results were also obtained by Shafshak et al (1994); Selim et al (1998); Shams (2000); El-Douby et al (2001); El-Metwaly et al (2001); Farghly (2001); Gomaa and El-Douby (2002); Abdel-Hameed (2005); El-Maihy (2007) and Siam et al (2008).

Table (16): Ear weight (g) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

ti i i	1 2000 S								
			20	05 seaso	n				
N Fertilizer rates	Genotypes								
1 1 01 01 01 01 01 01 01 01 01 01 01 01	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	145.44	179.20	134.25	137.23	130.13	119.53	140.96		
60 kg N/fed	195.13	215.80	181.33	194.73	185.20	167.88	190.01		
90 kg N/fed	223.13	229.78	203.85	210.75	203.70	188.50	209.95		
120 kg N/fed	234.10	247.90	213.85	223.13	219.48	202.20	223.44		
40 kg N/fed+20 (t/FYM)	200.68	218.70	185.35	197.70	187.20	166.30	192.65		
60 kg N/fed+30 (t/FYM)	231.30	234.05	203.55	216.18	206.23	192.13	213.90		
80 kg N/fed+40 (t/FYM)	236.20	248.18	216.83	227.43	222.13	205.30	226.01		
Means	209.42	224.80	191.29	201.02	193.44	177.40	199.56		
	2006 season								
N Fertilizer rates	Genotypes								
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-			
	3084	30K8	Dahab	323	GIZA Z	Gamal	Means		
Zero	3084 167.40	30K8 187.83	Dahab 122.80	323 143.08	143.98	Gamal 113.40	Means 146.41		
Zero 60 kg N/fed							146.41 195.06		
60 kg N/fed	167.40	187.83	122.80	143.08	143.98	113.40	146.41 195.06 209.77		
60 kg N/fed 90 kg N/fed	167.40 197.83	187.83 220.38	122.80 198.95	143.08 191.25	143.98 190.00	113.40 171.98 192.70 203.48	146.41 195.06 209.77 222.01		
60 kg N/fed 90 kg N/fed 120 kg N/fed	167.40 197.83 212.60	187.83 220.38 228.43	122.80 198.95 208.80	143.08 191.25 212.68	143.98 190.00 203.40	113.40 171.98 192.70 203.48 173.85	146.41 195.06 209.77 222.01 198.31		
60 kg N/fed 90 kg N/fed 120 kg N/fed 40 kg N/fed+20 (t/FYM)	167.40 197.83 212.60 227.50	187.83 220.38 228.43 242.93	122.80 198.95 208.80 216.10	143.08 191.25 212.68 223.13	143.98 190.00 203.40 218.95 193.28 205.43	113.40 171.98 192.70 203.48 173.85 199.38	146.41 195.06 209.77 222.01 198.31 213.35		
60 kg N/fed 90 kg N/fed 120 kg N/fed	167.40 197.83 212.60 227.50 201.63	187.83 220.38 228.43 242.93 224.53	122.80 198.95 208.80 216.10 203.35	143.08 191.25 212.68 223.13 193.23	143.98 190.00 203.40 218.95 193.28	113.40 171.98 192.70 203.48 173.85	146.41 195.06 209.77 222.01 198.31		

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	7.53	L.S.D. at 5% Genotypes =	7.32
L.S.D. at 5% Fertilizer =	3.09	L.S.D. at 5% Fertilizer =	2.77
L.S.D. at 5% G.XF. =	7.57	L.S.D. at 5% G.XF. $=$	6.79

2.5.3- Interaction effect.

The effect of the interaction between maize genotypes and N fertilizer rates on ear weight was significant in both seasons (**Table, 16**). The results indicated that the heaviest ear weight (248.18 and 247.78 g) was obtained from S.C. 30k8 with 80 kg N+40(t/FYM) fed⁻¹, whereas the lowest ear weight (119.53 and 113.40 g) was obtained from Nab El-Gamal cultivar under zero N in the first and second seasons, respectively.

2.6- Grain weight of ear:

Results in **Table (17)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on grain ear weight of maize in 2005 and 2006 seasons.

2.6.1- Effect of genotypes.

The results in **Table (17)** showed great differences in weight of grain/ear in both seasons among the 6 genotypes.

In the first season, S.C. 30k8 significantly surpassed the other 5 genotypes in this character and was followed by S.C. 3084 and T.W.C. 323 as the second rank without significant difference between them. The third rank was achieved by Giza 2 and D.C. Dahab as one group. The worst genotype was the open-pollinated variety Nab El-Gamal which was significantly inferior compared with the other 5 genotypes.

In the second season, about the same arrangement was observed for the 6 genotypes and S.C. 30k8 was the leading genotype, and the local variety Nab El-Gamal was the worst and

the other 4 genotypes were in-between with almost significant differences.

The present results are excepted since the single crosses recorded higher values in ear size and grain yield components compared with the open-pollinated varieties. The differences among maize genotypes were mainly due to the differences in their genetical constituents. These results agree with those obtained by El-Bana (2001); Khalil (2001); Nawar and Khalil (2004); Mehasen and Saeed (2006) and Atta (2007).

2.6.2- Effect of N rates.

Results presented in **Table (17)** show clearly that weight of grain ear⁻¹ of maize significantly increased with each increment in N rates in 2005 and 2006 seasons. Application of N rate of 80 kg N+40(t/FYM) fed⁻¹ in the first season increased weight of grain ear⁻¹ by 70.67, 23.24, 8.86, 1.65, 21.01 and 7.28%, compared with the zero, 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM) and 60 kg N+30(t/FYM) fed⁻¹, respectively. In the second season, the corresponding increases were 60.70, 18.99, 8.99, 1.83, 15.44 and 6.96%, respectively.

Such obtained increase in grain weight per ear is mainly due to the increase in ear length, ear diameter, number of grains per ear and 100-grain weight resulting from a good supply of N. The results indicate clearly the vital role of N as the most important element needed for a good vegetative growth and for grain formation in cereals. Also, it is worthy to note that organic N by means of FYM application positively affected grain weight/ear due to the inclusion of different nutritive elements in addition to

N. Also the biological and physical benefits of manure on soil and plant characters are clearly demonstrated. Similar results were also reported by Shafshak et al (1994); Shams (2000); El-Douby et al (2001); El-Metwaly et al (2001); Farghly (2001); Gomaa and El-Douby (2002); Abdel-Hameed (2005) and El-Gezawy (2005) and El-Maihy (2007).

Table (17): Grain weight per ear (g) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

	2005 season										
N Fertilizer rates		Genotypes									
	S.C. 3084	S.C. 30K8	D.C. Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means				
Zero	114.13	144.25	101.63	109,48	91.13	85.88	107.75				
60 kg N/fed	155.05	175.60	140.48	157.63	143.98	122.55	149.21				
90 kg N/fed	179.73	188.93	169.90	173.40	162.33	139.28	168.93				
120 kg N/fed	191.10	206.15	171.38	186.85	178.95	151.05	180.91				
40 kg N/fed+20 (t/FYM)	160.63	178.15	144.55	160.68	146.03	121.80	151.97				
60 kg N/fed+30 (t/FYM)	187.45	193.20	161.05	179.30	165.05	142.40	171.41				
80 kg N/fed+40 (t/FYM)	193.63	207.45	175.63	191.68	181.68	153.35	183.90				
Means	168.81	184.82	152.09	165.57	152.73	130.90	159.15				
	2006 season										
N Fertilizer rates		Genotypes									
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means				
Zero	133.25	150.73	92.73	114.15	112.03	82.38	114.21				
60 kg N/fed	159.58	179.30	154.00	155.43	150.63	126.53	154.24				
90 kg N/fed	173.50	187.88	165.78	175.08	164.43	143.68	168.39				
120 kg N/fed	187.18	201.48	174.05	185.98	179.70	153.00	180.23				
40 kg N/fed+20 (t/FYM)	163.30	182.73	160.23	157.90	157.90	131.85	158.98				
60 kg N/fed+30 (t/FYM)	177.43	192.15	168.33	175.58	167.25	148.83	171.59				
80 kg N/fed+40 (t/FYM)	191.58	207.98	177.40	187.08	182.40	154.83	183.54				
Means	169.40	186.03	156.07	164.45	159.19	134.44	161.60				

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	6.59	L.S.D. at 5% Genotypes =	5.98
L.S.D. at 5% Fertilizer =	3.33	L.S.D. at 5% Fertilizer =	2.51
L.S.D. at 5% G.XF. $=$	8.16	L.S.D. at 5% G.XF. =	6.16

2.6.3- Interaction effect.

Grain weight per ear of maize was significantly affected by the interaction between genotypes and N rates in 2005 and 2006 seasons as shown in **Table (17)**. The heaviest grain weight per ear in the two seasons (207.45 and 207.98 g) was obtained for S.C.30k8, with 80 kg N+40(t/FYM) fed⁻¹. Whereas, the lowest values of grain weight per ear were obtained from Nab El-Gamal cultivar under zero N in the two seasons (85.88 and 82.38 g).

These results agree with those obtained by El-Aref et al (2004) and Mehasen and Saeed (2006).

2.7- Weight of 100 grains:

Results for the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on 100-grain weight of maize in 2005 and 2006 seasons are presented in **Table (18)**.

2.7.1- Effect of genotypes.

The tested genotypes showed some significant differences in grain index in the first season as indicated in Table (18).

In that season, S.C. 30k8, S.C. 3084 and the local openpollinated variety recorded higher values in grain index, compared with the double and three way crosses and the composite variety Giza 2. The differences between the 2 single crosses and the double and three way crosses were significant.

In the second season, all differences among the 6 genotypes were below the level of significance.

The results reported by Shafshak et al (1994b), El-Hariri et al (1996), Mabrouk and Aly (1998), Fatma Nofal (1999), El-

Bana (2001), Hamed (2003), Khalil (2001), Hamed (2003), El-Aref et al (2004), Ahmed and Mekki (2005), Mehsen and saeed (2006) indicated marked differences in grain index of maize.

2.7.2- Effect of N rates.

Results in **Table (18)** show that the increase in N rates caused significant increase in 100-grain weight of maize in both seasons. In the first season, 100-grain weight increased with the application of 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ by 1.50, 3.25, 5.57, 2.76, 4.17 and 6.59g, respectively as compared with the control treatment. Similar results were obtained in the second season, where the increase in 100-grain weight was 1.48, 3.01, 5.78, 2.11, 3.97 and 7.09g as a results of applying the same rates compared with the control.

The present results clearly indicate that nitrogen application induced an increase in grain weight of maize showing the major role of this vital nutritive element. The increase in nitrogen application encourages photosynthesis activities and the metabolic efficiency which contributes in enhancing the accumulation of the produced metabolites in grain filling stages of maize. Similar results were reported by Shafshak et al (1994b); Ashoub et al (1996); Selim et al (1998); Fatma Nofal (1999); Gomaa and El-Douby (2002); Zohary and Farghaly (2003); Suleiman (2004); El-Gezawy (2005); Bader and Othman (2006), Bahr et al (2006); Moser et al (2006); El-Maihy (2007) and Siam et al (2008).

2.7.3- Interaction effect.

The effect of the interaction between maize genotypes and N rates on 100-grain weight was not significant in the first and second seasons (**Table**, **18**).

Table (18): 100-grain weight (g) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

			2	.005 seas	on				
N Fertilize rates	Genotypes								
N Tertifize Tates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	28.50	28.90	23.33	24.45	24.95	26.68	26.13		
60 kg N/fed	29.53	30.15	25.03	26.10	26.38	28.60	27.63		
90 kg N/fed	31.30	31.68	26.13	27.65	29.20	30.35	29.38		
120 kg N/fed	33.70	33.10	28.95	29.63	31.90	32.95	31.70		
40 kg N/fed+20 (t/FYM)	30.33	31.40	25.78	27.65	28.13	30.08	28.89		
60 kg N/fed+30 (t/FYM)	32.15	31.95	28.30	28.43	29.58	31.38	30.30		
80 kg N/fed+40 (t/FYM)	34.55	34.55	30.05	31.10	32.58	33.48	32.72		
Means	31.44	31.68	26.79	27.86	28.96	30.50	29.54		
Media	2006 season								
N. E. dilian mater				Genotyp	oes				
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zowa	24.98	25.78	23.98	24.68	24.75	25.85	25.00		
Zero	25.73	26.40	26.03	26.30	26.28	28.18	26.48		
60 kg N/fed 90 kg N/fed	27.08	27.28	27.10	27.83	29.10	29.68	28.01		
120 kg N/fed	29.48	31.30	30.38	30.30	31.70	31.53	30.78		
40 kg N/fed+20 (t/FYM)	26.03	26.53	26.20	26.90	28.23	28.78	27.11		
60 kg N/fed+30 (t/FYM)	27.98	28.65	28.25	28.73	30.33	29.88	28.97		
80 kg N/fed+40 (t/FYM)	30.48	32.33	31.63	31.60	33.15	33.35	32.09		
Means	27.39	28.32	27.65	28.05	29.08	29.60	28.35		

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	2.20	L.S.D. at 5% Genotypes =	NS
L.S.D. at 5% Fertilizer =	0.65	L.S.D. at 5% Fertilizer =	0.67
L.S.D. at 5% G.XF. =	NS	L.S.D. at 5% G.XF. =	NS

2.8- Shelling percentage:

Results in **Table (19)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on shelling percentage of maize in 2005 and 2006 seasons.

2.8.1- Effect of genotypes.

The results in **Table (19)** showed marked differences in shelling percentage among the 6 genotypes in both seasons.

In the first season, the highest values of shelling percentage was recorded by S.C.30k8 (82.17%), T.W.C.323 (82.17%), as the first group, followed by S.C. 3084 (80.46%), which was significantly higher compared with Giza2 (79.25%), D.C. Dahab (78.58%) and Nab El-Gamel (73.63%). The lowest shelling percentage was that recorded by Nab El- Gamel, being 73.63% which was significantly lower than the other 5 genotypes.

In the second season, about the same trend was observed, where T.W.C. 323 (with 82.07%) and S.C. 30 k8 (with 82.04%) where the highest in shelling percentage, and were also followed by S.C. 3084 (81.39%) and Giza2 (80.55%) as the second group, which were significantly superior than D.C. Dahab (78.85%). The Lowest shelling percentage was also of the open – pollinated variety Nab El-Gamal (74.63%) which was significantly lower than the other 5 genotypes.

It could be concluded that great variations were observed among the evaluated genotypes. Hybrid varieties recorded higher values of shelling percentag and the local open – pollinated variety Nab El-Gamal was the worst genotypes.

These results agree with those obtained by Shafshak et al (1994a); El-Bana (2001); El-Wakil (2002); Oraby et al (2003); Nawar and Khalil (2004); Abdel-Hameed (2005); Mehasen and Saeed (2006) and Atta (2007) who found great differences in shelling percentage among maize varieties.

2.8.2- Effect of N rates.

Results illustrated in **Table (19)** show that the increase in N rates caused a significant increase in shelling % of maize in 2005 and 2006 seasons. In the first season, applying N rates at 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ caused increases in shelling% of 1.72, 3.29, 4.93, 2.15, 3.84 and 5.45%, respectively when compared with the control treatment. In the second season, the increases in shelling% were 1.70, 3.27, 4.44, 2.34, 3.51 and 5.01%, respectively over the control.

Similar results were also obtained by Ashoub et al (1996); Selim et al (1998); Fatma Nofal (1999); Shams (2000); Gomaa and El-Douby (2002); Toaima and Saleh (2003); Ash-Shormillesy (2005) and El-Maihy (2007).

2.8.3- Interaction effect.

Shelling percentage of maize was significantly affected by the interaction between maize genotypes and N rates in 2005 and 2006 seasons as shown in **Table (19)**. The highest values of shelling percentage in the respective two seasons (84.20 and 83.73%) were obtained by T.W.C.323 and S.C.30k8 receiving 80 kg N+40(t/FYM) fed⁻¹. Whereas, the lowest values of shelling

percentage (71.88 and 72.63%) were obtained by Nab El-Gamal cultivar under zero N in the two seasons. These results agree with those obtained by El-Aref et al (2004).

Table (19): Shelling percentage of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

	2005 season									
N Fertilizer rates	Genotypes									
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	78.43	80.53	75.73	79.80	75.78	71.88	77.02			
60 kg N/fed	79.48	81.43	77.50	80.93	77.80	72.98	78.35			
90 kg N/fed	80.58	82.23	78.70	82.30	79.70	73.85	79.56			
120 kg N/fed	81.65	83.15	80.15	83.73	81.55	74.68	80.82			
40 kg N/fed+20 (t/FYM)	80.08	81.70	77.83	81.28	78.05	73.15	78.68			
60 kg N/fed+30 (t/FYM)	81.05	82.55	79.13	82.95	80.05	74.10	79.98			
80 kg N/fed+40 (t/FYM)	81.98	83.60	81.00	84.20	81.80	74.75	81.22			
Means	80.46	82.17	78.58	82.17	79.25	73.63	79.37			
	2006 season									
N Fertilizer rates				Genotype	es					
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	79.63	80.28	75.48	79.78	77.88	72.63	77.61			
60 kg N/fed	80.68	81.35	77.38	81.28	79.30	73.60	78.93			
90 kg N/fed	81.60	82.15	79.40	82.30	80.85	74.58	80.15			
120 kg N/fed	82.30	82.90	80.53	83.35	82.08	75.20	81.06			
40 kg N/fed+20 (t/FYM)	80.98	81.38	78.78	81.75	79.90	73.78	79.43			
60 kg N/fed+30 (t/FYM)	81.48	82.50	79.50	82.48	81.43	74.65	80.34			
80 kg N/fed+40 (t/FYM)	83.10	83.73	80.90	83.55	82.45	75.30	81.50			
Means	81.39	82.04	78.85	82.07	80.55	74.25	79.86			

First season(2005)			Second season(2006)	
L.S.D. at 5% Genotypes	=	1.19	L.S.D. at 5% Genotypes =	1.13
- TO I DI LICE / O I CI LINECI	=	0.30	L.S.D. at 5% Fertilizer =	0.25
L.S.D. at 5% G.XF.	=	0.73	L.S.D. at 5% G.XF. $=$	0.62

2.9- Grain yield plant-1:

Data in **Table (20)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interaction on grain yield plant⁻¹ of maize in 2005 and 2006 seasons.

2.9.1- Effect of genotypes.

The results in **Table (20)** showed that in both season, marked differences were recorded in grain yield / plant among the 6 genotypes.

In the first season S.C. 30 k8 significantly surpassed the other 5 genotypes with an average weight of grain/plant of 186.85 g this single cross was followed by, S.C. 3084 (170.25g) and T.W.C. 323 (169.15) as the second ranking group. This group was followed by D.C. Dahab (154.67g) and the composite variety Giza 2 (154.38g) as the third group. The worst genotype was the local open–pollinated variety Nab El-Gamal (115.39g), which was significantly inferior in grain yield / plant.

In the second season, a different arrangement was observed, but the leading genotype was also S.C. 30k8 with a grain yield/plant of 190.07 g which was significantly higher than the 5 other genotypes, and the worst genotype was also Nab El-Gamal with an average of grain yield/plant of 125.62g. The other 4 genotypes were in – between and could be arranged in a descending order as T.W.C. 323 (174.03g), D.C Dahab (166.37g), S.C. 3084 (163.33g) and Giza 2 (151.23g) with almost significant differences.

It could be concluded that hybrid maize varieties were superior in gram yield / plant compared with the local open

Table (20): Grain yield plant⁻¹ (g) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				005					
			2	2005 seas	on				
N Fertilizer rates				Genotype	es				
N Termizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means		
	3084	30K8	Dahab	323		Gamal			
Zero	98.99	129.55	93.00	102.09	86.14	64.68	95.74		
60 kg N/fed	146.95	163.63	133.40	152.33	135.52	97.95	138.30		
90 kg N/fed	180.07	191.73	160.44	174.17	159.12	117.90	163.91		
120 kg N/fed	199.26	220.02	186.37	201.29	188.32	141.38	189.44		
40 kg N/fed+20 (t/FYM)	163.44	178.44	146.12	157.61	142.11	102.46	148.36		
60 kg N/fed+30 (t/FYM)	195.01	198.97	170.67	183.80	166.55	128.07	173.85		
80 kg N/fed+40 (t/FYM)	208.06	225.64	192.70	212.72	202.91	155.30	199.56		
Means	170.25	186.85	154.67	169.15	154.38	115.39	158.45		
Treation				2006 seas	on				
N Fertilizer rates		Genotypes							
N Fer thizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means		
	3084	30K8	Dahab	323		Gamal			
Zero	104.43	144.09	81.95	99.38	83.16	67.21	96.70		
60 kg N/fed	136.46	174.46	152.76	146.05	127.21	109.89	141.14		
90 kg N/fed	158.31	191.02	172.79	181.62	145.86	128.87	163.08		
120 kg N/fed	212.05	210.45	201.46	210.67	197.21	152.29	197.36		
40 kg N/fed+20 (t/FYM)	144.15	186.44	165.63	163.61	136.73	119.22	152.63		
60 kg N/fed+30 (t/FYM)	173.38	198.38	182.41	192.80	160.12	143.96	175.17		
80 kg N/fed+40 (t/FYM)	214.54	225.66	207.57	224.10	208.36	157.93	206.36		
Means	163.33	190.07	166.37	174.03	151.23	125.62	161.78		

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	10.07	L.S.D. at 5% Genotypes =	9.83
L.S.D. at 5% Fertilizer =	3.63	L.S.D. at 5% Fertilizer =	5.25
L.S.D. at 5% G.XF. =	8.89	L.S.D. at 5% G.XF. $=$	12.87

2.9.3- Interaction effect.

Grain yield plant⁻¹ of maize was significantly affected by the interaction between genotypes and N rates in 2005 and 2006 seasons as shown in **Table (20)**. The heaviest grain yield plant⁻¹ in the two seasons (225.64 and 225.66 g) was obtained by S.C.30k8 when received 80 kg N+40(t/FYM) fed⁻¹. Whereas, the lowest values of grain yield plant⁻¹(64.68 and 67.21g) were

obtained from Nab El-Gamal cultivar under zero N in the two seasons, respectively. These results agree with those obtained by El-Aref et al (2004); Mehasen and Saeed (2006) and Abd El-Maksoud and Sarhan (2008).

2.10- Grain yield in kg feddan⁻¹:

Results for the effect of maize genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons on grain yield feddan⁻¹ of maize are presented in **Table** (21).

2.10.1- Effect of genotypes.

The results in **Table** (21) showed that the 6 evaluated genotypes significantly varied in their yield performance in both seasons. It was evident that the general trend of the results indicated that the 2 single crosses were superior in grain yield and ranked the first and second positions without significant difference between them in both seasons. The D.C.Dahab ranked the third position and was significantly superior compared with T.W.C. 323 in both seasons. The composite variety Giza 2 followed the 4 hybrids ranking the fifth position in both seasons and outyielded significantly the open – pollinated (local) variety Nab El-Gamal which was the last variety and significantly inferior compared with the 5 other genotypes.

It could be concluded that single crosses were superior in grain productivity, followed by double and three way crosses, then the composite variety Giza 2, and then Nab El-Gamal. The results were nearly identical in both seasons, and S.C. 3084

outyielded S.C.30k8, D.C. Dahab, T.W.C.323, Giza2 and Nab El- Gamal by 0.32, 4.03, 21.16, 47.11 and 80.74% respectively, in the first season.

In the second season, S.C. 30k8 outyielded S.C. 3084, D.C. Dahab, T.W.C. 323, giza2 and Nab El- Gamal by 1.61, 3.86, 15.96, 39.92 and 64.59%, respectively.

The present results are a good and clear evident for the superiority of single crosses and indicate the role of selecting the best maize varieties for increasing grain production of maize. The results are expected since single as well as three way and double crosses were superior than the open pollinated varieties in growth characters and yield components.

The superiority of growing hybrid maize varieties was also indicated by several investigators (Shafshak et al, 1994a; Mabrouk and Aly, 1998; El-Bana, 2001; Oraby et al, 2003; El-Aref et al, 2004; Ahmed and Mekki, 2005; Moser et al, 2006; Atta, 2007; Abd El-Maksoud and Sarhan, 2008 and Hassan et al, 2008).

2.10.2- Effect of N rates.

Grain yield feddan⁻¹ of maize as affected by N rates is presented in **Table (21)**. Grain yield was significantly increased by increasing N rates up to 80 kg N+40(t/FYM) fed⁻¹ in 2005 and 2006 seasons. In the first season, the grain yield increased by 70.66, 138.99, 191.14, 73.25, 151.62 and 206.20% when maize plants received 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹, respectively over the control treatment. Similar results

were noticed in the second season, and the application of the same N rate significantly increased grain yield by 61.27, 118.26, 169.31, 65.88, 130.16 and 177.56%, respectively. It is clear from **Table (21)** that the effect of N on grain yield feddan⁻¹ was evident in both seasons. In the first and second seasons, all differences in grain yield among N levels were significant.

It could be concluded that N is an essential element needed for producing higher grain yield. N rate of 80 kg N+40(t/FYM) fed⁻¹ or 120 kg N /fed could be recommended for producing the best grain yield and its components.

It is worthy to note that combining mineral and organic nitrogen by means of applying mineral fertilizer and FYM was more effective in increasing grain yield than single application of mineral fertilizer. The effect of FYM as a soil amendment as well as the inclusion of different macro and microelements in the manure contributed for the good performance of the manure. The present results are expected since N application significantly increased growth characters as well as grain yield components.

Similar results were also obtained by Mohamed and El-Aref (1999); Allam et al (2001); Costa et al (2002); Saleh and Nawar (2003); Loecke et al (2004); Suleiman (2004); Ma et al (2005); Derby et al (2005); Halvorson et al (2005); Pikul et al (2005); Valero et al (2005); Bahr et al (2006); Moser et al (2006); Ibrahim and Kandil (2007); El-Mekser and Seiam (2008); Shisanya et al (2008); Ayoola and Makinde (2009) and Lelei et al (2009)

Table (21): Grain yield (kg fed⁻¹) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

		***************************************		2005 seaso	n				
N Fertilizer rates	Genotypes								
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means		
Zero	1402.6	1268.1	1286.4	1240.6	1136.9	702.3	1172.8		
60 kg N/fed	2289.7	2322.8	2208.6	2070.7	1756.3	1361.8	2001.6		
90 kg N/fed	3679.4	3334.9	3400.2	2545.6	1999.4	1857.9	2802.9		
120 kg N/fed	4005.1	4224.2	3547.7	3484.8	2837.2	2388.3	3414.5		
40 kg N/fed+20 (t/FYM)	2227.9	2603.0	2222.4	2101.1	1787.9	1249.3	2031.9		
60 kg N/fed+30 (t/FYM)	3848.0	3389.4	3480.3	2837.9	2187.0	1963.9	2951.1		
80 kg N/fed+40 (t/FYM)	4226.0	4466.7	3738.7	3612.7	3031.7	2471.0	3591.2		
Means	3097.0	3087.0	2840.6	2556.2	2105.2	1713.5	2566.6		
Treation				2006 seaso	n				
PESAGENIC PATRICI	Genotypes								
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means		
	3084	30K8	Dahab	323		Gamal			
Zero	1559.2	1196.0	1554.8	1384.6	1073.1	854.5	1270.4		
60 kg N/fed	2332.2	2399.5	2154.5	2153.6	1872.7	1380.6	2048.9		
90 kg N/fed	3224.9	3243.0	3475.4	2655.4	2111.2	1927.4	2772.9		
120 kg N/fed	3806.5	4159.9	3681.7	3448.5	2970.1	2462.1	3421.4		
40 kg N/fed+20 (t/FYM)	2439.5	2445.9	2194.3	2168.5	1913.2	1483.3	2107.4		
60 kg N/fed+30 (t/FYM)	3257.9	3478.7	3508.1	2833.6	2204.1	2261.9	2924.0		
80 kg N/fed+40 (t/FYM)	4159.9	4191.5	3761.1	3563.8	3022.6	2458.2	3526.2		
Means	2968.6	3016.3	2904.3	2601.1	2166.7	1832.6	2581.6		

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	73.2	L.S.D. at 5% Genotypes =	63.9
L.S.D. at 5% Fertilizer =	60.9	L.S.D. at 5% Fertilizer =	50.1
L.S.D. at 5% G.XF. =	149.1	L.S.D. at 5% G.XF. =	122.8

2.10.3- Interaction effect.

Grain yield feddan⁻¹ of maize was significantly affected by the interaction between genotypes and N rates (mineral & organic) in 2005 and 2006 seasons as shown in **Table (21)**. The heaviest grain yield feddan⁻¹ in the two seasons (4466.7 and 4191.5 kg) was obtained by S.C.30k8 when received 80 kg N +

40 (t/FYM) fed⁻¹: Whereas, the lowest values of grain yield feddan⁻¹(702.3 and 854.5 kg) were obtained by Nab El-Gamal cultivar under zero N in the two seasons. These results agree with those obtained by Abu-Grab et al (1997); El-Sheikh (1998); El-Bana (2001); Oraby et al (2003); El-Aref et al (2004); Nawar (2004); Fatma Nofal et al (2005a); Mehasen and Saeed (2006) and El-Mekser and Seiam (2008).

2.11- Stover yield in kg feddan⁻¹:

Results for the effect of maize genotypes, N fertilizer rates (organic & mineral) and their interactions in 2005 and 2006 seasons on stover yield feddan⁻¹ are presented in **Table (22)**.

2.11.1- Effect of genotypes.

The results in **Table (22)** showed marked differences in stover yield among the 6 maize genotypes in both seasons.

In the first season, the 6 genotypes could be arranged in a descending order in their stover yield as follows: S.C.30k8, S.C.3084, D.C. Dahab, Giza 2, T.W.C.323, and Nab El- Gamal. All differences were significant except that between S.C.3084 and D.C. Dahab

In the second season, about the same arrangement was observed but S.C. 30k8 was the highest genotype in stover yield and the open pollinated variety Nab El-Gamal was the lowest in stover yield as shown in the other season. The four other genotypes were in between with some significant differences.

It could be concluded that hybrid maize in general and single crosses in particular surpassed the open-pollinated varieties in stover yield. It was observed that stover yield of maize varieties followed the same pattern of performance as shown with grain yield. These differences may be due to genetical differences between the maize genotypes.

These results agree with those obtained by Abu-Grab et al (1997) and El-Bana (2001).

2.11.2- Effect of N rates.

Stover yield of maize as affected by N fertilizer rates (organic & mineral) is presented in **Table (22)**. Stover yield was significantly increased by increasing N rates up to 80 kg N+40(t/FYM) fed⁻¹ in 2005 and 2006 seasons. In the first season, stover yield increased by 16.89, 45.74, 61.85, 17.73, 47.31 and 62.12% when maize plants received 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹, respectively compared with the control. Similar results were noticed in the second season, and stover yield increased by 18.15, 42.68, 61.01, 18.38, 45.67 and 61.09%, respectively by applying the same N rates.

It could be concluded that the stover yield of maize significantly increased with the increase in nitrogen treatments up to 80 kg N+40(t/FYM) fed⁻¹. The increase in stover yield due to increasing nitrogen treatments is more likely attributed to the increase in plant height, stem diameter and leaf area index. These results are in agreement with those obtained by Ashoub et al (1996); El-Habbak and Shams El-Din (1996); Abu-Grab et al (1997); Selim et al (1998);; El-Bana and Gomaa (2000);

Costa et al (2002); Abdel-Hameed (2005); Derby et al (2005) and El-Maihy (2007).

Table(22): Stover yield (kg fed⁻¹) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

	MAN DESIGNATION OF THE PERSON			2005 sea:	son		
N Fertilizer rates				Genotyp	oes		
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero	3201.0	3445.3	2645.8	2684.4	2805.5	2480.2	2877.0
60 kg N/fed	3313.0	3703.7	3200.2	3018.1	3719.2	3223.6	3363.0
90 kg N/fed	4648.0	4768.8	4646.8	3526.8	3633.9	3934.2	4193.1
120 kg N/fed	4794.7	4905.6	4772.4	4702.6	4570.1	4193.9	4656.6
40 kg N/fed+20 (t/FYM)	3288.4	3869.8	3267.6	3102.9	3634.2	3161.1	3387.3
60 kg N/fed+30 (t/FYM)	4622.4	4809.9	4604.2	3841.9	3707.8	3843.1	4238.2
80 kg N/fed+40 (t/FYM)	4629.4	5060.7	4921.8	4729.2	4526.9	4118.0	4664.4
Means	4071.0	4366.3	4008.4	3658.0	3799.7	3564.9	3911.4
				2006 seas	son		
N Fertilizer rates				Genotyp	es		
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero	3150.0	3123.2	2894.4	2687.7	2792.4	2571.8	2869.9
60 kg N/fed	3367.3	3486.5	3049.2	30710	3958.1	3412.8	3390.8
90 kg N/fed	4157.5	4485.7	4524.1	3623.6	3790.7	3987.2	4094.8
120 kg N/fed	4335.6	4991.5	4745.6	4628.7	4607.5	4416.8	4621.0
40 kg N/fed+20 (t/FYM)	3315.5	3542.1	3171.9	3069.7	3868.0	3417.6	3397.5
60 kg N/fed+30 (t/FYM)	4169.7	4610.0	4582.9	3883.1	3815.5	4023.4	4180.8
80 kg N/fed+40 (t/FYM)	4436.2	5109.3	4681.0	4612.0	4589.6	4311.9	4623.3
Means	3847.4	4192.6	3949.9	3853.7	3917.4	3734.5	3882.6

First season(2005)			Second season(2006)		
L.S.D. at 5% Genotypes	=	86.8	L.S.D. at 5% Genotypes	=	82.6
L.S.D. at 5% Fertilizer	=	78.1	L.S.D. at 5% Fertilizer	=	69.9
L.S.D. at 5% G.XF.	=	191.4	L.S.D. at 5% G.XF.	=	171.1

2.11.3- Interaction effect.

Stover yield feddan⁻¹ of maize was significantly affected by the interaction between genotypes and N rates (mineral & organic) in 2005 and 2006 seasons as shown in **Table (22)**. The heaviest stover yield feddan⁻¹ in the two seasons (5060.7 and 5109.3 kg) was obtained for S.C.30k8 when received 80 kg N + 40 (t/FYM) fed⁻¹. Whereas, the lowest values of stover yield feddan⁻¹(2480.2and 2571.8 kg) were obtained from Nab El-Gamal cultivar under zero N in the two seasons.

2.12- Biological yield in kg feddan⁻¹:

Results in **Table (23)** present biological yield feddan⁻¹ of maize as affected by genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons.

2.12.1- Effect of genotypes.

The results in **Table (23)** showed that biological yield of the 6 genotypes showed significant differences in both seasons.

In the first season, S.C. 30 k8 was the highest genotype in biological yield /fed followed by S.C. 3084, D.C. Dahab, T.W.C. 323, Giza 2 and Nab El-Gamal, in a descending order. All differences among the 6 genotypes were significant. In that season, S.C. 30k8 outyielded the 5 other genotypes by 3.98, 8.82, 19.94, 27.61 and 41.16% respectively.

In the second season, slight difference was observed where D.C. Dahab was the second genotype followed by S.C. 3084 without significant difference between then. The genotypes could be arranged, in the second season, in the following descending order: S.C. 30K8, D.C. Dahab, S.C. 3084, T.W. C. 323, Giza 2 and Nab El-Gamal. S.C. 30k8 out yielded these 5 genotypes by 5.18, 5.77,15.52,18.47 and 27.05%, respectively

It could be concluded that single as well as three way crosses were superior in biological yield compared with the open-pollinated varieties, this result is a clear evidence for the good performance of hybrid maize. The differences between maize genotypes were mainly due to the differences in genetical constituents. These results agree with those obtained by El-Bana (2001); Khalil (2001); Nawar and Khalil (2004); Mehasen and Saeed (2006) and Atta (2007).

2.12.2- Effect of N rates.

Results in **Table (23)** indicate that biological yield feddan⁻¹ of maize was significantly affected by N fertilizer rates (organic and mineral) in 2005 and 2006 seasons. In 2005 season, biological yield increased with the increase in N rates up to 80 kg N+40(t/FYM) fed⁻¹. Increasing N rates from zero to 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ caused an increase of 31.03, 69.80, 98.02, 32.95, 76.38 and 102.54% in the biological yield, respectively. Similar results were obtained in 2006 season where the respective increases in biological yield were 31.38, 65.87, 94.24, 35.97, 71.60 and 96.85%, due to the application of the same N rates compared with the control.

The increase in biological yield due to the increase in nitrogen level is attributed to the increase in plant height, stem diameter, leaf area index (stover yield), number of ears feddan⁻¹, ear weight and shelling % and grain yield. These results are in agreement with those obtained by El-Habbak and Shams El-Din (1996); Selim *et al* (1998) and Abdel-Hameed (2005).

Table (23): Biological yield (kg fed⁻¹) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

			2	005 seas	on					
N Fertilizer rates	Genotypes									
N Fertinzer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means			
Zero	4603.6	4713.4	3932.2	3924.9	3942.3	3339.0	4075.9			
60 kg N/fed	5602.7	6026.4	5408.7	5088.8	5475.5	4441.7	5340.7			
90 kg N/fed	8327.4	8103.6	8047.0	6072.4	5183.3	5792.1	6921.0			
120 kg N/fed	8799.9	9129.7	8320.1	8187.4	7407.3	6582.2	8071.1			
40 kg N/fed+20 (t/FYM)	5516.2	6472.9	5490.0	5204.0	5422.2	4410.3	5419.3			
60 kg N/fed+30 (t/FYM)	8470.4	8199.3	8084.5	6679.8	5894.8	5807.0	7189.3			
80 kg N/fed+40 (t/FYM)	8856.1	9528.2	8660.5	8341.9	7558.6	6589.0	8255.7			
Means	7168.0	7453.4	6849.0	6214.2	5840.6	5280.2	6467.6			
	2006 season									
N.E. 471				Genotyp	es					
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means			
	3084	30K8	Dahab	323	Giza z	Gamal				
Zero	4709.2	4319.2	4449.2	4072.3	3865.6	3426.2	4140.3			
60 kg N/fed	5699.5	5886.0	5203.7	5224.6	5830.7	4793.4	5439.6			
90 kg N/fed	7382.4	7728.7	7999.4	6279.0	5901.9	5914.7	6867.7			
120 kg N/fed	8142.0	9151.4	8427.3	8077.1	7577.6	6878.9	8042.4			
40 kg N/fed+20 (t/FYM)	5754.9	5988.0	5366.1	5238.2	5781.2	5650.9	5629.9			
60 kg N/fed+30 (t/FYM)	7427.5	8088.7	8090.9	6716.7	6019.6	6285.3	7104.8			
80 kg N/fed+40 (t/FYM)	8596.1	9300.7	8442.1	8175.8	7617.2	6770.1	8150.3			
Means	6815.9	7208.9	6854.1	6254.8	6084.8	5674.2	6482.1			

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	191.1	L.S.D. at 5% Genotypes =	160.4
L.S.D. at 5% Fertilizer =	139.3	L.S.D. at 5% Fertilizer =	166.8
L.S.D. at 5% G.XF. =	341.2	L.S.D. at 5% G.XF. $=$	408.4

2.12.3- Interaction effect.

Biological yield feddan⁻¹ of maize was significantly affected by the interaction between genotypes and N rates (mineral & organic) in 2005 and 2006 seasons as shown in **Table (22)**. The heaviest biological yield feddan⁻¹ in the two seasons (9528.2 and 9300.7 kg) was obtained by S.C.30k8 when received 80 kg N+40(t/FYM) fed⁻¹. Whereas, the lowest values

of biological yield feddan⁻¹ (3339.0 and 3426.2 kg) were obtained by Nab El-Gamal cultivar under zero N in the two seasons.

2.13- Harvest index:

Data in **Table (24)** show the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions on harvest index (HI) of maize in 2005 and 2006 seasons.

2.13.1- Effect of genotypes.

The results in **Table (24)** indicated marked difference in H.I. among the 6 genotypes in both seasons. It was clear that S.C. 3084 was superior compared with the other 5 genotypes and significantly surpassed them in H.I. in both seasons. S.C. 3084 recorded a H.I. of 42.10% and 42.73% in 2005 and 2006 seasons, respectively.

This superior genotype was followed by the other 3 crosses, namely S.C. 30k8, D.C. Dahab and T.W.C. 323 as one group without significant differences and were superior to the 2 open – pollinated varieties Giza2 and Nab El-Gamal.

It could be concluded that the 6 genotypes could be classified into 4 distinct groups with significant differences among them as follows:

First group: includes S.C. 3084 as the leading genotype.

Second group: includes S.C. 30k8, D.C. Dahab and T.W.C. 323.

Third group: includes Giza 2.

Fourth group: includes Nab El-Gamal.

The results could be considered as an argument for the superiority of hybrid maize versus open pollinated varieties. From **Table (24)** H.I of S.C. 3084 was 42.10% in 2005 and 42.73% in 2006, as against 30.77% in 2005 and 32.09% in 2006 for the local open–pollinated variety Nab El-Gamal. This difference of 11.33% and 10.64% in the first and second season, respectively between S.C. 3084 and the local variety caused a severe reduction in maize grain yield.

These differences may be due to genetical differences between the maize genotypes. These results agree with those obtained by El-Hariri et al (1996); Ahmed and Mekki (2005) and Abd El-Maksoud and Sarhan (2008).

2.13.2- Effect of N rates.

Harvest index (H.I.) values as affected by N rates (mineral & organic) are presented in **Table (24)**. H.I. significantly increased by increasing N rates up to 80 kg N+40(t/FYM) fed⁻¹ in the first and second seasons. H.I. increased by 8.11, 11.29, 13.57, 8.50, 11.91 and 14.54%, in the first season and by 7.08, 9.37, 11.80, 8.16, 10.37 and 12.47%, in the second season when maize plants received 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ over the control treatment, respectively.

Similar results were obtained by Shams (2000); Costa et al (2002); Ma et al (2005) and Siam et al (2008).

Table (24): Harvest index of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

The second secon	T THE REAL PROPERTY.		E A RESULT TO BE	Shimp Silks and water	医一种一种心理			
		2005 season						
N Fertilizer rates				Genotyp	es			
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	M	
	3084	30K8	Dahab	323	Giza 2	Gamal	Means	
Zero	30.50	26.93	32.73	31.58	28.83	21.23	28.63	
60 kg N/fed	40.88	38.55	40.85	40.68	32.08	27.40	36.74	
90 kg N/fed	44.23	41.15	42.28	41.93	35.48	32.08	39.52	
120 kg N/fed	45.53	46.25	43.13	42.58	38.33	34.98	41.80	
40 kg N/fed+20 (t/FYM)	40.38	40.23	40.50	40.40	32.98	28.33	37.13	
60 kg N/fed+30 (t/FYM)	45.45	41.30	43.03	42.48	37.13	33.85	40.54	
80 kg N/fed+40 (t/FYM)	47.75	46.85	43.45	43.30	40.13	37.53	43.17	
Means	42.10	40.18	40.85	40.42	34.99	30.77	38.22	
			ю	2006 seas	on			
N Fertilizer rates				Genotype	es			
	S.C	S.C	D.C	T.W.C	C: 2	Nab El-	14	
	3084	30K8	Dahab	323	Giza 2	Gamal	Means	
Zero	33.10	28.20	34.90	33.98	27.73	24.93	30.47	
60 kg N/fed	40.95	40.78	41.43	41.23	32.13	28.80	37.55	
90 kg N/fed	43.70	41.98	43.43	42.30	35.03	32.60	39.84	
120 kg N/fed	46.73	45.48	43.70	42.73	39.20	35.78	42.27	
40 kg N/fed+20 (t/FYM)	42.40	43.33	40.90	41.40	33.10	30.25	38.56	
60 kg N/fed+30 (t/FYM)	43.88	43.03	43.35	42.20	36.60	35.98	40.84	
80 kg N/fed+40 (t/FYM)	48.38	45.08	44.55	43.58	39.75	36.33	42.94	
Means	42.73	41.12	41.75	41.06	34.79	32.09	38.92	

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	0.72	L.S.D. at 5% Genotypes =	0.90
L.S.D. at 5% Fertilizer =	0.65	L.S.D. at 5% Fertilizer =	0.64
L.S.D. at 5% G.XF. =	1.60	L.S.D. at 5% G.XF. =	1.56

2.13.3- Interaction effect.

Harvest index (H.I.) of maize was significantly affected by the interaction between genotypes and N rates (mineral & organic) in 2005 and 2006 seasons as shown in **Table (24)**. The highest H.I. in the two seasons (47.75% and 48.38%) was obtained for S.C.3084 when received 80 kg N+40(t/FYM) fed⁻¹. Whereas, the lowest values of H.I. (21.23% and 24.93%) were obtained from Nab El-Gamal cultivar under zero N in the two seasons, respectively.

3- Effect of genotypes, N fertilizer rates and their interaction on chemical properties of maize grain and NUE.

3.1- Nitrogen content in grain:

Results for the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons on N content in maize grain are presented in **Table (25)**.

3.1.1- Effect of genotypes.

Results in **Table (25)** slowed significant differences in total N% in grain among the 6 genotypes in both seasons.

In 2005 season, the local open–pollinated variety Nab El-Gamal contained significantly greater N% in grain than the other 5 genotypes, then 4 genotypes namely, Giza2, D.C. Dahab, S.C. 3084 and T.W.C. 323 followed as one group and the lowest genotypes was S.C. 30k8 with 1.48%N in grain.

In 2006 season, the highest N% in grain was 1.77% which was recorded by D.C. Dahab, and the lowest content was 1.63% recorded by the two single crosses and the rest 3 genotypes, namely, Giza2 (1.73%), Nab El-Gamal (1.71%) and T.W.C. 323 (1.69%) were in – between as one group. It could be concluded that the 2 open–pollinated varieties as well as the yellow maize D.C. Dahab were superior in N% in grain. The differences in this trait are mainly due to the genetically differences among the genotypes.

Similar results were obtained by Shafshak et al (1994a); Abu-Grab (1997) and Khalil (2001).

3.1.2- Effect of N rates.

Results presented in **Table (25)** clearly show that the increase in N rates caused significant increase in N content in maize grains during 2005 and 2006 seasons. In the first season, applying N at 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ caused significant increases in nitrogen content in maize grains over the control treatment by 0.08, 0.13, 0.27, 0.14, 0.17 and 0.29%, respectively when compared with the control treatment. In the second season, the respective increases were 0.06, 0.09, 0.22, 0.10, 0.14 and 0.19%. The differences in the N content in maize grain due to applying 120 kg N fed⁻¹ and 80 kg N+40(t/FYM) fed⁻¹ as well as 90 kg N, 40 kg N+20(t/FYM) and 60 kg N+30(t/FYM) fed⁻¹ were not significant in both seasons.

It could be concluded that the increase in N supply improved the grain quality of the end product expressed as nitrogen content in maize grains These results are in agreement with that obtained by Shafshak et al (1994 a); Abdullah (1995); Abu-Grab et al (1997); Mohamed and El-Aref (1999); Suleiman (2004); Derby et al (2005); Halvorson et al (2005) and Hussaini et al (2008).

3.1.3- Interaction effect.

N content in maize grains was significantly affected by the interaction between genotypes and N rates (mineral & organic) in both seasons (**Table, 25**). The highest N contents (1.91 and 1.99%) were obtained by Nab El-Gamal and D.C. Dahab when received 120 kg N fed⁻¹ in the first and second seasons,

respectively, whereas, the lowest values of N content (1.37 and 1.52%) were obtained from S.C.3084 under zero N in both seasons.

Table (25): Total nitrogen % in maize grain as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

			1	2005 seas	on			
N Fertilizer rates	Genotypes							
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means	
Zero	1.37	1.40	1.50	1.43	1.50	1.60	1.46	
60 kg N/fed	1.46	1.44	1.60	1.50	1.57	1.71	1.54	
90 kg N/fed	1.49	1.45	1.65	1.55	1.62	1.79	1.59	
120 kg N/fed	1.81	1.50	1.82	1.65	1.71	1.91	1.73	
40 kg N/fed+20 (t/FYM)	1.73	1.46	1.61	1.55	1.63	1.63	1.60	
60 kg N/fed+30 (t/FYM)	1.77	1.50	1.60	1.60	1.65	1.65	1.63	
80 kg N/fed+40 (t/FYM)	1.82	1.64	1.74	1.64	1.78	1.90	1.75	
Means	1.63	1.48	1.64	1.56	1.64	1.74	1.62	
Marketis			Ti di	2006 seas	son			
				Genotyp	es	*		
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza	Nab El-	Means	
	3084	30K8	Dahab	323	2	Gamal		
Zero	1.52	1.53	1.67	1.62	1.62	1.55	1.58	
MIN CALC	1.55	1.59	1.70	1.65	1.65	1.70	1.64	
60 kg N/fed	1.58	1.61	1.72	1.68	1.71	1.72	1.67	
90 kg N/fed	1.73	1.68	1.99	1.74	1.90	1.77	1.80	
120 kg N/fed	1.63	1.65	1.69	1.68	1.71	1.73	1.68	
40 kg N/fed+20 (t/FYM)	1.68	1.68	1.77	1.70	1.74	1.76	1.72	
60 kg N/fed+30 (t/FYM)		1.72	1.83	1.78	1.80	1.78	1.77	
80 kg N/fed+40 (t/FYM) Means	1.72 1.63	1.63	1.77	1.69	1.73	1.71	1.69	

First season(2005)		Second season(2006)				
L.S.D. at 5% Genotypes =	0.10	L.S.D. at 5% Genotypes =	0.07			
L.S.D. at 5% Genotypes =	0.04	L.S.D. at 5% Fertilizer =	0.03			
L.S.D. at 5% Fertilizer	0.10	L.S.D. at 5% G.XF. $=$	0.06			

3.2- Protein percentage in maize grain:

Results for the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons on protein percentage in maize grain are presented in Table (26).

3.2.1- Effect of genotypes.

The six genotypes under study significantly varied in protein content in grain in both seasons (Table, 26).

In 2005 season, the greatest protein % was 10.86% recorded by the local variety Nab El-Gamal followed by D.C. Dahab (10.28%) and Giza2 (10.22%). The lowest values were recorded by T.W.C. 323 (9.74%) and S.C. 30k8 (9.25%). The differences among the genotypes were almost significant.

In 2006 season, about the same arrangement of the 6 genotypes was observed, and the D.C. Dahab was on the top with 11.04% protein content, followed by Giza2 (10.80%) and Nab El-Gamal (10.71%) with significant superiority for Dahab. T.W.C. 323 was the fourth in the arrangement with 10.57% protein content, and the 2 single crosses with the same protein content of 10.19% were the last in this arrangement.

It could be concluded that D.C. Dahab, Giza2 and Nab El-Gamal cultivars were superior in assimilating protein percentage in maize grains compared with the other three hybrids, which may be due to the genetical differences between maize genotypes. Similar results were obtained by **Khalil** (2001).

respectively, whereas, the lowest values of N content (1.37 and 1.52%) were obtained from S.C.3084 under zero N in both seasons.

Table (25): Total nitrogen % in maize grain as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				2005 seas	on		
N Fertilizer rates				Genotyp	es		
1 (I ex chiller 1 miles	S.C	S.C	D.C	T.W.C	Giza	Nab El-	Means
	3084	30K8	Dahab	323	2	Gamal	
Zero	1.37	1.40	1.50	1.43	1.50	1.60	1.46
60 kg N/fed	1.46	1.44	1.60	1.50	1.57	1.71	1.54
90 kg N/fed	1.49	1.45	1.65	1.55	1.62	1.79	1.59
120 kg N/fed	1.81	1.50	1.82	1.65	1.71	1.91	1.73
40 kg N/fed+20 (t/FYM)	1.73	1.46	1.61	1.55	1.63	1.63	1.60
60 kg N/fed+30 (t/FYM)	1.77	1.50	1.60	1.60	1.65	1.65	1.63
80 kg N/fed+40 (t/FYM)	1.82	1.64	1.74	1.64	1.78	1.90	1.75
Means	1.63	1.48	1.64	1.56	1.64	1.74	1.62
				2006 seas	on		
N Fertilizer rates				Genotyp	es	•	
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza	Nab El-	Means
i i	3084	30K8	Dahab	323	2	Gamal	
Zero	1.52	1.53	1.67	1.62	1.62	1.55	1.58
60 kg N/fed	1.55	1.59	1.70	1.65	1.65	1.70	1.64
90 kg N/fed	1.58	1.61	1.72	1.68	1.71	1.72	1.67
120 kg N/fed	1.73	1.68	1.99	1.74	1.90	1.77	1.80
40 kg N/fed+20 (t/FYM)	1.63	1.65	1.69	1.68	1.71	1.73	1.68
60 kg N/fed+30 (t/FYM)	1.68	1.68	1.77	1.70	1.74	1.76	1.72
80 kg N/fed+40 (t/FYM)	1.72	1.72	1.83	1.78	1.80	1.78	1.77
Means	1.63	1.63	1.77	1.69	1.73	1.71	1.69

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	0.10	L.S.D. at 5% Genotypes =	0.07
L.S.D. at 5% Fertilizer =	0.04	L.S.D. at 5% Fertilizer =	0.03
L.S.D. at 5% G.XF. =	0.10	L.S.D. at 5% G.XF. =	0.06

3.2- Protein percentage in maize grain:

Results for the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons on protein percentage in maize grain are presented in **Table (26)**.

3.2.1- Effect of genotypes.

The six genotypes under study significantly varied in protein content in grain in both seasons (Table, 26).

In 2005 season, the greatest protein % was 10.86% recorded by the local variety Nab El-Gamal followed by D.C. Dahab (10.28%) and Giza2 (10.22%). The lowest values were recorded by T.W.C. 323 (9.74%) and S.C. 30k8 (9.25%). The differences among the genotypes were almost significant.

In 2006 season, about the same arrangement of the 6 genotypes was observed, and the D.C. Dahab was on the top with 11.04% protein content, followed by Giza2 (10.80%) and Nab El-Gamal (10.71%) with significant superiority for Dahab. T.W.C. 323 was the fourth in the arrangement with 10.57% protein content, and the 2 single crosses with the same protein content of 10.19% were the last in this arrangement.

It could be concluded that D.C. Dahab, Giza2 and Nab El-Gamal cultivars were superior in assimilating protein percentage in maize grains compared with the other three hybrids, which may be due to the genetical differences between maize genotypes. Similar results were obtained by **Khalil** (2001).

3.2.2- Effect of N rates.

The increase in N rates significantly increased protein percentage in maize grain in the both seasons, as shown in **(Table 26)**. In the first season, applying nitrogen at60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ significantly increased protein percentage by 0.50, 0.81, 1.68, 0.87, 1.06 and 1.81%, respectively when compared with the control treatment. Similar results were noticed in the second season, and by applying the same N rates, protein percentage increased by 0.37, 0.56, 1.37, 0.62, 0.87 and 1.16%, respectively. The differences between 120 kg N fed⁻¹ and 80 kg N+40(t/FYM) fed⁻¹ in their effect on protein percentage were not significant in the first season.

The present results show clearly the influence of nitrogen in increasing the nutritive value of cereals. This result is mainly due to the effect of nitrogen in increasing nitrogen content in maize grain. It could be concluded that the increase in N supply improved the grain quality as an end product expressed in protein content of maize grain. These results are in agreement with those obtained by El– Moursy et al (1998); Selim et al (1998); Fatma Nofal (1999); Allam et al (2001); El-Metwaly et al (2001); Saleh and Nawar (2003); El-Gezawy (2005); Bahr et al (2006) and El-Maihy (2007).

Table (26): Crude protein % in maize grain as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

	pital and anyon	Since the Control of	NAME OF STREET	2005 seas	on	CHARLES IO	
N Fertilizer rates				Genotyp	es		
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero	8.57	8.72	9.35	8.94	9.35	9.97	9.15
60 kg N/fed	9.13	8.97	10.01	9.38	9.79	10.66	9.65
90 kg N/fed	9.32	9.04	10.32	9.66	10.13	11.16	9.93
120 kg N/fed	11.28	9.35	11.38	10.29	10.69	11.91	10.81
40 kg N/fed+20 (t/FYM)	10.82	9.10	10.07	9.69	10.16	10.16	10.00
60 kg N/fed+30 (t/FYM)	11.03	9.35	10.00	10.00	10.32	10.31	10.17
80 kg N/fed+40 (t/FYM)	11.38	10.22	10.85	10.22	11.13	11.88	10.94
Means	10.22	9.25	10.28	9.74	10.22	10.86	10.09
				2006 seas	on		
N Fertilizer rates		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Genotyp	es		
5	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero	9.50	9.57	10.44	10.10	10.10	9.69	9.90
60 kg N/fed	9.66	9.94	10.63	10.32	10.28	10.60	10.23
90 kg N/fed	9.85	10.07	10.76	10.50	10.66	10.75	10.43
120 kg N/fed	10.82	10.47	12.41	10.88	11.85	11.03	11.24
40 kg N/fed+20 (t/FYM)	10.16	10.38	10.57	10.47	10.69	10.82	10.51
60 kg N/fed+30 (t/FYM)	10.50	10.47	11.07	10.63	10.85	10.97	10.75
80 kg N/fed+40 (t/FYM)	10.72	10.72	11.41	11.10	11.22	11.10	11.04
Means	10.17	10.23	11.04	10.57	10.80	10.71	10.59

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	0.61	L.S.D. at 5% Genotypes =	0.44
L.S.D. at 5% Fertilizer =	0.27	L.S.D. at 5% Fertilizer =	0.16
L.S.D. at 5% G.XF. =	0.65	L.S.D. at 5% G.XF. =	0.39

3.2.3- Interaction effect.

Protein percentage in maize grains was significantly affected by the interaction between genotypes and N rates (mineral & organic) in both seasons (**Table, 26**). The highest protein percentage (11.91 and 12.41%) was obtained by Nab El-Gamal and D.C. Dahab supplied with 120 kg N fed⁻¹, whereas, the lowest values of protein percentage (8.57 and 9.50%) were

obtained by S.C.3084 under zero N in the first and second seasons.

3.3- Protein yield (kg feddan⁻¹):

Results for the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons on protein yield feddan⁻¹ of maize grain are presented in **Table (27)**.

3.3.1- Effect of genotypes.

The results in **Table (27)** showed significant differences among the 6 maize genotypes in protein yield / fed in both seasons.

In 2005 season, S.C.3084 was the leading genotype and surpassed significantly the five other genotypes in protein yield / fed. This genotype was followed by D.C. Dahab and S.C.30k8 which were significantly superior to the last three genotypes, T.W.C. 323, Giza2 and Nab El- Gamal. All differences in protein yield/fed in that season among the 6 genotypes were significant except that between S.C.30k8 and D.C. Dahab.

In 2006 season, some differences were observed in the performance of the evaluated genotypes. In that season, the genotypes could be arranged in a descending order in relation to protein yield per fed as follows: D.C. Dahab, S.C.30k8, S.C.3084, T.W.C.323, Giza2 and Nab El- Gamal. All differences among these genotypes were significant except that between S.C.3084 and S.C.30k8.

It could be concluded, that great differences were detected in the performance of the tested genotypes in their quality at expressed as protein yield/fed. The results here are good indication for the superiority of hybrid maize due to their superiority in grain yield/ plant as well as per Feddan.

These results agree with those obtained by Abu-Grab (1997) and Khalil (2001).

3.3.2- Effect of N rates.

Results presented in **Table (27)** clearly show that the increase in N rates caused significant increase in protein yield feddan⁻¹ during 2005 and 2006 seasons. In the first season, applying N rates of 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ caused significant increase in protein yield by 82.71, 165.99, 259.52, 95.82, 193.72 and 283.97 kg, respectively when compared to the control. In the second season, the respective increases were 82.92, 162.09, 257.43, 95.03, 187.84 and 262.69 kg.

The present results show clearly the influence of nitrogen in increasing the nutritive value of cereals. This result is mainly due to the effect of nitrogen application in increasing protein percentage in maize grain and grain yield per feddan. Such results are in agreement with what was obtained by Mohamed and El-Aref (1999); Saleh and Nawar (2003); El-Maihy (2007) and Siam et al (2008).

Table (27): Protein yield (kg fed⁻¹) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				2005 seas	on		
N Fertilizer rates		11		Genotyp	es		
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero	120.15	110.65	120.00	110.88	106.25	70.02	106.32
60 kg N/fed	208.93	208.33	221.08	194.15	171.90	129.83	189.03
90 kg N/fed	342.78	290.00	350.80	240.75	202.45	207.08	272.31
120 kg N/fed	451.28	394.60	403.28	358.25	303.30	284.33	365.84
40 kg N/fed+20 (t/FYM)	240.08	236.78	223.70	203.83	181.58	126.88	202.14
60 kg N/fed+30 (t/FYM)	423.83	317.00	347.98	283.25	225.60	202.60	300.04
80 kg N/fed+40 (t/FYM)	480.13	456.53	405.25	369.08	337.43	293.35	390.29
Means	323.88	287.70	296.01	251.45	218.36	187.72	260.85
			7	2006 seas	on		
N Fertilizer rates				Genotyp	es		
112 of the contract	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero	148.40	114.40	162.18	139.78	108.35	-82.33	125.90
60 kg N/fed	224.88	238.30	228.80	222.13	192.50	146.33	208.82
90 kg N/fed	317.15	326.30	373.70	278.80	224.78	207.20	287.99
120 kg N/fed	411.58	435.63	456.60	375.20	349.35	271.65	383.33
40 kg N/fed+20 (t/FYM)	247.98	253.88	231.75	227.08	204.53	160.40	220.93
60 kg N/fed+30 (t/FYM)	342.13	364.23	388.00	301.00	238.85	248.23	313.74
80 kg N/fed+40 (t/FYM)	445.80	449.40	429.03	395.30	339.25	272.75	388.59
Means	305.41	311.73	324.29	277.04	236.80	198.41	275.62

First season(2005)			Second season(2006)	
L.S.D. at 5% Genotypes	=	21.27	L.S.D. at 5% Genotypes =	11.79
L.S.D. at 5% Fertilizer	=	10.77	L.S.D. at 5% Fertilizer =	6.42
L.S.D. at 5% G.XF.	=	26.39	L.S.D. at 5% G.XF. =	15.73

3.3.3- Interaction effect.

Data for protein yield feddan⁻¹ in **Table (27)** indicate that the interaction between maize genotypes and N fertilizer rates was significant in the first and second seasons. The highest values of protein yield feddan⁻¹ (480.13 and 456.60 kg) were produced from S.C. 3084 and D.C. Dahab under 80 kg N + 40 (t/FYM) fed⁻¹ and 120 kg N fed⁻¹ in the first and second seasons,

respectively. Whereas, Nab El-Gamal cultivar under zero N fed⁻¹ gave the lowest protein yield feddan⁻¹ (70.02 and 82.33 kg) in the first and second seasons, respectively.

3.4- Nitrogen uptake (kg feddan⁻¹) in maize grain:

Results for the effect of genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons on N uptake feddan⁻¹ in maize grain are presented in **Table (28)**.

3.4.1- Effect of genotypes.

The results presented in **Table (28)** showed that the 6 genotypes significantly differed in N uptake in maize grain in both seasons.

In 2005 season, the genotypes could be arranged in regard to N uptake in grain in a descending order as follows: S.C.3084, D.C. Dahab, S.C.30k8, T.W.C.323, Giza2 and Nab El- Gamal, all differences among these 6 genotypes were significant except that S.C.30k8 and D.C. Dahab.

In 2006, slight differences were observed but the 2 single crosses as well as D.C. Dahab were superior than T.W.C.323 and the 2 open pollinated varieties. The arrangement of the 6 genotypes in the second could be made as follows: D.C. Dahab, S.C.30k8, S.C.3084, T.W.C.323, Giza2 and Nab El. Gamal, all differences in N uptake in grain were significant except that between D.C. Dahab and S.C.30k8 as shown in the first season also. It could be concluded that 3 genotypes (the2 single crosses as well as well as D.C. Dahab) were superior in N uptake in

grain in both season, one genotype (T.W.C.323) was in between, and the 2 open-pollinated varieties were inferior in this trait

The superiority of the single crosses as well as the D.C. Dahab is mainly due to better growth characters and higher response to N. The results here indicate a clear argument for the advantages of hybrid maize compared with the open pollinated variation.

Similar results were obtained by Abu-Grab et al (1997).

3.4.2- Effect of N rates.

N uptake in maize grain as affected by N fertilizer rates is presented in **Table (28)**. N uptake significantly increased by increasing N fertilizer rates up to 80 kg N+40(t/FYM) fed⁻¹ during 2005 and 2006 seasons. In the first season, the N uptake increased by 80.07, 158.67, 244.09, 90.12, 182.24 and 267.07% when maize plants received 60 kg N, 90 kg N, 120 kg N, 40 kg N+20(t/FYM), 60 kg N+30(t/FYM) and 80 kg N+40(t/FYM) fed⁻¹ respectively over the control. Similar results were noticed in the second season, and N uptake increased by 65.93, 128.74, 204.76, 75.17, 149.20 and 208.63%, respectively.

It could be concluded that the nitrogen uptake of maize significantly increased with the increase in nitrogen level up to 80 kg N+40(t/FYM) fed⁻¹. The increase in N uptake due to increasing N fertilizer rates is attributed to the increase in grain yield and N content in maize grain.

Table (28): Nitrogen uptake (kg fed⁻¹) in maize grain as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				2005 seas	on	Alexandra Approximation		
N Fertilizers rates	Genotypes							
	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means	
Zero	19.22	17.70	19.19	17.73	17.00	11.20	17.01	
60 kg N/fed	33.41	33.33	35.36	31.06	27.49	23.15	30.63	
90 kg N/fed	54.83	48.21	56.11	39.32	32.40	33.12	44.00	
120 kg N/fed	72.21	63.13	64.52	57.31	48.52	45.50	58.53	
40 kg N/fed+20 (t/FYM)	38.40	37.88	35.79	32.61	29.08	20.30	32.34	
60 kg N/fed+30 (t/FYM)	67.82	50.71	55.68	45.32	36.09	32.42	48.01	
80 kg N/fed+40 (t/FYM)	76.82	73.03	64.83	59.04	53.98	46.93	62.44	
Means	51.82	46.28	47.35	40.34	34.93	30.38	41.85	
	2006 season				-			
N Fertilizer rates				Genotype	es .			
	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means	
	3084	30K8	Dahab	323		Gamal		
Zero	23.75	18.30	25.94	22.36	17.33	13.17	20.14	
60 kg N/fed	35.98	38.18	36.61	35.53	30.80	23.40	33.42	
90 kg N/fed	50.74	52.20	59.77	44.61	35.97	33.15	46.07	
120 kg N/fed	65.84	69.69	73.06	60.00	56.25	43.46	61.38	
40 kg N/fed+20 (t/FYM)	39.66	40.24	37.07	36.32	32.71	25.66	35.28	
60 kg N/fed+30 (t/FYM)	54.74	58.23	62.07	48.16	38.22	39.71	50.19	
80 kg N/fed+40 (t/FYM)	71.32	71.90	68.62	63.24	54.27	43.63	62.16	
Means	48.86	49.82	51.88	44.32	37.94	31.74	44.09	

First season(2005)	Second season(2006)
L.S.D. at 5% Genotypes = 3.36	L.S.D. at 5% Genotypes = 1.90
L.S.D. at 5% Fertilizer = 1.72	L.S.D. at 5% Fertilizer = 1.02
L.S.D. at 5% G.XF. = 4.21	L.S.D. at 5% G.XF. = 2.49

It is worthy to note that the application of mineral N in combination with organic N by means of FYM was more effective an increased N uptake considerably. For example applying 60 kg N/fed as mineral N increased N uptake by 30.82% in the first season and 33.60% over the control in the second one. When this N rate was applied as 40 kg N/fed as mineral 20 kg N (as FYM) the increases in grain yield were 32.51 and 35.40% in the first and second seasons, respectively.

The increase in grain yield may be due to the inclusion of many macro and microelements in the manure.

These results are in agreement with those obtained by Abdullah (1995); Abu-Grab et al (1997); El-Sheikh (1998); Fatma Nofal (1999); Al-Kaisi and Yin (2003); Suleiman (2004); Derby et al (2005); El-Gezawy (2005); Bader and Othman (2006); Bahr et al (2006) and Siam et al (2008).

3.4.3- Interaction effect.

Data for N uptake in maize grain in kg feddan⁻¹ of maize in **Table (28)** indicate that the interaction between maize genotypes and N fertilizer rates was significant in the first and second seasons. The highest value of N uptake (76.82 and 73.06 kg) was produced from S.C. 3084 and D.C. Dahab under 80 kg N + 40(t/FYM) fed⁻¹ and 120 kg N fed⁻¹ in the first and second seasons, respectively, whereas, Nab El-Gamal cultivar under zero N fed⁻¹ gave the lowest N uptake (11.20 and 13.17 kg) in the first and second seasons, respectively.

3.5-Nitrogen use efficiency (NUE):

Results in **Table (29)** present nitrogen use efficiency (NUE) as affected by maize genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons.

3.5.1- Effect of genotypes.

The six evaluated genotypes showed marked differences in their performance concerning NUE in both seasons as indicated in **Table (29)**. The efficiency of the genotypes showed similar trend in both seasons. The 6 genotypes could be arranged in a descending order in regard to their NUE in the first season as follows: S.C.30k8 (22.94 kg), S.C.3084 (21.04 kg), D.C. Dahab (19.83kg), T.W.C.323 (16.48 kg), Nab El- Gamal (12.63 kg) and Giza2 (12.06 kg). All differences among the 6 genotypes were significant except that between the two open-pollinated varieties.

In the second season, about the same arrangement was observed, and the 6 genotypes could be arranged in a descending order as follows: S.C.30k8 (23.11 kg), S.C. 3084 (17.56 kg), D.C. Dahab (16.64 kg), T.W.C.323 (15.25 kg), Giza2 (13.92 kg) and Nab al- Gamal (12.26 kg). All differences were significant in NUE except those between S.C.3084 and D.C. Dahab, D.C. Dahab and T.W.C323, T.W.C323 and Giza2, as well as between Giza2 and Nab El Gamal. It could be concluded that the 2 single crosses were superior varieties in NUE, followed by D.C. Dahab, T.W.C 323, and the 2 open – pollinated varieties were inferior in this character.

It is clear that S.C.30k8 as the leading variety surpassed the local open - pollinated variety by 81.63 and 88.50% in the first and second season, respectively. These marked increases in NUE could be an argument for the advantages of growing single as well as three way and double crosses of maize.

Similar results were also reported by Shafshak et al (1994b) and Fatma Nofal et al (2005a).

3.5.2- Effect of N rates.

Results in **Table (29)** showed that NUE was significantly affected by N application rate. In both seasons, the application of mineral + organic N recorded higher values of NUE compared

with single application of mineral N. It was also observed that the increase in N level from 60 to 90 and 120 kg N / fed increased NUE but without significant differences between 90 and 120kg N / fed levels.

It is worth mentioning here that the use of FYM as a source of organic N significantly raised NUE in both season. For example the application of 80kg mineral N+ 40kg organic N/fed significantly increased NUE by 8.62 and 5.58% in the first and second seasons, respectively, compared with single application of 120 kg/fed mineral N. Also, applying 60 kg mineral N+30 kg organic N/fed caused an increase NUE of 8.61 and 10.07% in the first and second season , respectively, compared with the single application of 90kg mineral N/fed .

It could be concluded, that FYM as a source of organic N can play a good role in raising NUE. The manure contains many macro and micro elements in addition to organic matter, and improves physical and biological characters of the soil, Therefore, the increase in NUE of organic N is quite expected.

The present results recommend the use of the highest level of N in combination of 80kg mineral N and 40t FYM, according to the current prices for N and grain maize. One kg of grain maize = one E.L and one kg of mineral N = 3.43 E.L. (According to the prices of the Agric. Devel. &Credit Bank*)

The FYM in commonly available in small as well as large size farms in Egypt and is usually used for several field crops,

^{*}Personal Communication.

particularly maize. It is a common practice to use FYM of the farm and the costs are mainly those of transportation from the staple to the field. Also the residual effect of FYM will extend for at least 2 years.

According to the Annual Agricultural Statistical Year Book, Vol 2, "Summer and Nile Crops 2005, one fed of summer maize needs on the average 100 E.L for the costs of FYM. Taking this value in consideration, one kg of organic N costs about 2.5 E.L., consequently, it is selfexplanatory that the highest level of N, (80 kg mineral N + 40kg organic N) is the optimum N level under the conditions of the experiments.

Similar results were obtained by **Shafshak** *et al* (1994a), who reported that NUE markedly increased due the increase in N level.

The results reported by **Fatma Nofal (1999)** showed that NUE decreased with increasing N level from 45,90 and 135 kg N/ fed.

3.5.3- Interaction effect.

NUE was significantly affected by the interaction between maize genotypes and N fertilizer rates in both seasons, as shown in **Table (29)**. The highest values of NUE were 27.17 and 25.36 which were obtained by S.C.3084 and S.C.30k8 under 60 kg N +30(t/FYM) fed⁻¹ in the first and second seasons, respectively. Whereas, Nab El-Gamal under 40 kg M+20(t/FYM) fed⁻¹ and 60 kg N fed⁻¹ gave the lowest value of NUE being 9.12 and 8.77 in the first and second seasons, respectively. Similar results were

obtained by El-Sheikh (1998) and El-Mekser and Seiam (2008).

Table (29): Nitrogen use efficiency (kg grain kg⁻¹ N) of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				2005 seas	on			
N Fertilizer rates	Genotypes							
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means	
Zero					555			
60 kg N/fed	14.78	17.58	15.37	13.84	10.32	10.99	13.81	
90 kg N/fed	25.30	22.96	23.49	14.50	9.58	12.84	18.11	
120 kg N/fed	21.69	24.63	18.84	18.70	14.17	14.05	18.68	
40 kg N/fed+20 (t/FYM)	13.75	22.25	15.60	14.34	10.85	9.12	14.32	
60 kg N/fed+30 (t/FYM)	27.17	23.57	24.38	17.75	11.67	14.02	19.76	
80 kg N/fed+40 (t/FYM)	23.53	26.65	21.27	19.77	15.79	14.74	20.29	
Means	21.04	22.94	19.83	16.48	12.06	12.63	17.50	
	2006 season							
	Genotypes							
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza	Nab El-	Means	
	3084	30K8	Dahab	323	2 .	Gamal		
Zero								
60 kg N/fed	12.88	20.06	10.00	12.82	13.33	8.77	12.98	
90 kg N/fed	18.51	22.74	21.34	14.12	11.53	11.92	16.69	
120 kg N/fed	18.73	24.70	17.72	17.20	15.81	13.40	17.93	
40 kg N/fed+20 (t/FYM)	14.67	20.83	10.66	13.07	14.00	10.48	13.95	
60 kg N/fed+30 (t/FYM)	18.87	25.36	21.70	16.10	12.57	15.64	18.37	
80 kg N/fed+40 (t/FYM)	21.67	24.96	18.39	18.16	16.25	13.36	18.80	
Means	17.56	23.11	16.64	15.25	13.92	12.26	16.46	

First season(2005)		Second season(2006)	
L.S.D. at 5% Genotypes =	1.25	L.S.D. at 5% Genotypes =	1.89
L.S.D. at 5% Fertilizer =	0.79	L.S.D. at 5% Fertilizer =	0.66
L.S.D. at 5% G.XF. =	1.94	L.S.D. at 5% G.XF. $=$	1.61

3.6-Apparent nitrogen recovery %:

Results in **Table (30)** present means of apparent nitrogen recovery% as affected by maize genotypes, N fertilizer rates (mineral & organic) and their interactions in 2005 and 2006 seasons.

3.6.1- Effect of genotypes.

The results in **Table (30)** showed great differences in N recovery % among the 6 maize genotypes.

In 2005 season, S.C.3084 significantly surpassed the other 5 genotypes with a N recovery % of 40.23%. This leading S.C.3084 was followed by S.C.30k8 (35.71%) and D.C. Dahal (35.33%), then T.W.C.323 was followed ranking the fourth position with N recovery% of 28.17% and the 2 open-pollinated varieties Nab El- Gamal (23.56%) and Giza2 (22.17%) recorded the lowest values.

In 2006 season, some differences were observed in the performance of the genotypes, where S.C.30k8 recorded the highest N recovery % being 39.88% and significantly surpassed the other 5 genotypes. D.C. Dahab (31.48%) and S.C.3084 (31.01%) were followed and were significantly superior to T.W.C.323 (27.34%), Giza2 (25.87%) and Nab El- Gamal (23.36%).

The result showed clearly the superiority of the single crosses as well as the D.C. Dahab in N recovery % indicating greater response and better use of the applied N. Consequently, higher yield potentiality should be obtained by growing hybrid maize.

Similar results were also reported by Shafshak et al (1994b) and Fatma Nofal (1999).

3.6.2- Effect of N rates.

Results in Table (30) show that N recovery% was markedly affected by N rates in the first and second seasons. The highest value of N recovery% was recorded with 80 kg N + 40(t/FYM) fed⁻¹ being 37.86 and 35.02% in the first and second season, respectively, whereas, the lowest value of N recovery% was recorded from application of 60 kg mineral N fed⁻¹ being 22.71 and 22.13% in the first and second season, respectively. The difference between the 60 kg N/fed+30 (t/FYM) and 120 kg N fed⁻¹ was not significant in the first season, also, the difference between 120 kg N and 80 kg N +40 (t/FYM) fed⁻¹ was not significant in the second season.

The results indicated clearly that combining mineral N with organic N raised significantly N recovery % in both seasons.

For example, applying 40 kg mineral N + 20 kg organic N/fed, significantly increased N recovery% by 2.84 and 3.10% in the first and second season, respectively compared with the application of 60 kg mineral N/ fed.

Also, Applying 60 kg mineral N+30 kg organic /fed, resulted in an increase in N recovery % of 4.45 and 4.58 % in the first and second season, respectively compared with the application of 90 kg mineral N/ fed.

The increase of applying 80~kg mineral N+40~kg organic N / fed versus 120~kg mineral N / fed reached 3.26 and 0.65%, in the two successive seasons.

It could be concluded that the application of a mixture of both mineral and organic N resulted in an increase in N recovery %. The role of FYM as a soil amendment is clearly demonstrated

The results reported by **Shafshak** *et al* (1994a) showed that N recovery % increased by increasing N level up to 130 kg N/ fed. On the other hand, **Fatma Nofal** (1999) reported that raising N level from 45 to 135 kg N / fed reduced N recovery %.

3.6.3- Interaction effect.

N recovery% was significantly affected by the interaction between maize genotypes and N fertilizer rates in both seasons, as shown in **Table (30)**. The highest value of N recovery% was 54.00% and 44.67% which was obtained by S.C.3084 and S.C.30k8 under 60 kg N +30(t/FYM) fed⁻¹ and 80 kg N +40 (t/FYM) fed⁻¹ in the first and second seasons, respectively. Whereas, Nab El-Gamal under 40 kg N+ 20(t/FYM) and 60 kg N fed⁻¹ gave the lowest value of N recovery% being 15.17% and 17.05% in the first and second seasons, respectively.

Table (30): Apparent nitrogen recovery% of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				2005 seas	son		
N Fertilizer rates		Genotypes					
1 Tertifizer Tates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means
Zero	222		***			7222	
60 kg N/fed	23.65	26.05	26.94	22.22	17.49	19.92	22.71
90 kg N/fed	39.57	33.90	41.02	23.99	17.11	24.35	29.99
120 kg N/fed	44.16	37.86	37.78	32.97	26.27	28.58	34.60
40 kg N/fed+20 (t/FYM)	31.98	33.63	27.66	24.79	20.10	15.17	25.55
60 kg N/fed+30 (t/FYM)	54.00	36.68	40.54	30.65	21.21	23.58	34.44
80 kg N/fed+40 (t/FYM)	48.00	46.11	38.03	34.43	30.82	29.77	37.86
Means	40.23	35.71	35.33	28.17	22.17	23.56	30.86
		2006 season					
N. Etili wates	Genotypes						
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero							
60 kg N/fed	20.40	33.14	17.79	21.95	22.45	17.05	22.13
90 kg N/fed	29.99	37.66	37.58	24.72	20.71	22.20	28.81
120 kg N/fed	35.08	42.83	39.27	31.37	32.43	25.24	34.37
40 kg N/fed+20 (t/FYM)	26.52	36.58	18.55	23.27	25.64	20.81	25.23
60 kg N/fed+30 (t/FYM)	34.43	44.41	40.14	28.66	23.21	29.49	33.39
80 kg N/fed+40 (t/FYM)	39.65	44.67	35.57	34.07	30.78	25.39	35.02
Means	31.01	39.88	31.48	27.34	25.87	23.36	29.82

First season (2005)	Second season (2006)	
L.S.D. at 5% Genotypes = 4.65	L.S.D. at 5% Genotypes =	2.70
L.S.D. at 5% Fertilizer = 1.80	L.S.D. at 5% Fertilizer =	1.29
L.S.D. at 5% G.XF. = 4.41	L.S.D. at 5% G.XF. $=$	3.17

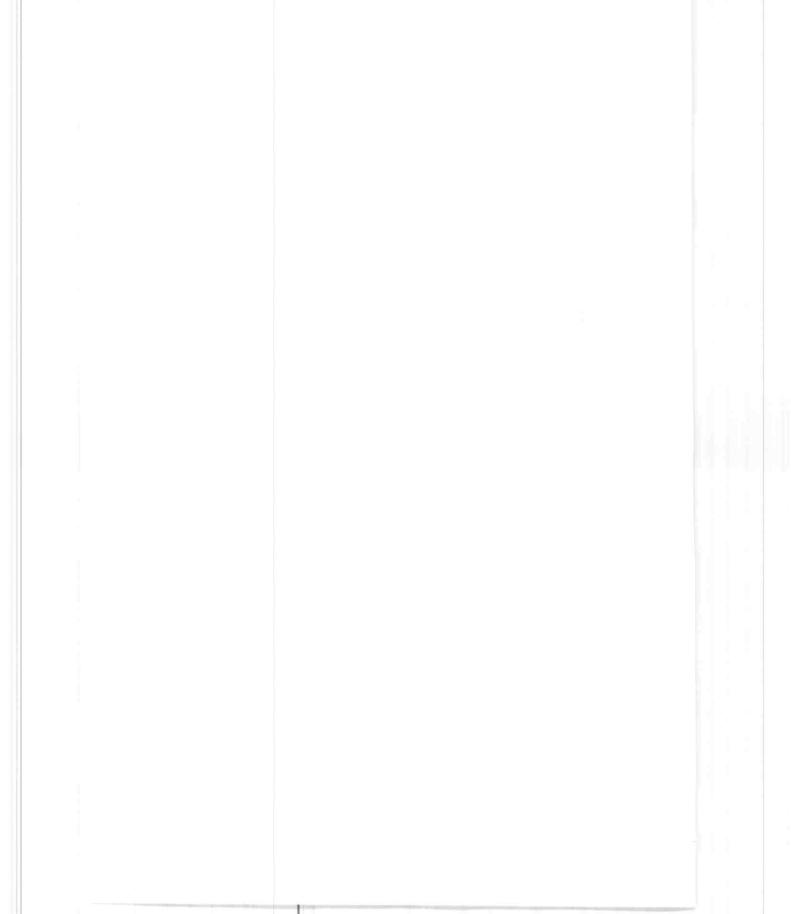


Table (30): Apparent nitrogen recovery% of maize as affected by genotypes, N fertilizer rates and their interactions in 2005 and 2006 seasons.

				2005 seas	on		
N Fertilizer rates		Genotypes					
N Fertilizer rates	S.C 3084	S.C 30K8	D.C Dahab	T.W.C 323	Giza 2	Nab El- Gamal	Means
Zero							
60 kg N/fed	23.65	26.05	26.94	22.22	17.49	19.92	22.71
90 kg N/fed	39.57	33.90	41.02	23.99	17.11	24.35	29.99
120 kg N/fed	44.16	37.86	37.78	32.97	26.27	28.58	34.60
40 kg N/fed+20 (t/FYM)	31.98	33.63	27.66	24.79	20.10	15.17	25.55
60 kg N/fed+30 (t/FYM)	54.00	36.68	40.54	30.65	21.21	23.58	34.44
80 kg N/fed+40 (t/FYM)	48.00	46.11	38.03	34.43	30.82	29.77	37.86
Means	40.23	35.71	35.33	28.17	22.17	23.56	30.86
	2006 season						
				Genotyp	oes		
N Fertilizer rates	S.C	S.C	D.C	T.W.C	Giza 2	Nab El-	Means
	3084	30K8	Dahab	323		Gamal	
Zero							
60 kg N/fed	20.40	33.14	17.79	21.95	22.45	17.05	22.13
90 kg N/fed	29.99	37.66	37.58	24.72	20.71	22.20	28.81
120 kg N/fed	35.08	42.83	39.27	31.37	32.43	25.24	34.37
40 kg N/fed+20 (t/FYM)	26.52	36.58	18.55	23.27	25.64	20.81	25.23
60 kg N/fed+30 (t/FYM)	34.43	44.41	40.14	28.66	23.21	29.49	33.39
80 kg N/fed+40 (t/FYM)	39.65	44.67	35.57	34.07	30.78	25.39	35.02
Means	31.01	39.88	31.48	27.34	25.87	23.36	29.82

First season (2005)	Second season (2006)
L.S.D. at 5% Genotypes = 4.65	L.S.D. at 5% Genotypes = 2.70
L.S.D. at 5% Genotypes L.S.D. at 5% Fertilizer = 1.80	L.S.D. at 5% Fertilizer = 1.29
L.S.D. at 5% G.XF. = 4.41	L.S.D. at 5% G.XF. = 3.17