RESULTS AND DISCUSSION

A- Effect of maize varieties on :

I- Growth characters :-

1- Plant height : -

The results presented in table (3) show the performance of the three evaluated maize varieties with regard to some of their growth characters .

The tested varieties differed significantly in plant height after 60 days from planting in both seasons .

In 1994 seasons, Giza-2 was the shortest plant at 60 days from planting with significant differences when compared with the two other varieties, whereas the single cross 156 was the tallest followed by the single cross 151 without significant differences in their height .

In 1995 season the tested varieties showed the same response in their height but there were significant differences between S.C.151 and S.C 156.

Generally the three tested varieties could be arranged in a descending order according to their height as follows: S.C. 156, S.C 151 and Giza-2 .

The differences recorded at certain growth stages between the tested varieties are mainly due to the differences in their genetical make up.

Table (3) : Effect of vrieties on some growth characters of maize plants in 1994 and 1995 seasons .

Growth Characters / Varieties	Plant height (cm)	Ear height (cm)	Stem diameter (cm)	No. of leaves per plant	Area of topmost ear leaf dcm	Days to 50 % Tasseling	Days to 50 % silking
				1994			
Giza 2	**204.3 b**	**107.6 c**	**2.1 c**	**15.6 a**	**617.6 c**	**51.6 a**	**55.2 a**
Single cross 151	**241.6 a**	**131.7 a**	**2.2 b**	**15.8 a**	**650.2 a**	**54.4 a**	**57.8 a**
Single cross 156	**244.4 a**	**121.7 b**	**2.5 a**	**16.0 a**	**630.6 b**	**55.5 a**	**58.8 a**
				1995			
Giza 2	**176.6 c**	**102.2 c**	**1.9 b**	**14.0 c**	**570.9 b**	**50.6 c**	**55.0 c**
Single cross 151	**222.2 b**	**122.0 a**	**2.2 a**	**14.6 b**	**605.7 a**	**55.0 b**	**58.0 b**
Single cross 156	**233.9 a**	**114.6 b**	**2.3 a**	**14.9 a**	**562.8 b**	**57.1 a**	**60.4 a**

These results agree with those reported by Eraky *et al* .(1980), Mourad *et al* (1986), Matta *et al* (1990), EL-Bialy *et al* (1991), Gouda *et al* (1992), Shafshak *et al* (1994), Aly *et al* (1996), and Atta-Allah (1996). EL-Gezawy (1996) showed marked differences in plant height of the different maize varieties .

2-Ear height :

The results, illustrated in Table (3) show that ear height of maize varieties differed significantly in both seasons .

In 1994 season , the three tested varieties could be arranged according to ear height in the following descending order : S.C. 151 , S.C. 156 and Giza -2 , with significant differences among all varieties .

In 1995 season , a similar arrangement was observed for the three tested varieties .

It could be concluded that S.C. 151 has the highest ear position than the other varieties and G-2 has lowest position . The results are mainly due to the differences in the genetical constitution of the evaluated varieties .

Similar results were also obtained by Eraky *et al* (1980), Mourad *et al* (1986), Matta *et al* (1990), EL-Bialy *et al* (1991)Gouda *et al* (1992),Basha (1994), Shafshak (1994),Aly *et al* and EL-Gezawy (1996).

3-Stem diameter (cm) :

The results presented in Table (3) show the performance of the three evaluated maize varieties with regard to some of their growth characters .

The tested varieties differed significantly in stem diameter in both seasons.

In 1994 season , Giza-2 gave the lowest stem diameter at 60 days from planting with significant differences when compared with the other varieties, whereas S.C. 156 gave the highest value and S.C.151 was in between with significant differences between the stem diameter.

In 1995 season the three tested varieties showed the same arrangement in their stem diameter but without significant differences between S.C. 151 and S.C.156 .

The differences between the three varieties under study in stem diameter are mainly due to the differences in their genetical make up.

These results coincide with those recorded by Mourad *et al* (1986), Matta *et al* (1990), EL-Bialy *et al* (1991), Shafshak *et al* (1994),Aly *et al* (1996),Atta-Allah (1996), and EL-Gazawy (1996).

4-Number of leaves/ plant :

The results of number of leaves/ plant of the three tested varieties of maize at 60 days from planting in 1994 and 1995 seasons are presented in Table (3).

The results did not show any significant differences in the number of leaves/ plant among the three tested varieties in the first season (1994). But in 1995 season there were significant differences in number of leaves of the thee studied varieties.

In the second season (1995) the differences between the three mentioned varieties in number of leaves/ plant were significant, S.C.

156 surpassed S.C. 151 which was better than Giza-2 in number of leaves/ plant .

Differences among Giza-2 ,S.C. 151 and S.C. 156 were significant.

Similar results were recorded by Mourad *et al* (1986), Ahmed (1989a), Matta *et al* (1990), EL-Bialy *et al* (1991) ,Gouda *et al* (1992),Shafshak *et al* (1994),Hassan (1995) and Atta-Allah (1996) .

5-Area of topmost ear leaf :

The results presented in Table (3) show that the three tested varieties differed significantly in the area of the topmost ear leaf in both seasons .

In the first season, the three varieties could be arranged according to leaf area in a descending order as follows :S.C. 151 , S.C. 156 and Giza-2. Significant differences were recorded between the three tested varieties.

In 1995 season ; S.C. 156 was inferior in this character when compared with the two other varieties without any significant differences. As the first season S.C. 151 was superior to the other two varieties which was in line with those obtained by Nigm (1989), Moustafa (1990), Dawood *et al* (1992), Gouda *et al* (1992), Basha (1994), and Atta-Allah (1996) .

6- Days to 50% tasseling :

The results in Table (3) show that tested varieties differed significantly in their tasseling date in the second season only of experimentation.

In 1994 season, Giza-2 variety was the earliest variety in tasseling followed by S.C. 151 and S.C. 156 without any significant differences among the three tested varieties.

In 1995 season, the earliest tasseling was achieved by Giza-2 followed by S.C. 151 and S.C. 156. Differences between the three tested varieties in date of tasseling were significant.

The present results are mainly due to the differences in the genetical constitution of the three tested varieties.

Several investigators reported marked differences in tasseling date of maize varieties [Mourad *et al*, 1986; Moustafa, 1990; Atta-Allah, 1996; and EL-Gezawy, 1996].

7- Days to 50 % Silking :

The results in Table (3) show that significant differences among the three tested maize varieties were observed only in the second season.

In 1994 season, Giza-2 was the earliest variety followed by S.C. 151 and S.C. 156 .

All differences between the three varieties in silking date were below the level of significance.

In 1995 season, the same trend was observed where Giza-2 was the earliest variety followed by S.C. 151 and S.C. 156 . Significant differences were found between Giza-2 and the two other varieties as well as between S.C. 151 and S.C. 156 .

The three tested varieties could be arranged according to earliness as follows : Giza-2, S.C. 151 and S.C. 156 .

The present results are mainly due to the differences in the genetical make up of the evaluated varieties and agree with those reported by Mourad *et al* (1986), Moustafa (1990) and Hassan (1995).

II- Yield and yield components :

1- Ear length :

The ear length of the three tested varieties is presented in Table (4). There were significant differences in ear length among the three tested maize varieties in both seasons .

In 1994 season, S.C. 156 has the longest ears followed by S.C. 151 and Giza-2 in descending order . Significant differences were obtained between S.C. 156 and each of S.C. 151 and Giza-2. The differences in ear length between S.C.151 and Giza-2 was not significant .

In 1995 season, similarly ear length of S.C. 156 surpassed the two other varieties with significant differences . On the other hand Giza-2 has the shortest ears which were significantly shorter when compared with the S.C. 151 variety .

It could be concluded that maize hybrids revealed superiority in ear length over Giza-2 variety .

These results agree with those recorded by Eraky *et al* (1980), EL-Hattab *et al* (1985), EL-Bialy *et al* (1991), Mohamed and Shames (1991), Gouda *et al* (1992), Ibrahim *et al* (1995), Aly *et al* (1996), Atta-Allah (1996) and EL-Gezawy (1996) .

Table (4) : Effect of varieties on yield and yield components of maize plants in 1994 and 1995 season .

Chahacters / varaieties	Ear length cm	Ear diameter cm	Ear weight gm	No.of rows/ ear	No.of kernles/ row	100 kernles wight gm	Ears yield kg/fed.	Grain yield kg/fed.	Straw yield kg/fed.	Biologcal yield kg/fed.
1994										
Giza - 2	**17.24 b**	**4.77 a**	**202.5 c**	**13.5 b**	**34.4 c**	**35.9 a**	**2742 a**	**2387 a**	**3395 c**	**5782 b**
S.C 151	**17.89 b**	**4.71 a**	**217.9 b**	**13.9 a**	**37.6 b**	**34.4 a**	**3416 a**	**2956 a**	**4220 b**	**7175 a**
S.C.156	**19.57 a**	**4.61 a**	**233.5 a**	**14.3 a**	**39.2 a**	**35.3 a**	**3209 a**	**2753 a**	**4595 a**	**7348 a**
1995										
Giza- 2	**16.20 b**	**4.50 a**	**206.4 c**	**13.4 b**	**33.2 c**	**38.1 a**	**5139 b**	**4402 c**	**5600 b**	**10002 b**
S.C.151	**16.70 b**	**4.50 a**	**218.6 b**	**13.7 b**	**38.0 b**	**34.2 b**	**5376 b**	**4672 b**	**5575 b**	**10246 b**
S.C.156	**18.50 a**	**4.50 a**	**233.2 a**	**14.3 a**	**40.6 a**	**33.4 b**	**6174 a**	**5411 a**	**6406 a**	**11816 a**

2- Ear diameter :

The results, illustrated in Table (4) indicate that the three evaluated varieties did not significantly differ in their ear diameter . The three tested varieties showed no apparent differences in this trait and more or less of a similar diameter . The present results show clearly that the increase in ear size of the hybrid varieties in general and S.C. 156 in particular is mainly due to the increase in ear length rather than ear diameter .

The present results disagree with those observed by Eraky *et al* (1980), EL-Hattab *et al* (1985), Ahmed (1989a), Moustafa (1990), Mohamed and Shames (1991), Basha (1994), Shafshak *et al* (1994), Ibrahim *et al* (1995), Aly *et al* (1996), Atta-Allah (1996) and EL-Gezawy (1996) .

3- **Ear weight :**

The tested varieties differed significantly in ear weight in both seasons as shown in Table (4). The results indicated clearly the superiority of hybrid varieties in this trait over the composite variety Giza-2 .

In 1994 season, the three varieties could be arranged in descending order according to their ear weight as follows : S.C. 156, S.C. 151 and Giza-2. Significant differences in ear weight were found between S.C. 156 and the other two varieties as well as between Giza-2 and all other varieties .

The difference between the leading variety S.C. 156 and the worst variety Giza-2 was 31.0 gm.

In 1995 season, the tested varieties showed the same arrangement in their ear weight. Whereas the difference between the leading variety S.C. 156 and the worst variety Giza-2 was 26.8 gm.

It could be concluded that hybrid varieties surpassed significantly the composite variety Giza-2 in ear weight. The present results are mainly due to superiority of hybrids in growth characters and ear size.

Similar results were reported by Eraky *et al* (1980), Shafshak *et al* (1994) and Aly *et al* (1996).

4- Number of rows/ ear :

The results in Table (4) showed that significant differences among the three evaluated varieties in number of rows/ ear in both seasons of experimentation. It was observed that S.C. 156 has higher number of rows/ ear than the two other varieties whereas Giza-2 has the lowest number of rows/ ear and S.C. 151 ranked the second.

In 1994 season, results showed that no significant differences were observed between the two hybrids S.C. 151 and S.C. 156, but there were significant differences between Giza-2 and the other two tested varieties. Single cross 156 variety surpassed S.C. 151 which was better than Giza-2 variety in number of rows/ ear.

In 1995 season, significant differences were only recorded between S.C. 156 and the other two tested varieties.

The three tested varieties could be arranged in the descending order due to number of rows/ ear as follows : S.C. 156, S.C. 151 and Giza-2. The result is mainly due to the genetical constitution of the tested varieties because it is well known that number of rows/ ear is mainly a genetical trait .

These results are in line with those obtained by Eraky *et al* (1980, Ahmed (1989c), Mohamed and Shames (1991), Basha (1994) and Aly *et al* (1996) .

5- Number of kernels/ row :

The tested varieties differed significantly in number of kernels/row in both seasons as shown in Table (4) .

The results indicated clearly the superiority of hybrid varieties in this trait over the composite variety Giza-2 .

In 1994 season, the three varieties could be arranged in descending order according to their number of kernels/row as follows :S.C.156, S.C.151 and Giza-2 .

Significant differences in number of kernels/row were found between S.C.156 and the other varieties as well as between Giza-2 and other varieties .

It could be concluded that S.C.156 gave the highest number of kernels/row when compared with the two tested varieties, namely S.C 151 and Giza-2 .

1995 season, the tested varieties showed the same arrangement in their number of kernels/row. S.C.156 was superior than the other two tested varieties and Giza-2 was the inferior in number of kernels/row. It could be concluded that hybrid varieties surpassed significantly the composite variety Giza-2 in number of kernels/row .

Similar results were reported by Ahmed (1989c), Mohamed and Shames (1991), Gouda *et al* (1992), Basha (1994), Aly *et al* (1996) and Atta-Allah *et al* (1996) .

6- Weight of 100 kernels in gm :

Results, presented in Table (4) show that the three evaluated varieties did not significantly differ in their weight of 100 kernels in the first season . In 1994 season, Giza-2 was superior to other varieties in grain index without significant differences between Giza-2, S.C.151 and S.C.156 whereas S.C.151 had the lowest grain index .

In 1995 season, Giza-2 was significantly superior to the other varieties in this trait, followed by S.C.151 .

The differences between S.C.151 and S.C.156 was not significant. Single cross 156 had the lowest grain index when compared with the other varieties .

It could be concluded that Giza-2 was at the tope of the tested varieties and S.C.156 was the worst variety, while S.C.151 was in between as for as grain index is compared .

The present results show marked differences in the genetical make up of the tested varieties and are in good agreement with those reported by EL-Hattab et al (1985) and Ahmed (1989c) .

7- Ears yield :

Data in Table (4) showed significant differences among the three tested maize varieties in the second season only.

In 1994 season, S.C.151 produced the highest ear yield (3416 kg/fed.) followed by S.C.156 (3209 kg/fed.) and Giza-2 (2742). However, all differences in ear yield in the first season were below the level of significance .

In 1995 season, different trend was observed whereas S.C.156 was the highest ear yield than S.C.151 and Giza-2 .

Significant differences were only found between S.C.156 and the two other varieties, whereas no difference was observed between Giza-2 and S.C.151 in ears yield . The present results are mainly due to the differences in the genetical make up of the evaluated varieties .

It could be concluded that the maize hybrids were superior to Giza-2 in ears yield .

8- Grain yield :

Results in Table (4) showed clearly that the tested varieties significantly and markedly differed in their productivity in thesecond season only .

In 1994 season, single cross 151 was the best variety with an excellent potentiality, followed by single cross 156 and Giza-2 in a descending order. Single cross 151 out yielded S.C.156 and Giza-2 by 7.37 and 23.83 % , respectively. No significant differences were detected between the three tested varieties in grain yield .

In 1995 season, single cross 156 was superior to the other varieties in grain yield followed by S.C.151 and Giza-2 in a descending order. S.C 156 out yielded S.C.151 and Giza-2 by 15.80 and 22.92 % , respectively . Significant differences were found in grain yield between S.C.156 and two other varieties as well as between Giza-2 and S.C.151 .

The present results show clearly the importance of growing high yielding single crosses as an effective tool for increasing maize grain yield .

The superiority of the hybrid varieties in general and the single cross in particular is mainly due to the increase in ear length , ear weight , number of rows/ear, number of kernels/ear, and weight of 100 kernels .

The superiority of growing hybrid maize varieties was also indicated by several investigators [Eraky *et al* 1980, Ahmed 1989c, Nigm 1989, Matta *et al* 1990, EL-Bialy *et al* 1991, Mohamed and Shames 1991, Gouda *et al* 1992, Shafshak *et al* 1994, Ibrahim *et al* 1995, Aly *et al* 1996, Atta-Allah 1996 and EL-Gezawy 1996] .

9- Straw yield :

The results in Table (4) show the differences in straw yield of the tested varieties . It is clear that the tested varieties significantly differed in their straw yield in both seasons .

In 1994 season, S.C.156 significantly surpassed the other two evaluated varieties followed by S.C.151 and Giza-2 in a descending order. Single cross 156 outyielded S.C.151 and Giza-2 by 375 and 1200 kg/ fed., respectively . Significant differences were found in straw yield between the three varieties under study .

In 1995, season a similar trend was also observed where S.C.156 outyielded S.C.151 and Giza-2 by 831 and 806 kg/fed., respectively . Significant differences were found in straw yield between S.C.156 and the other two varieties, whereas no significant differences was detected between S.C.151 and Giza-2 .

It could be concluded that S.C.156 was the best variety in the straw yield followed by S.C.151. The tow hybrids were superior to Giza-2 .

The results reported by Ahmed (1989c) indicated that maize varieties differed in straw yield .

10- Biological yield :

Biological yield of the three evaluated varieties is presented in Table (4). Significant differences in biological yield were recorded among the three tested maize varieties in both seasons .

In 1994 season, S.C.156 was at the top of all varieties followed by S.C.151and Giza-2 . It is clear that S.C.156 outyielded S.C.151 and Giza-2 by 173 and 1566 kg/ fed. , respectively .

In 1995 season, a similar trend was also observed where S.C.156 outyielded S.C.151 and Giza-2 by 1570 and 1814 kg / fed., respectively. There were significant differences in biological yield between S.C.156 and the other tow varieties, whereas no significant differences was detected between S.C.151 and Giza-2 varieties .

It could be concluded that maize varieties differed in biological yield and that hybrids were superior to Giza-2 .

These results were mainly due to the differences in plant height, ear length, ear weight and straw yield .

III- Chemical content of grain maize :

1- Nitrogen content of grain maize :

The results presented in Table (5) indicate that nitrogen content in grain of the three tested varieties showed no apparent differences in the second season only .

In 1994 season, Giza-2 gave the highest nitrogen percent in grain equal to 1.92 % followed by S.C.156 (1.72 %) and S.C.151 (1.67%) in descending order without significant differences between S.C.156 and S.C.151 .

In 1995 season, there were no significant differences between the three tested varieties . However Giza-2 showed higher grain content of nitrogen percent (1.79 %), whereas S.C.156 contained the lowest nitrogen percent 1.55 % and S.C.151 was in- between in nitrogen percent (1.65 %) in grain .

2- Phosphorus content in grain of maize :

Concerning phosphorus content in grain, there were no significant differences between the three studied varieties in both seasons. It could be concluded that the studied varieties did not differ in its grain phosphorus content.

Table (5) : Effect of varieties on some chemical contents of maize grains in 1994 and 1995 season .

Chemical content / Varieties	Nitrogen %	Phosphorous %	Potassium %	Protein %	Protein yield kg/fed.
1994					
Giza 2	**1.92 a**	**0.57 a**	**0.35 a**	**11.98 a**	**286.92 a**
Single cross 151	**1.67 b**	**0.70 a**	**0.38 a**	**10.44 b**	**312.10 a**
Single cross 156	**1.72 b**	**0.61 a**	**0.43 a**	**10.74 b**	**302.81 a**
1995					
Giza 2	**1.79 a**	**0.64 a**	**0.29 a**	**11.09 a**	**493.59 a**
Single cross 151	**1.65 a**	**0.56 a**	**0.28 a**	**10.32 a**	**490.29 a**
Single cross 156	**1.55 a**	**0.56 a**	**0.30 a**	**9.67 a**	**521.56 a**

3- Potassium content in grain of maize :

Potassium percent in the three tested varieties showed no apparent differences in both seasons of experimentation. However S.C.156 showed higher grain content of potassium percent in both seasons. All differences were too slight to reach the level of significance (Table 5). The differences in potassium content in different varieties of maize grains may be due to the differences in the genetical constitution .

4- Protein content in grain of maize :

Results presented in Table (5) show clearly that significant differences were detected among the three evaluated varieties in their protein content in grain in the first season only .

In 1994 season, Giza-2 showed the highest protein percent in grain being 11.98 % followed by S.C.156 (10.74 %) and S.C.151 (10.44%) without any significant differences between S.C.156 and S.C.151 .

In 1995 season, a similar trend was recorded where Giza-2 recorded the highest protein percent in grain being 11.9 % followed by S.C.151 (10.32%) and S.C.156 (9.67%). However, slight differences were observed which did not reach the level of significance .

This result is expected since nitrogen percent in grain was also significantly differed in the first season only. Whereas there were no significant differences between the three tested varieties in the second season .

Results reported by Tasi *et al* (1983) indicated that there were wide variation in kernels nitrogen sink. Also EL-Kalla *et al* (1985) and Gomaa (1985), Mahgoube (1987), Attia (1989), and Gouda (1989, observed that there were significant differences in protein percent between maize varieties and Giza-2 was higher than hybrids in this trait. On the other hand Salwau (1985), Fatma- Nofal (1994) and EL-Gezawy (1996) found that chemical content, namely, nitrogen, phosphorus, potassium percent were not affected by various maize varieties .

5- Protein yield kg/ fed. :

The results presented in Table (5) show that no significant differences were detected among the three evaluated varieties in their protein yield in both seasons. However, slight differences were observed where S.C.151 was at the top in the first season being 312.10 kg/ fed. followed by S.C.156 (302.8 kg/fed.) and Giza-2 (286.92 kg/fed.), respectively .

In the second season, S.C.156 gave the highest protein yield equal to 521.56 kg/fed. followed by Giza-2 (493.59) and S.C.151 (490.29 kg/fed.), respectively .

The results reported by Salwau (1985) indicated that the differences between the tow varieties i.e. pioneer 514 and Giza-2 in protein yield/ fed. was not significant in both seasons .

B- Effect of nitrogen fertilizer on :

I- Growth characters of maize plants :

1- Plant height :

Results show in Table (6) indicate that plant height of maize was significantly affected by nitrogen fertilizer levels in the second season only.

In 1994 season, plant height insignificantly increased with the increase in nitrogen levels up to 120 kg/feddan . Increasing nitrogen levels from 0 to 30,60,90 and 120 kg/fed. caused an increase in plant height of about 10,11.8,14.2 and 30.2 cm, respectively but did not reach the 5 % level of significance.

Similar results were obtained in 1995 season where the increases in plant height were 6.1,10.1,21.8 and 24.4 cm., respectively due to the application of 30,60,90 and 120 kg N/fed. when compared with the control treatment . The differences between the averages of 90 and 120 kg N/fed. was not significant .

It is clear that the plant height of maize increased by increasing nitrogen application up to 90 Kg N/feddan. Further increase in nitrogen application was not profitable.

The increase in maize plant height with the increase in nitrogen application may be attributed to the increase in meristimatic activity which are induced by nitrogen application, and this contribute to the increase in the number of cell in maize stem .

Table (6) : Effect of nitrogen fertilizer levels on some growth characters of maize plants in 1994 and 1995 season .

Characters / N. levels kg/fed	plant height (cm)	Ear height (cm)	Stem diameter (cm)	No. of leaves/ plant	Area of topmost ear leaf (dcm)	Days to 50% tasseling	Days to 50% silking
1994							
0 (Control)	**217.2 a**	**114.2 d**	**2.10 d**	**15.40 c**	**607.9 d**	**53.3 a**	**56.8 a**
30	**227.2 a**	**119.2 c**	**2.20 c**	**14.70 b**	**625.4 c**	**53.7 a**	**57.2 a**
60	**229.0 a**	**21.0 bc**	**2.30 bc**	**15.80 b**	**635.7 bc**	**53.9 a**	**57.1 a**
90	**231.4 a**	**123.1 ab**	**2.40 ab**	**16.00 a**	**642.8 ab**	**53.8 a**	**57.5 a**
120	**247.4 a**	**124.3 a**	**2.40 a**	**16.20 a**	**652.2 a**	**54.2 a**	**57.8 a**
1995							
0 (Control)	**198.4 c**	**105.7 d**	**2.06 d**	**14.10 c**	**534.4 d**	**53.8 b**	**57.2b**
30	**204.5 b**	**10.8 c**	**2.08 c**	**14.30 bc**	**559.6 c**	**54.0 b**	**57.2 b**
60	**208.5 b**	**2.9bc**	**2.13 bc**	**14.50 b**	**89.9 b**	**54.1 b**	**57.3 b**
90	**220.2 a**	**16.4 ab**	**2.18 b**	**14.70 a**	**03.4 ab**	**54.1 b**	**57.4b**
120	**222.8 a**	**118.8 a**	**2.30 a**	**14.80 a**	**11.7 a**	**55.2 a**	**58.6 a**

Similar results were obtained by EL-Hattab *et al*, Eraky *et al*, and Koraim *et al* (1980) ; Shafshak *et al* (1981) ; Abdel-Gawad *et al*, Faisal and Salem *et al* (1983) ; Moursi *et al* (1983); Gomaa (1985) ; Abdel-Aziz, EL-Agamy *et al*, Khedr and Mourad *et al* (1986) ; Abdel-Aziz (1987) ; Ahmed(a), Gouda and Salamah *et al* (1989) ; Ahmed, EL-Noemani *et al* (1990) ; Khalil, Nawar *et al* (1992) ; EL-Sheikh, Salwau (1993) ; Abdel-Samie, Ali *et al*, Mokadem and Salem, Younis *et al* (1994) and Aly (1996) who noticed that plant height of maize gradually increased as the rate of nitrogen increased up to 120 kg N/feddan .

2- Ear height :

Results in Table (6) show clearly that ear height was significantly increased with the increase in nitrogen levels from 0 to 30,60,90 and 120 Kg N/fed. in both seasons of experimentation .

In 1994 season, applying nitrogen at 30,60,90, and 120 Kg N/fed. resulted in significant increases in ear height by 5.0, 6.8,8.9, and 10.1 cm over the control treatment, respectively.

The corresponding increases in 1995 season were 5.1, 7.2, 10.7, and 13.1 cm, respectively for 30, 60, 90 and 120 kg N/ fed. over the control treatment . It is clear that the role of nitrogen in increasing ear height was more evident in 1995 when compared with 1994 season . The present results are expected since maize plant height was markedly influenced by the increase in nitrogen level .

Similar results were also obtained by EL-Kassaby and EL-Kalla (1981); EL-Agamy *et al* and Khedr (1986); Ahmed (a), EL-Hossary and Salwau, Salamah *et al* (1989); Younis *et al* (1990); Mahgoub *et al*

(1991); Nawar *et al* (1992); EL-Sheikh *et al* , Salwau (1993); Ali *et al*, Mokadem and Salem, Shafshak *et al* (1994) and EL-Gezawy (1996) .

3- Stem diameter :

Results in Table (6) indicate that stem diameter of maize was significantly affected by nitrogen fertilizer level .

In 1994 season, stem diameter increased with the increase in nitrogen levels up to 120 Kg N/feddan. Increasing nitrogen application from 0 to 30, 60, and 90 Kg N/fed. caused an increase of about 0.1,0.2 and 0.3 cm in stem diameter, respectively in 1994. Further increase in nitrogen application did not show any increase in stem diameter when compared with 90 Kg N/feddan.

In 1995 season, the differences between the average values of stem diameter were significant due to the nitrogen levels. These increases were of about 0.02, 0.07, 0.12, and 0.24 cm, respectively due to the application of 30, 60, 90 and 120 kg N/ fed. when compared with the control treatment . Stem diameter in 1995 responded positively to nitrogen application up to 120 Kg N/fed. The increase in maize stem diameter with the increase in nitrogen application may be attributed to the increase in meristemic activity .

Many investigators found similar results [Salem et al ,1983; EL-Agamy et al, and Mourad; 1986; Abdel-Aziz ,1987; Ahmed, 1989a; Mokadem and salem, 1994] .

4- Number of leaves/plant :

The effect of nitrogen levels on number of leaves in maize plant, illustrated in Table (6) was significant . The number of leaves/plant increased with the increase in nitrogen levels up to 120 Kg N/fed. without significant differences between 90 and 120 Kg N/fed. in both seasons .

In 1994 season, number of leaves/plant was 15.4,15.7,15.8,16.0 and 16.2 for 0,30,60,90, and 120 Kg N/fed., respectively

In 1995 season, plant received 0.30,60,90 and 120 Kg N/fed. produced 14.1,14.3,14.5,14.7 and 14.8 leaf/plant, respectively with significant differences between zero and other levels .

It is clear that number of leaves/plant in maize responded significantly and positively to higher levels of nitrogen up to 90 Kg N/feddan .

The increase in number of leaves/ maize plant due to nitrogen application is mainly due to the role of nitrogen in encouraging meristimatic tissues in maize plants. Number of leaves could be considered an external expression of the meristimic activity in plants.

These results coincide with those obtained by Shafshak *et al* (1981); Abdel-Gawad *et al* (1987); Ahmed (1989a); EL-Hosary and Sedhom (1989); EL-Noemani *et al* (1990); EL-Ashmony *et al* (1991); Khalil and Nawar *et al* (1992); Younis *et al* (1994); Hassan and Ibrahim *et al* (1995) and EL-Gezawy (1996) .

5- Area of the topmost ear leaf :

Results in Table (6) show that the increase in nitrogen levels significantly increased the area of topmost ear leaf in both seasons .

In 1994 season, applying nitrogen equal to 30,60,90 and 120 Kg N/red. significantly increased leaf area over the check treatment by 17.5, 27.8, 34.9 and 44.3 cm, respectively. The corresponding increase being 25.2,55.5,69.0 and 77.3 cm per plant in 1995 season for the respective nitrogen levels. The present results are good evident for the role of nitrogen in plant life. Encouraging vegetative growth of maize plant expressed in terms of a marked increase in leaf area is a good manifestation of the role of nitrogen as an essential element for all plant growth particularly cereals .

The present results are in agreement with those reported by Shafshak *et al* (1981); Abdel-Gawad *et al*, Faisal, Salem *et al* (1983); EL-Agamy *et al*, Kheder and Mourad *et al* (1986); Abdel-Aziz, Ahmed (1989a), Gouda, Salamah *et al* (1989); Ahmed (1990); Nawar *et al* (1992); EL-Sheikh (1993); Amin, Nofal, Shafshak *et al* and Younis *et al* (1994) and EL-Gezawy (1996) .

6- Days to 50% tasseling :

Results in Table (6) show that the increase in nitrogen levels caused a significant increase in number of days to 50% tasseling in the second season .

In 1994 season, applying nitrogen at 30,60,90 and 120 Kg N/fed. recorded insignificant increase in the number of days to 50% tasseling of about 0.4, 0.6, 0.5 and 0.9 days when compared with the check treatment, respectively .

In 1995 season, the increase in number of days to 50% tasseling were 0.2,0.3,0.3, and 1.4 days due to applying nitrogen levels at

30,60,90 and 120 kg N/fed., respictively when compared with the control treatment. The differences between the average of 30,60 and 90 kg N/fed. was not significant .

It could be concluded that high nitrogen application delay tasseling in maize . Similar results were reported by Hassan (1995) .

7- Days to 50% silking :

The results in Table (6) show that the increase in nitrogen levels resulted in a significant increase in number of days to 50% silking in the second season only .

In 1994 season, applying nitrogen at 30,60,90 and 120 kg N/fed. caused a slight increase in days to 50% silking being 0.4,0.3,0.7 and 1.0 days, respectively when compared with control treatment. However all these increases were below the level of significance .

In 1995 season, applying nitrogen at 30,60,90 and 120 kg N/fed. significantly increased number of days to 50% silking by 0.0,0.1,0.2 and 1.4 days, respectively when compared with the check treatment without significant differences between 30,60, and 90 Kg N/feddan.

These results are in good agreement with those obtained by Hassan (1995) and differed with the findings of EL-Hattab *et al* (1980); Abdel-Gawad *et al* (1983 and 1986); Mohamed and Mourad *et al* (1986); Abdel-Aziz (1987); Matta *et al* (1990); Mahgoub et al (1991); Gouda *et al* (1992); El-Sheikh(1993); Younis *et al* (1994); Abdullah and Amer *et al* (1995) and El-Gezawy (1996) .

II- Yield and yield components :

1- Ear length :

Results presented in Table (7) show that nitrogen resulted a significant increases in ear length in both seasons .

In 1994 season, increasing nitrogen levels from 0 to 30,60,90 and 120 kg/fed. caused a significant increase in ear length by 0.6,1.4,1.6 and 3.6 cm, respectively when compared with the control treatment .

In 1995 season, the corresponding increases were 1.2, 2.4, 2.7 and 3.1 cm. for the same respective nitrogen levels . It is clear that an increase in ear length was recorded with each increase in nitrogen level in both seasons .

This result is a good manifestation for the role of nitrogen as an essential element in building maize ears. The increase in ear length is mainly due to the positive effect of nitrogen on the growth of maize which in turn is reflected on the yield components .

Many investigators found similar results [Shafshak *et al* (1981; Abdel-Gawad et al (1983 and 1984); Salwau (1985); Kamel *et al* and Khedr (1987); Salamah *et al* (1988); Gouda 1989; Ahmed (1989b); Younis *et al* (1990); Dawood *et al* and Nawar (1992); Mohamed and Salwau (1993); Abd-ELsamie, Ali *et al* and Mokadem and Salem (1994); Ibrahim *et al* and Soliman *et al*(1995); Aly *et al* and EL-Gezawy (1996)].

2- Ear diameter :

Results, illustrated in Table (7) indicate that ear diameter significantly increased only in the second season by increasing nitrogen levels up to

Table (7) : Effect of nitrogen fertilizer levels on yield and yield components of maize plants in 1994 and 1995 seasons .

Characters / Nitrogen levels	Ear Length (cm)	Ear diameter (cm)	Ear Weight (g)	No. of rows/ ear	No. of Kernels per row	100 Kernels weight (g)	Ears yield kg / fed.	Grain yield kg / fed.	Straw yield kg / fed.	Biological yield kg / fed.
					1994					
0 (Control)	16.8 d	4.4 a	177.7 e	13.5 a	33.8 d	32.2 d	2370. e	2029. e	3383. e	5415. e
30	17.4cd	4.4 a	208.5 d	13.6 a	36.1 c	35.0 c	2905. d	2501. d	3717. d	6214. d
60	18.2bc	4.7 a	218.1 c	14.0 a	37.8 b	35.9 b	3168. c	2729. c	4000. c	6214. c
90	18.4 b	4.8 a	237.8 b	14.2 a	38.6 ab	36.3 ab	3509. b	3033. b	4350. b	7382. b
120	20.4 a	5.1 a	247.6 a	14.2 a	39.2 a	36.8 a	3663. a	3206. a	4900. a	8100. a
					1995					
0 (Control)	15.2 d	4.3 c	180.2 e	13.2 d	32.7 d	33.1 c	4345. e	3730. e	4892. e	8617. e
30	16.4 c	4.5 b	206.0 d	13.6 c	36.4 c	34.5 b	5082. d	4475. d	5467. d	9940. d
60	17.6 b	4.6 ab	220.6 c	13.8 bc	38.2 b	35.4 b	5668. c	4848. c	5800. c	10645. c
90	17.9ab	4.6 ab	237.4 b	14.0 ab	39.0 ab	36.4 a	6087. b	5265. b	6367. b	11631. b
120	18.3 a	4.6 a	252.9 a	14.3 a	39.9 a	36.8 a	6636. a	5785. a	6825. a	12605. a

60 kg N/fed., whereas there was no significant differences in ear diameter in the first season .

In 1994 season, applying nitrogen fertilizer at 0,30,60,90, and 120 kg N/fed. increased ear diameter by 0.0, 0.3, 0.4, and 0.7 cm., respectively. The differences did not reach the level of significance at 5% level .

In 1995 season, increasing nitrogen levels from 0 to 30, 60, 90 and 120 kg/ fed. caused an increase in ear diameter of about 0.2,0.3,0.3 and 0.3cm., respectively with significant differences between zero and the other levels .

The differences between the average of 60,90 and 120 kg N/fed were not significant .

It is clear that nitrogen application resulted in a significant increase in ear size which is the fundamental component of grain yield. This result is mainly due to the encouraging effect of nitrogen on the vegetative growth of maize plant .

Similar results were also reported by EL-Hattab *et al* (1980); Shafshak *et al* (1981); Salwau (1985); EL-Agamy *et al* and Mohamed (1986); Abdel-Aziz (1987); Salamah *et al* (1988); Ahmed (1989b); EL-Noemani *et al* and Younius *et al* (1990); Dawood *et al*, Gouda and Nawar *et al* (1992); Mohamed, Salwau (1993); AbdEL-Sanie, Amin, Mokadem and Salem, Nofal and Shafshak *et al* (1994); Ibrahim *et al*, Soliman *et al* (1995); Aly *et al* and EL-Gezawy (1996) .

3- Ear weight :

The results presented in Table (7) show clearly that ear weight significantly increased with each increase in nitrogen level in both seasons. The application of 30,60,90 and 120 kg N/fed. significantly increased ear weight over the check treatment by 30.4, 40.4, 60.1 and 69.9 gm., respectively in 1994 season .

In 1995 season, the increases were 25.8,40.4,57.0 and 72.7 gm. for the respective nitrogen levels. It is evident from Table (7) that the increases in ear weight by each increment in nitrogen level reached the level of forming and building up heavy maize ears which in turn is reflected in an increase in maize grain yield. The increase in ear weight is mainly due to the increase in ear length, ear diameter, number of kernels/row, and weight of 100-kernel resulting from a good supply of nitrogen fertilizer .

The results are in a good agreement with those reported by Salem *et al* (1982); Abdel-Aziz (1986); Gouda (1989); EL-Noemani *et al* (1990); Mokadem and Salem, Shafshak *et al* (1994); Aly *et al* and EL-Gezawy (1996) .

4- Number of rows /ear :

Results, illustrated in Table (7) show that the increase in nitrogen level caused an increase in number of rows/ear in both seasons. This increase was only significant in one year out of two the season.

In 1994 season, applying nitrogen at 30,60,90, and 120 kg/fed. increased number of rows/ear by 0.1, 0.5, 0.7, and 0.7 row, when compared with the control treatment. However all these increases were below the level of significance. It could be concluded that the number of rows/ear is a trait which is not greatly affected by nitrogen application as the other yield component characters, showing a great genetical effect on this trait .

In 1995 season, the application of 30,60,90, and 120 kg N/fed. increased the number of rows/ear by 0.4, 0.6, 0.8 and 1.1 row/ear, respectively over the check treatment. The significant increase were detected between each of zero and 90 kg N/fed. and 30 and 120 kg N/fed. levels . It could be concluded that the number of rows/ear significantly increased by increasing nitrogen level up to 120 kg N/fed. only in the second season .

The results of the second season coincide with those reported by EL-Agamy et al (1986); Ahmed (1989b); EL-Noemani et al (1990); Dawood et al and Nawar et al (1992); Salwau (1993); Shafshak et al (1994) and EL-Gezawy (1996); On the other hand Shafshak (1981); Salwau (1985); Mohamed (1986); Salamah et al (1988); EL-Hosary and Sedhom (1989); Younis et al (1990); Selim and EL-Sergany, and Soliman et al (1995) who found that nitrogen application had no significant effect on number of rows/ear, in line with the finding of the first season .

5- Number of kernels/row :

Results, illustrated in Table (7) indicate that the number of kernels/row of maize ear was significantly affected by the nitrogen fertilizer levels under study in both seasons .

In 1994 season, the number of kernels/row increased with the increase in nitrogen levels up to 120 Kg N/feddan. Increasing nitrogen levels from 0 to 30,60,90 and 120 Kg N/fed. caused increases of about

2.3, 4.0, 4.8 and 5.4 kernel, respectively compared with the check treatment .

Similar results were obtained in 1995 season, where the increase in number of kernels/row were 3.7, 5.5, 6.3 and 7.2 kernel due to the application of 30,60,90 and 120 Kg N/fed., respectively with significant differences between zero and other levels. The difference between the 90 and 120 levels was not significant .

It could be concluded that the number of kernels/row of ear increased by increasing nitrogen application up to 90 Kg N/feddan.

The increase in number of kernels/row with the increase in nitrogen application may be attributed to the increase in ear length .

These results agree with those obtained by Salwau (1985); Mohamed (1986); Abdel-Aziz and Reiad *et al* (1987); Salamah *et al* (1988); EL-Hosary and Salaw, EL-Hosary and Sedhom (1989); EL-Noemani *et al* (1990); Dawood *et al,* Gouda, Khalil, Nawar *et al* (1992); EL-Sheikh, Mohamed, Salwau (1993); Abdel-Sami, Amin, Mokadem and Salem, Shafshak *et al* (1994); Abdullah, Hammam, Selim and EL-Sergany, Soliman *et al* (1995) and EL-Gezawy (1996), who found that nitrogen application increased number of kernels/row in maize ear .

6- Weight of 100- kernel :

Results in Table (7) show that the increase in nitrogen leaves significantly influenced the 100-kernel weight in both seasons of experimentation.

In 1994 season, applying nitrogen at 30,60,90 and 120 Kg N/fed. increased significantly the 100-kernel weight by 2.8, 3.7, 4.1 and 4.6 gm., respictively when compared with the check treatment .

In 1995 season, nitrogen levels increased 100-kernel weight over the control treatment by 1.4, 2.3, 3.3 and 3.7 gm. when plants received 30, 60, 90 and 120 Kg N/ fed., respectively

The differences between 90 and 120 Kg N/fed. was not significant. The differences in grain index among the different nitrogen levels were almost significant. The present results indicate clearly that nitrogen application induced an increase in grain plumbness of maize showing the major role of this vital nutritive element. The increase in nitrogen application encourages the metabolic efficiency which contributes to the increase in the metabolites, most of which is consumed in grain filling.

Similar results were reported by EL-Hattab *et al*, Koraiem *et al* (1980); Abdel-Gawad *et al* (1983 and 1984); Abdel-Aziz, EL-Agamy *et al* and Mohamed (1986); Abdel-Aziz, Reiad et al (1987); Salamah *et al* (1988); EL-Hosary and Salwau (1989); EL-Noemani *et al* (1990); Dawood *et al*, Gouda, Khalil (1992); EL-Sheikh, Mohamed, Salwau (1993); Abdel-Samie, Mokadem and Salem, Shafshak *et al* (1994); Abdullah, Selim and EL-Sergany (1995); Aly *et al* and EL-Gezawy (1996) .

7-Ears yield :

The effect of nitrogen levels on ears yield, illustrated in Table (7) was significant .

In 1994 season, the ears yield increased with the increase in nitrogen level up to 120 kgN/fed. The increases in ears yield/fed. were 22.7, 33.68, 48.9 and 54.56 % for 30,60,90 and 120 kgN/fed., respectively .

In 1995 season, the plants received 0, 30, 60,90 and 120 Kg N/fed. increased maize ears yield over the control with about 16.96, 30.45, 40.07 and 52.72 %, respectively .

It is clear that maize plants responded significantly and positively to higher levels of nitrogen up to 120 Kg N/feddan. The increase in maize ears yield resulted from the increase in ear length, ear diameter, weight of ears and number of rows/ear .

These results coincide with those obtained by Salwau (1985); Abdel-Aziz (1986); EL-Hosary and Salwau (1986); EL-Noemani et al (1990) and Abdullah (1995); who found that the highest ears yield in maize was obtained by applying 120 Kg N/feddan .

8- Grain yield :

Grain yield of maize as affected by nitrogen application is represented in Table (7). It was significantly and consistently increased by increasing nitrogen levels up to 120 Kg N/fed. in both seasons .

In the first season, the grain yield increased by 23.26, 34.50, 49.48 and 58.00 % when maize plants received 30,60,90 and 120 Kg N/fed., respictively over the control treatment (Table 7) .

Similar results were noticed in 1995 season by increasing nitrogen levels from 0 to 30,60,90 and 120 Kg N/fed. the grain yield increased with about 19.98, 29.97, 41.15 and 55.09 %, respectively .

It could be concluded that the grain yield of maize significantly increased with the increase in nitrogen level up to 120 Kg N/feddan. The increase in grain yield due to increasing nitrogen level is attributed to the increase in ear length, ear diameter, ear weight, number of rows/ear, number of kernels/row, weight of 100 kernel and ears yield/ feddan .

These results are in good agreement with those recorded by Shafshak *et al* (1981); Abded-Gawad *et al* (1983 and 1984); Gomaa (1985); Kamel *et al* , Mohamed (1986); Abdel-Aziz (1986 and 1987); Abdel-Hadi *et al*, Reiad *et al* (1987); Salamah *et al* (1988); EL-Hosary and Sedhom, Gouda, Mikhail *et al* (1989); Ahmed (1989b); EL-Noemani *et al*, Matta *et al*, Younis *et al* (1990); Dawood *et al*, Gouda, Khalil, Nawar *et al* (1992); Gouda, Salwau (1993); Abdel-Samie, Ali *et al*, Amin, Mokadem and Salem, Nofal, Shafshak *et al*, Younis *et al* (1995); Aly *et al* and El-Gezawy (1996) .

9- Straw yield :

Straw yield of maize as affected by nitrogen application is represented in Table (7). It was significantly and consistently increased by increasing nitrogen levels up to 120 Kg N/fed. in both seasons .

In 1994 season, The straw yield increased by 334, 617, 967 and 1517 kg/fed. due to the nitrogen levels equal to 30,60,90 and 120 Kg N/fed., respectively over the control .

Similar response was noticed in 1995 season when applying nitrogen levels to maize plants at 30, 60, 90 and 120 Kg N/fed. caused an increase of 575, 1008, 1475 and 1933 kg/fed., respectively over the unfertilized treatment .

It could be concluded that the straw yield of maize was significantly increased with the increase in nitrogen application to maize plants .

The increase in straw yield attributed to the increase in nitrogen levels is mainly due to the increase in the plant height, number of leaves/plant and leaf area (Table 6) .

These results coincide with those obtained by Abdel-Aziz (1987); EL-Noemani *et al* (1990); Amin, Mokadem and Salem (1994) and Abdullah (1995) .

10- Biological yield :

Results shown in Table (7) indicate that biological yield of maize was significantly affected by nitrogen fertilizer levels .

In 1994 season, biological yield increased with the increase in nitrogen levels up to 120 Kg N/fed. Increasing nitrogen application from 0 to 30,60,90 and 120 Kg N/fed. caused an increase of about 799, 1613, 1967 and 2685 kg/fed., in straw yiel, respectively .

Similar results were obtained in 1995 season where the increases in biological yield were 1323, 2028, 3014 and 4088 kg/fed. due to the application of 30,60,90 and 120 Kg N/fed. when compared with the control treatment .

It could be concluded that biological yield of maize increased by increasing nitrogen application up to 120 Kg N/feddan . The increase in biological yield due to the increase in nitrogen levels is mainly attributed to the increase in plant height, ear height, ear length, ear weight, number of kernels/row 100- grain weight and grain yield .

These results are in good agreement with those recorded by Salamah et al (1988); Ahmed (1989b) and Amin (1994) .

III- Chemical content

1- Nitrogen content in grain of maize :

Results presented in Table (8) show clearly that the increase in nitrogen level resulted in a significant increase in nitrogen percentage in maize grain in both seasons of experimentation .

In 1994 season, applying nitrogen at 30,60,90, and 120 Kg N/fed. caused a significant increase in nitrogen percentage in grain over the control treatment by 0.18, 0.26, 0.32 and 0.37 %, respectively.

In 1995 season, the four respective nitrogen levels induced significant increase in nitrogen percentage of 0.14, 0.18, 0.21 and 0.28 %, respectively .

This results is in agreement with those reported by Shafshak *et al* (1981); Salem *et al* (1983); Asghari and Hanson (1984); Salwau (1985); Abdel-Aziz *et al* (1986); Mohamed (1986); Moll (1987); Salamah *et al*

Table (8) : Effect of Nitrogen fertilizer levels on chemical contents of maize grain in 1994 and 1995 seasons .

Chemical content / Nitrogen Levels kg/ fed.	Nitrogen %	Phosphorus %	Potassium %	Protein %	Protein Yield (kg / fed.)
1994					
0 (Control)	1.54 d	0.44 c	0.29 d	9.64 d	196.19 d
30	1.72 c	0.54 c	0.36 c	10.76 c	268.08 c
60	1.80 b	0.66 b	0.38 c	11.26 b	305.45 bc
90	1.86 ab	0.72 ab	0.42 b	11.65 ab	351.73 ab
120	1.91 a	0.77 a	0.48 a	11.95 a	381.60 a
1995					
0 (control)	1.50 c	0.84 d	0.24 e	9.39 c	348.44 c
30	1.64 b	1.11 c	0.26 d	10.22 b	453.44 bc
60	1.68 b	1.21 b	0.28 c	10.49 b	510.17 b
90	1.71 ab	1.30 ab	0.31 b	10.63 ab	557.66 ab
120	1.78 a	1.38 a	0.36 a	11.08 a	639.35 a

(1988); Khalil (1992); Randy and Demtio (1992); Nofal (1994); Scelhgel and Havlin (1995) and EL-Gezawy (1996) .

2- Phosphorus content in grain of maize :

Results presented in Table (8) show that the effect of nitrogen fertilizer on phosphorus content in grain was significant in both seasons where a marked increase in phosphorus percent was induced due to the increase in nitrogen fertilizer levels .

In 1994 season, applying nitrogen at 30,60,90, and 120 Kg N/fed. significantly increased phosphorus percent in grain over the control treatment by 0.10, 0.22, 0.28 and 0.33 %, respectively .

Similar results were obtained in 1995 season where the increase in phosphorus percent were 0.27, 0.37,0.46 and 0.54 % due to the application of 30,60,90, and 120 Kg N/fed., respectively when compared with the control treatment without significant differences between 90 and 120 Kg N/feddan .

It could be concluded that phosphorus percentage of grain maize increased by increasing nitrogen application up to 90 Kg N/fed. Further increase in nitrogen application did not cause any significant increase in phosphorus percentage .

Results reported by EL-Gezawy (1996) showed that nitrogen application increased nitrogen content in maize grain as well as phosphorus and potassium especially on soils well supplied with these element .

3- Potassium content in grain :

The increase in nitrogen application levels significantly increased potassium percentage (K%) in grain in both seasons of experimentation (Table 8) .

In 1994 season, applying nitrogen at 30,60,90 and 120 Kg N/fed. caused an increase in potassium percentage in grain by 0.07, 0.09, 0.13 and 0.19 %, respectively when compared with the check treatment .

In 1995 season, increases in potassium percentage of 0.02, 0.04, 0.07 and 0.12 % were recorded for the respective levels of nitrogen .

All differences in potassium percentage among the different nitrogen levels were significant indicating an important role of nitrogen on potassium content in grain. The present results may be due to the increase in the other major element, brought about by the good supply of nitrogen as well as to the positive effect of nitrogen on maize growth which encouraged greater uptake of the available macro nutrient elements.

Similar results were obtained by Fatma- Nofal (1994) and EL-Gezawy (1996) who showed that a higher nitrogen level caused a significant increase in nitrogen, phosphorus and potassium percentage in maize yield.

4- Protein content in grain :

The increase in nitrogen level significantly increased protein content in maize grain in both seasons of experimentation as shown in Table (8).

In 1994 season, applying nitrogen at 30,60,90 and 120 Kg N/fed. significantly increased protein percentage by 1.12, 1.62, 2.01 and 2.31 %, respectively when compared with the control treatment.

The corresponding increases in 1995 season for the respective nitrogen levels were 0.83, 1.10, 1.24 and 1.69 %.

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 on increasing nitrogen content in maize grains.

Similar results were also reported by Faisal (1983); Abdel-Gawad *et al* (1986); Mahgoub (1987); Dawood *et al* (1992); Amin (1994); Fatma Nofal (1994); Selim and EL-Sergany (1995) and EL-Gezawy (1996).

5- Protein yield kg/feddan :

The results presented in Table (8) show the effect of nitrogen levels on protein yield where the increase in nitrogen application level significantly increased protein yield on both seasons of experimentation.

In 1994 season, applying nitrogen at 30,60,90 and 120 kg/fed. increased protein yield by 71.89, 109.26, 155.54 and 195.41 kg/fed., respectively when compared with the check treatment.

In 1995 season, the respective nitrogen levels induced increases in protein yield by 105.00, 161.73, 209.22 and 291.91 Kg N/feddan.

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 on increasing nitrogen and protein content in grain as well as the grain yield of maize (Tables 7 and 8).

Similar results were reported by EL-Gezawy (1996) who found that a higher nitrogen level caused a significant increase in protein yield/fed. of maize in both seasons.

C- Effect of interaction between maize varieties and nitrogen fertilization :

The analysis of variance of the present results show that maize varieties x nitrogen levels had no significant effect on growth and ear characters as well as grain yield, its components and chemical analysis of maize grain expect on ears yield, grain yield, biological yield, nitrogen percentage, protein percent in maize grain and protein yield kg/fed. in 1994 season as well as days to 50 % tassling and ear weight in 1995.

1- Ears yield :

Concerning the effect of interaction between maize varieties and nitrogen levels on ears yield. It is clear that ear yield was significantly affected by the interaction between varieties x nitrogen levels in the first season (Table 9).

The highest ears yield (3948.0 kg/fed.) was obtained from S.C.151 with 120 Kg N/fed. Whereas the lowest ears yield (2286 kg) was recorded when Giza-2 variety without N fertilization.

Table (9) : Effect of Interaction between maize varieties and nitrogen fertilizer levels on ears yield in 1994 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	2286. k	2650.0 i	2128.0 l
30	2524. j	3092.0 f	3099.0 f
60	2776.0 h	3504.0 d	3224.0 e
90	2936.0 g	3843.0 b	3747.0 c
120	3188.0 e	3948.0 a	3848.0 b

Table (10) : Effect of Interaction between maize varieties and nitrogen fertilizer levels on grain yield in 1994 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	1988.7 n	2267.3 l	1831.2 o
30	2171.8 m	2667.7 i	2665.9 j
60	2368.4 k	3040.4 e	2776.6 h
90	2797.7 g	3273.9 b	3225.9 d
120	2812.6 f	3534.3 a	3269.7 c

2- Grain yield :

The results in Table (10) indicated that grain yield was significantly affected by the interaction between maize varieties and nitrogen levels in first season .

The highest grain yield (3534.3 kg/ fed.) was obtained from S.C.151 and 120 Kg N/fed. Whereas the lowest value (1831.20 kg/ fed.) was produced from single cross 156 without N fertilizer .

3- **Biological yield**

Concerning the effect of interaction between maize varieties and nitrogen levels on biological yield in 1994 season (Table 11), the highest biological yield (8982) kg/ fed. was obtained from S.C. 156 with 120 kg N/ fed. whereas the lowest biological yield (4792 kg/fed.) was recorded when Giza-2 variety with zero level of nitrogen.

4- Nitrogen percentage in grain of maize :

Giza-2 given 120 kg N/fed. nitrogen produced the highest nitrogen percentage (1.98%). On the other hand S.C.156 without nitrogen application produced the lowest value (1.31%) (Table 12) .

5- Protein percentage in grain maize :

The interaction between maize varieties and nitrogen levels showed significant effect on protein percentage in the first season only .

The results, illustrated in Table (13) indicate that highest protein percent (12.38 %) was obtained by Giza-2 and 120 Kg N/fed. Whereas S.C.156 produced the lowest value (8.18 %) at zero level of nitrogen fertilizer .

Table (11) : Effect of Interaction between maize varaieties and nitrogen fertilizer levels on biological yield in 1994 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	4792 n	5945 j	5508 l
30	5272 m	6618 h	7652 e
60	5715 k	7232 f	7248 f
90	6195 i	7700 d	8250 c
120	6938 g	8380 b	8982 e

Table (12) : Effect of Interaction between maize varaieties and nitrogen fertilizer levels on nitrogen percentage in maize grains in 1994 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	1.83 cd	1.49 g	1.31 h
30	1.84 bcd	1.62 f	1.70 e
60	1.96 a	1.63 f	1.81 d
90	1.97 a	1.74 e	1.88 bc
120	1.98 a	1.87 bc	1.89 b

Table (13) : Effect of Interaction between maize varaieties and nitrogen fertilizer levels on protein percentage in 1994 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	11.44 cd	9.30 g	8.18 h
30	11.50 bcd	10.16 f	10.62 e
60	12.25 a	10.19 f	11.33 d
90	12.31 a	10.88 e	11.75 bc
120	12.38 a	11.67 bcd	11.81 b

Table (14) : Effect of Interaction between maize varaieties and nitrogen fertilizer levels on protein yield in 1994 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	227.73 h	209.9 h	150.9 i
30	249.6 gh	270.6 fg	284.1 efg
60	292.1 efg	310.4 def	313.9 cdef
90	318.7 cde	357.2 bc	379.2 ab
120	346.4 bcd	412.4 a	385.7 ab

6- Protein yield :

The results in Table (14) indicate that protein yield was significantly affected by the interaction between maize varieties and nitrogen levels in the first season only .

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The highest value (412.4 %) was produced when S.C.151 received 120 Kg N/fed. On the other hand single cross 156 without nitrogen fertilizer produced the lowest value (150.9 %).

7- Number of days to 50 % tasseling :

In the second season (1995) the number of days to 50 % tasseling was significantly affected by the interaction between maize varieties and nitrogen levels .

The highest value (61.2 days) was obtained by S.C.156 without any nitrogen application . Whereas Giza-2 given 90 Kg N/fed. gave the lowest value (53.2 days). It is obvious that Giza-2 with 90 kg N fertilizer gave the earlier tasseling plants

8- Ear weight :

The interaction between maize varieties and nitrogen levels showed significant effect on ear weight in the second season only (1995). Where the highest ear weight (265.3 gm) was obtained by S.C.156 fertilized with 120 Kg N/fed. On the other hand Giza- 2 without nitrogen fertilizer gave the lowest value (163.7 gm) (Table 16) .

Table (15) : Effect of Interaction between maize varaieties and nitrogen fertilizer on number of days to 50% tasseling in 1995 season.

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	58.5 e	59.5 d	61.2 a
30	54.8 h	57.5 f	60.0 c
60	54.8 h	57.0 g	60.0 c
90	53.2 i	58.2 e	60.2 c
120	53.5 i	57.8 f	60.8 b

Table (16) : Effect of Interaction between maize varaieties and nitrogen fertilizer levels on ear weight (gm) in 1995 season .

Maize varieties / Nitrogen levels Kg/Fed	Giza - 2	Single Cross 151	Single Cross 156
0 (control)	163.7 k	199.2 h	177.7 j
30	185.2 i	207.8 g	225.0 ef
60	209.1 g	213.6 g	239.1 d
90	222.2 f	230.4 e	258.9 b
120	251.8 c	241.9 d	265.3 a