RESULTS & DISCUSSION

4- Leaf area of the topmost ear :

The data reported in Table (3) show that the mean values of leaf area of the topmost ear was significantly affected by cultivars in the second season only. Three way cross 321 cultivar gave the highest value of leaf area of the topmost ear (782.6 cm^2), whereas, Giza 2 cultvar gave the lowest one (731.7cm^2) in 2001 season. On the contrary, the differences between maize cultivars under study was not significant in leaf area of the topmost ear in 2000 season. These differences may be due to genetical differences between the three cultivars. These results agree with those obtained by **Ahmed (1989), El-Shenawy (1990), Matta et al, (1990), Gouda et al. (1992), Ibrahim et al (1992), El- Habbak (1996) and El- Sheikh (1998),** they found that the difference between maize varieties was significant in ear leaf area. Whereas, **Kamel et al (1986) and El-Gezawy (1996)** Showed that difference between maize varieties on ear leaf area was not significant.

5- Time of tasseling and silking :

Data presented in Table (3) show that maize cultivars had highly significant on the number of days to 50% tasseling and silking in both seasons. Giza 2 was the earliest variety in Tasseling and silking dates, Single cross 122 cultivar ranked the second, while Tree way cross 321 cultivar gave the latest variety. These differences may be due to the genetical differences between varieties. These results are in harmony with those obtained by **Hefni et al. (1993)** Found that Time of silking was earlier in Giza 2 than T.W.C. 310 and karnak varieties by 2.07 and 4.56 days, respectively. Also, **Soliman et al.(1995b), El-**

2- Stem diameter :

The results in Table (3) indicated that Three way cross 321 cultivar significantly surpassed the other maize cultivars under study in the mean values of stem diameter in the second season. On the other hand, no significant difference was obtained between Giza 2 and Single cross 122 in this character. In this connection, it could be noticed that these differences may be due to the genetical differences between cultivars. Similar results were reported by El-Shenawy **(1990), Hefni et al (1993a), El-Gezawy (1996) and El-Hasawy (2001).** On other hand, the three cultivars of maize were similar for stem diameter in the first season Similar trend was obtained by **El-Deepah et al (1989).**

3- Number of green leaves / plant :

There were significant differences in number of green leaves / plant at 80 days after sowing among maize cultivars under study in both seasons (Table 3). Three way cross 321 cultivar significantly surpassed the other cultivars in number of green leaves / plant (14.6 and 13.6) in the first and second seasons, respectively. Whereas, no significant difference was obtained between Single cross 122 and Giza 2 cultivar in this character. On the other hand, Giza 2 cultivar gave the lowest mean values which equal 9.9 and 11.8 in the first and second seasons, respectively. These differences may be due to genetical differences between the three cultivars. These results confirm well with those obtained by **Ahmed (1989), El-Deepah et al. (1989), Gouda et al. (1992), Nofal- Fatma (1994), El-Gezawy (1996) and El-Sheikh (1998)**

Table (3) The average values of some growth characters of maize plants as affected by maize cultivars in 2000 and 2001

Characters Treatments	Plant height c/m	Ear height (c/m)	Stem diameter (m m)	No of green leaves /plant	Leaf area of the topmost ear (c/m^2)	Tasseling date (days)	Silking date (days)
Cultivrs:-	First season						
S.C 122	253.0 b	161.2 a b	22.1 a	11.4 ab	700.0 a	64.3 b	66.9 b
T.W.C.321	286.9 a	169.0 a	23.2 a	14.6 a	693.1 a	66.3 a	68.2 a
Giza 2	251.8 b	151.1 b	22.0 a	9.9 b	667.1 a	62.7 a	65.9 c
F – test	*	*	N . S	*	N .S	*	*
	second season						
S.C 122	266.4 b	131.7 b	25.1 b	12.2 b	748.1 b	65.6 b	69.4 b
T.W.C 321	284.2 a	143.3 a	27.7 a	13.6 a	782.6 a	67.2 a	71.4 a
Giza 2	266.1 b	125.8 c	24.4 b	11.8 b	731.7 c	63.8 c	68.2 c
F- test	*	*	*	*	*	*	*

* significant at 5 %

RESULTS AND DISSCUSSION

I - Growth characters

A- Varietal differences :

The average values of plant height, ear height, leaf area of the topmost ear ,stem diameter, number of green leaves per plant ,at 80 days after sowing as well as tasseling and silking dates as influenced by maize caltivars in 2000 and 2001 seasons are shown in Table (3)

1- Plant and ear height :

The differences between maize cultivars under study were significant in the mean values of plant and ear height in both seasons. Three way cross 321 (T.w.C321) cultivar surpassed significantly single cross 122 (S.C.122) and Giza 2 cultivar in the heights of plant and ear . Giza 2 cultivar ranked the second, while S.C. 122 cultivar gave the lowest ones. On the other hand, no significant difference was obtained between S.C. 122 and Giza 2 cultivars in plant height in both seasons and ear height in the first season. Such differences might be due to their genetic constitution which may be manifested in lower number and shorter interposed. These results are in good agreement with those obtained by **Ahmed (1989), El.Deepah et al (1989), El Shenawy (1990) , Younis et al (1990), Mahrous (1991), Gouda et al (1992), Ibrahim et al (1992), Hefni et al (1993a), Soliman et al. (1995 a) , Ismail (1996) and El-Bana (2001) .**

Gezawy (1996), El-Habbak (1996) and Khedr et al (1996) Found that there were significant difference among maize cultivars in tasseling and silking dates

B- Effect of plant density :

The average values of plant height, ear height, leaf area of the topmost ear, stem diameter, number of green leaves/plant at 80 days after sowing as well as tasseling and silking dates as affected by plant density in 2000 and 2001 growing seasons as shown in Table (4) .

1- Plant and ear height :

Results in Table (4) revealed that the plant density had significant effect on plant height in the second season only. The Tallest plant was 266.4 and 275.4 cm, obtained when plants were spaced 20cm apart in the ridge (20000 plants / fed.). Whereas, the mean values of plant height of maize plants was not significantly affected by plant density in the first season. Also, the average values of ear height was not significantly affected by increasing plant density from 20000 to 30000 plants / feddan in both seasons. The increase in plant height by narrowing distance between plants might lead to the high competition between plants for light. Such results are in general agreement with those obtained by **Abdul Galil et al. (1990 b), Amin (1994), Soliman *et al* (1995) El-Habbak (1996), El-Sheikh (1998) and Hussein *et al* (1998)** who Found that increasing plant densities caused a significant increase in plant height and ear position. On the contrary, **El-Bona and Gomaa (2000), El-Koomy (2000) and Ibrahim and Abd El-Maksoud (2001)** indicated that increasing plant density from 20000 to 30000 plants /feddan

Table (4) The average values of some growth characters of maize plants as affected by plant density in 2000 and 2001 growing seasons .

Characters Treatments	Plant height c/m	Ear height (c/m)	Stem diameter (m m)	No of green leaves /plant	Leaf area of the topmost ear (c/m^2)	Tasseling date (days)	Silking date (days)
plant density	First season						
30000	266.4 a	162.3 a	22.10 a	11.4 a	677.1 a	64.9 a	67.2 a
24000	264.3 a	160.8 a	22.30 a	13.0 a	687.8 a	64.1 a	67.0 a
20000	261.1 a	158.1 a	22.90 a	11.5 a	695.5 a	64.2 a	66.8 a
F- test	N. S	N. S	N . S	N .S	N .S	N. S	N. S
	second season						
30000	275.5 a	135.1 a	25.2 b	12.4 a	738.9 c	65.6 a	69.7 a
24000	271.9 ab	134.0 a	25.8 ab	12.5 a	746.0 b	65.8 a	69.9 a
20000	269.4 b	131.7 a	26.2 a	12.8 a	777.5 a	65.3 a	69.6 a
F- test	*	N. S	*	N. S	*	N .S	N. S

* significant at 5 %

significantly increased plant height and ear height, On the other hand , **Koraiem et al. (1980) and Lucas (1986)** showed that there was no significant effect on plant and ear height du to the density.

2- Stem diameter:

Results in Table (4) indicate clearly that the distance between plants had a pronounced effect on stem diameter. The mean values of stem diameter increased significantly by widening the distance between plants (30 cm a part) in the second season only . The highest mean values of stem diameter was 22.9 and 26.2 mm, produced when plants were spaced 30cm apart in the ridge (20000 plant/ feddan) in the first and second seasons, respectively. Whereas, stem diameter was not significantly affected by increasing plant density from 20000 to 30000 plants/feddan in the first season .

This results might be attributed to the lower amounts of metabolites in leaves at narrow spaced (20 cm apart) as a result of high competition for light, water and minerals. The same trend was obtained by **Abdul Galil et al. (1990 b), El-Habbak (1996) and Hussein et al (1998).** On the other hand, **Lucas (1986)** found that there was no significant density effect on stem diameter.

3- Number of green leaves / plant :

The average values of the number of green leaves / plant was not markedly influenced by increasing plant densities from 20000 to 30000 plants/feddan in both seasons as shown in Table (4) This is because the total number of leaves/plant is a gentical trait These results agree with those obtained by **Lucas (1986)**

and El-Sheikh (1998) showed that the differences due to plant density regarding total number of leaves / plant and green leaves / plant were not significant.

4- Leaf area of the topmost ear :

The mean values of ear leaf area as affected by plant density during the Two seasons are illustrated in Table (4). The average values of ear leaf area significantly increased by increasing the distance between hill from 20 cm to 30 cm apart in the ridge in the second season. The ear leaf area reached maximum value (695.5 and 777.5 cm^2) in the first and second seasons, respectively, at the lowest plant density (20000 plants/feddan) as compared with any other plant density. In generally leaf area was higher in thin population when compared with dense population. This improve in the mean leaf area with this stand may be due to more availability of nutrients, light and water. Similar results were recorded by **Abdul Galil et al. (1990 a.), El-Habbak (1996), EL-Sheikh (1998), Hussein et al. (1998), El-Koomy (2000) and Ibrahim and Abd EL-Maksoud (2001).**

5- Time of tasseling and silking :

It was observed that number of days to 50% tasseling and silking were not significantly affected by increasing plant density up to 30000 plants / feddan during the Two growing seasons (Table 4). Generally, tasseling and silking were delayed by increasing plant density. These results may be due to the increase in light penetration, interception and photosynthetic efficiency at lower density. Also at lower densities more nutrients are available which are required for the development of maize

plants. Similar results were also reported by **Abdul Galil et al.(1990b), Younis et al (1994), Soliman et al. ((1995) and EL-Habbak (1996)** who found that dense planting delayed tasseling and silking dates of maize. However in some other studies there were no significant differences in tasseling and silking dates due to plant population.

C- Effect of N level :-

The effect of nitrogen fertilizer level on some growth characters are presented in Table (5) .

1- Plant and ear height :

Nitrogen fertilization showed significant effect on the mean values of plant height and ear height of maize plants in both seasons.

In the first season, application of 135 kg N/ feddan gave the tallest plant (288.3 cm) and highest ear position (186.4 cm). Whereas no significant difference was obtained between 90 kg and 135 kg N/feddan on plant height. On the other hand, the shortest mean values of plant height and ear height were 225.9 and 127.8 cm, respectively, produced from without application of nitrogen fertilizer.

In the second season, the highest mean values of plant height and ear height were 289.1 and 145.4 cm, respectively, produced from applied 135 kg N/ feddan. The increases in plant height due to adding 45,90 and 135 kg N/feddan were 15.45%, 24.21% and 27.62%, respectively over the control treatment in the first season. However in the second season, applying the same sub-sequent N level increased plant height by 8.32%, 10.0 4% and 14.77 %, respectively. The increase in plant height may

Table (5) The average values of some growth characters of maize plants as affected by nitrogen fertilizer level in 2000 and 2001 growing seasons .

Characters Treatments	Plant height (c/m)	Ear height (c/m)	Stem diameter (m m)	No of green leaves /plant	Leaf area of the topmost ear (c/m^2)	Tasseling date (days)	Silking date (days)
N – level	First season						
Zero	225.9 c	127.9 d	18.9 d	11.9 a	506.9 d	66.6 a	68.8 a
45 kg/ fed.	260.8 b	155.1 c	22.2 c	10.6 a	676.1 c	64.5 b	67.1 b
90 kg/fed.	280.6 a	172.3 b	23.6 b	12.1 a	748.5 b	63.1 c	65.9 c
135 kg/fed.	288.3 a	186.4 a	25.0 a	13.2 a	815.7 a	63.6 c	66.3 c
F-test	*	*	*	N. S	*	*	*
	second season						
Zero	251.9 d	117.5 d	22.8 d	10.9 d	615.8 d	68.9 a	73.4 a
45 kg/ fed.	270.7 c	132.6 c	25.3 c	12.4 c	762.6 c	64.7 b	69.4 b
90 kg/fed.	277.2 b	139.0 b	26.9 b	13.2 b	801.9 b	64.1 c	68.4 c
135 kg/fed.	289.1 a	145.5 a	27.9 a	13.7 a	836.1 a	64.4 bc	67.4 d
F-test	*	*	*	*	*	*	*

* significant at 5 %

be due to the increase in meristematic activity in maize plants as well as cell elongation. Nitrogen encourage both meristematic activity and auxin production in plants. These results are in accordance with those obtained by **Saleh and Wali (1988), Ahmed (1989), El-Deeb (1990), Gouda et al (1992), Khalil (1992), Salwau (1993), Amin (1994), Nofal-Fatma (1994). Soliman et al (1995), El-Gezawy (1996), El-Habbak (1996), Reiad et al .((1997) Hussein et al. (1998), Salem (1999) and EL-Bana (2001).**

2- Stem diameter:

The data illustrated in Table (5) show that the average values of stem diameter significantly increased by increasing N level up to 135 kg N/feddan in both seasons. The maximum stem diameter was 25.0 and 27,9 mm, produced from applied nitrogen fertilizer at 135 leg N/feddan in the first and second seasons, respectively. Whereas the minimum one was 18.9 and 22.8 mm, obtained from without application of nitrogen fertilizer, respectively. These results are expected since N increases the vegetative growth of maize plants The same trend was also realized by **Saleh and Wali (1988), Khalil (1992), Abdullah (1995), EL-Gezawy (1996), Hussein et al. (1998), Zaghloul (1999) and Salem (1999) .**

3- Number of green leaves / plant:

The average values of green leaves number per plant was significantly increased by increasing N rate up to 135 Kg N /feddan in the second season only (Table 5). On the other hand, the differences between the mean values of green leaves number/plant were not significantly affected by nitrogen

fertilization in the first season. The highest number of green leaves / plant was 13.2 and 13.7, obtained by adding 135 kg N/feddan in the first and second seasons, respectively. This result might be attributed to the effect of N in increasing vegetative growth and meristemic activity of maize plant. These results agree with those obtained by **Ahmed (1989), Gouda et al. (1992), Amin (1994), Nofal-Fatma (1994), Abdullah (1995) and EL-Gezawy (1996). Whereas, Hussein et al. (1974), Nour EL-Din et al (1975), Khalil (1992) and Gouda and EL-Banna (1995)** reported that number of leaves/plant is a genetical character which is not affected by environmental conditions,

4- Leaf area of the topmost ear:

Results in Table (5) indicate clearly that leaf area of the topmost ear significantly increased as the N level increased up to a higher rate (135 kg N/feddan) in the two seasons. The application of 45, 95 and 135 kg N/feddan increased leaf area by 33.34 % ,47.66 % and 60.91% respectively, over the check treatment in the first season. The corresponding increases were 24.02%, 30.22% and 35,77%, respectively, in the second season: In general, N encouraged growth of leaf area as an essential element which plays a prominent role in building new merestematic cells, cell elongation and increasing photosynthesis activity of maize plants. It could be concluded that maize yield potentiality was determined early in the season by leaf area, which was in turn affected by N fertilizer. These results agree with several results obtained by **Saleh and Wali (1988), Ahmed (1989), Gouda et al. (1992) , Khalil (1992) , Amin**

(1994), Nofal-Fatma (1994), EL-Habbak (1996), Reiad et al . (1997), Hussein et al. (1998) and Zaghloul (1999)

5- Time of tasseling and silking :

Nitrogen fertilizer levels showed a significant influence on tasseling and silking dates of maize plant in the two growing seasons (Table 5). Plants reached 50% tasseling and silking data significantly earlier than the control when N increased up to 135 kg N/ feddan. It was observed that the difference between the mean values of number of days to 50% tasseling and silking were not significant between 90 and 135 kg in / feddan in the first season. On the other hand the highest number of days to 50% tasseling and silking were 66.6 and 68.8 days, respectively in the first season, respectively as well as 68.9 and 73.4 days, respectively in the second seasons, respectively, produced from without application of nitrogen fertilizer, These results might be due to nitrogen fertilizer may encourage the meristematic activity and increase the vegetative growth which push maize plants towards the earlier tasseling and silking. The same trend were observed by **Gouda et al. (1992), Nofal-Fatma (1994), Younis et al (1994), EL-Habbak (1996) and Zaghloul (1999).**

D-Interaction effects:

D-1- Interaction effect between maize cultivars and plant density:-

The interaction between maize cultivers and plant density did not affect significantly all characters of growth under study in both seasons, consequently the data were excluded. Similar results were obtained by **Soliman et al (1995)** noticed that growth characters under study were not significant as affected by

the interaction between plant population densities and maize hybrids. On the other hand, **EL-Habbak (1996) and EL-Sheikh (1998)** showed that S.C. 10 under the moderate density (24000 plants/ feddan) gave the highest ear leaf area

D-2 Interaction effect between maize cultivars and N level:-

The effect of the interaction between maize cultivars and N level was significant on plant height and silking data in one season out of two as shown in Table (6 and 7). On the other hand, the other growth characters under study were not significantly affected by the interaction between maize cultivars and N-level in both seasons, the data were excluded.

Table (6) obviously clear that the tallest plant was 321.1 cm , produced from Three Way Cross 321 with applied 135 kg N/feddan in the first season. Whereas no significant difference was obtained between applied 90 and 135 kg N/ feddan with Three Way Cross 321 cultivar. On the other hand, the three maize cultivar under study without application of nitrogen gave the shortest plant.

Data in Table (7) indicate that Giza 2 cultivar with applied 135 kg N/feddan gave the ear list silking data (66.3 days) in the second seasons, However, The latest silking data was 75.7 days , produced from Three way cross 321 cultivar.

It could be concluded that adding 135 kg N / fed to T.W. C321 cultivar caused a significant increase in plant height. Also application the highest level of nitrogen to Giza 2 cultivar push maize plants towards the earlier silking. These results are in full agreement with those obtained by **Gouda et al (1992)** in plant height and **El-Habbak (1996)** in silking data . whereas **Ahmed**

Table (6) : Interaction effect between maize cultivars and N level on plant height in 2000 and 2001 season.

Character	Plant height					
Season	First season			Second season		
cultivars	S.c 122	T.w.c 321	Giza 2	S.c 122	T.w.c 321	Giza 2
N - level						
zero	223.7 f	240.8 e	213.4 f	246.2 a	263.8 a	245.9 a
45 kg N/fed.	254.5 cdf	277.5 b	250.5 df	263.5 a	283.0 a	265.5 a
90 kg N/fed.	268.8 bc	308.5 a	264.6 bcd	272.2 a	286.9 a	272.4 a
135 kg N/fed	265.0 bcd	321.1 a	278.7 b	283.6 a	303.1 a	280.7 a
F test	*			N.S		

* significant at 5 %

Table (7) : Interaction effect between maize cultivars and N level on Silking data in 2000 and 2001 seasons.

Character	Silking date					
Season	First season			Second season		
cultivars	S.c 122	T.w.c 321	Giza 2	S.c 122	T.w.c 321	Giza 2
N - level						
zero	69.5 a	69.7 a	67.3 a	73.0 b	75.7 a	71.5 c
45 kg N/fed.	66.8 a	68.2 a	66.4 a	68.6 ef	71.5 c	68.0 ef
90 kg N/fed.	65.7 a	67.3 a	64.7 a	68.3 ef	69.8 d	67.2 g
135 kg N/fed	65.7 a	67.7 a	65.3 a	67.8 fg	68.8 e	66.3 h
F test	N.S			*		

* significant at 5 %

(1989) concluded that the effect of the interaction maize varieties and N level on growth characters was not significant.

D-3 Interaction effect between plant density and N- levels:

The effect of the interaction between plant density and N level was not significant on all growth characters under study in both seasons, the data were excluded. These results are in harmony with those reported by **Koraiem et al. (1980), EL-Hosary and Salwau (1989) and EL-Habbak (1996)** indicated that the interaction between plant density and N level was not significant on growth characters of maize plants.

D-4 Interaction effect between the three factors:

The interaction between maize cultivars, plant density and N level did not affect significantly all characters of growth under study in both seasons, consequently the data were excluded.

II- Yield and its components

A- Varietal differences :

The average values of ear length, ear diameter, number of rows / ear, number of grains/row, ear weight, grain weight per ear, shelling percentage, 100-grain weight, number of plants per feddan, number of ears/plant and grain yield per feddan as influenced by maize cultivars in 2000 and 2001 seasons are presented in Table (8)

1- Ear length and diameter :

The differences between maize cultivars under study were significant in the mean values of ear length in the first season and ear diameter in both seasons, whereas no significant difference were obtained between the three maize cultivars under

Table (8) The average values of grain yield and its components characters of maize plants as affected by maize cultivars in 2000 and 2001 growing seasons .

Characters Treatments	Ear length (cm)	Ear diameter (m.m)	No .of rows /ear	No .of grains/ row	Ear weigh (gm)	Grain weight /ear (gm)	Shelling percentage	100-grain weight (gm)	No-of plants/fed	No-of ears/ plants	Grain yield Ardab/ feddan
Cultivas :	First season										
S.C 122	15.9ab	42.5 b	13.2 a	37.6 a	149.0 b	128.5 ab	86.1 a	31.9 a	23358.8 a	0.9 a	29.5 a
T.W.C.321	16.3 a	45.2 a	13.2 a	38.2 a	159.0 a	134.5 a	84.1 b	32.9 a	23306.2 a	0.9 a	29.1 ab
Giza 2	15.6 b	45.4 a	13.4 a	34.5 b	149.7 b	123.7 b	81.4 c	34.6 a	22339.5 a	0.9 a	28.2 b
F-test	*	*	N.S	*	*	*	*	N.S	N.S	N.S	*
Cultivas :	second season										
S.C 122	18.6 a	47.0 b	14.0 a	39.2 a	184.4 b	153.4 b	83.0 a	31.0 c	23590.1 a	0.9 a	30.9 a
T.W.C.321	18.9 a	49.8 a	14.0 a	39.9 a	207.6 a	165.2 a	79.2 b	32.7 b	23503.9 a	0.8 b	29.7 b
Giza 2	17.8 a	49.8 a	13.8 a	37.5 a	180.6 c	141.7 c	78.3 c	35.1 a	23518.6 a	0.9 a	28.9 c
F-test	N .S	*	N.S	N . S	*	*	*	*	N.S	*	*

* significant at 5 %

study in ear length in the second season (Table 8) T.W .C. 321 cultivar gave the longest ear (16.3 and 18.9 cm) in the first and second seasons, respectively. While the shortest one was 15.6 and 17.8 cm, obtained from Giza 2 cultivar in both seasons, respectively. On the contrary, Giza 2 cultivar gave the maximum mean values of ear diameter (45.4 and 49.8 mm). Whereas the minimum one was 42.5 and 47,0 mm in 2000 and 2001 seasons respectively, produced from S.C. 122 cultivar, The differences between maize cultivars were mainly due to genetical constituents. These results are in good agreement with those obtained by **Kamel *et al.* (1986), Aly (1988), EL-Deepah *et al.* (1989), Younis *et al* (1990), Hefni et al (1993 b) , Nofal-Fatma (1994), Soliman *et al.* (1995 a), El – Gezawy (1996), EL- Habbak (1996), El-Sheikh (1998)** and **Khalil (2001).** On the other hand, **Gouda** and **EL-Banna (1995)** and **EL-Bana (2001)** found that the Varietal differences in ear length and diameter did not reach the level of significance,

2- Number of rows per ear:

The data in Table (8) showed that the Varietal differences in number of rows / ear did not reach the level of significance in both seasons. Similar results were obtained by **Nofal – Fatma (1994), Gouda and EL-Banna (1995), and EL-Bona (2001)** found that

Number of rows/ear was not influenced by maize varieties. On the contrary, **Aly (1988), EL-Deepah et al.(1989), Younis et al (1990), Hefni et al (1993b), EL-Habbak (1996)and Esmail (1996)** whom indicated that the differences

between the mean values of rows number/ear of maize varieties were significant.

3- Number of grains per row :

It is clear from Table (8) that T.W.C. 321 cultivar significantly surpassed the other maize cultivars in number of grains / row in the first season only. The maximum number of grains/row was 38.2 and 39.9, produced from T.W.C. 321 cultivar in the first and second seasons, respectively. Whereas ,Giza 2 cultivar gave the minimum mean values of grains numbers per row which equal to 34.5 and 37.5 in both seasons respectively. On the other hand, the differences between S.C122 and T.W.C. 321 cultivars in the average values of grains number/row was not significant. Superiority of T.W.C. 321 cultivar in number of grains/row may be due to the superiority in ear length. These results is in accordance with those recorded by **Aly (1988), EL-Deepah et al (1989), Younis et al. (1990), Hefni et al (1993b), Soliman et al. (1995 a and b), EL-Sheikh (1998), EL-Bana (2001) and Khalil (2001)**

4- Ear weight and grain weight per ear :

Data presented in Table (8) show that there was significant differences among the tested maize cultivars regarding ear weight and grain weight / ear in the two growing seasons.T.W.C.321 cultivar significantly surpassed S.C. 122 and Giza 2 cultivars in ear weight (159.0 and 134.5 gm) and grain weight / ear (207.6 and 165.2 gm) in the first and second seasons, respectively. While, the lowest weight of ear and grain /ear were produced from Giza 2 cultivar in both seasons. The increase in ear weight and grain weight /ear of T.W.C. 321

cultivar may be due to the increase in ear length and number of grains /row. These results are in harmony with those obtained by **Aly (1988), EL-Deepah et al. (1989), Hefni et al. (1993 b), Nofal-Fatma (1994), EL-Habbak (1996), EL-Sheikh (1998), EL-Bana (2001),EL-Hasawy (2001)and Khalil (2001).**

5- Shelling percentage :

Single cross 122 cultivar significantly exceeded the other maize cultivars in shelling percentage followed by Three way cross321 and Giza2 cultivars in both seasons are shown in Table (8) . The highest percentage of shelling was 86.1 and 83.0 %, obtained from S.C.122 cultivar in the first and second seasons, respectively. These results may be due to the fact that this character is genetically controlled. These results are in fit with the results obtained by **Aly (1988), EL-Deepah et al(1989), Esmail (1996) and Khalil (2001).**

6- 100-grain weight:

The results in Table (8) indicated that the average values of 100-grain weight was significantly affected by the three maize cultivars under study in one season out of Two. In the second season, maize cultivar of Giza2 surpassed significantly than the other cultivars in the mean values of 100- grain weight (35.1gm). Whereas, S.C 122 cultivar gave the lowest one (31.0 gm). In the first season, the results did not reach the level of significance. These results may be due to the cultivars genetical effects. These results coincide with the findings of **Aly (1988), EL- Deepah et al. (1989), Hefni et al. (1993b), EL-Gezawy (1996), EL-Habbak (1996), Esmail (1996), EL-Sheikh (1998), EL-Bana (2001) and Khalil (2001).**

7- Number of plants / feddan :

The data illustrated in Table (8) show that the differences between the three maize cultivars on the mean values of plants number/feddan was not significant in 2000 and 2001 seasons, S.C. 122 cultivar gave the highest number of plants /feddan which equal to 23 358.8 and 23590.1 plants in the first and second seasons, respectively. It could be concluded that the number of plants / feddan was not affected by maize cultivars. **EL-Hasawy (2001)** mentioned that no significant differences was obtained between the maize varieties on the number of plants / feddan .

8- Number of ears / plant :

The results in Table (8) show that there was a significant differences between maize cultivers on the mean values of ears number / plant in the second season only. The higher values of ears number / plant were produced from S.C. 122 and Giza 2 cultivars. Whereas, T.W.C. 321 cultivar gave the lowest number of ears/ plant (0.8). No significant difference was obtained between S.C..122 and Giza 2 cultivar in the number of ears/plant. Similar results were reported by **Aly (1988), EL-Deepah *et al.* (1989), Ibrahim *et al.* (1992), Nofal- Fatma (1994), Younis *et al.* (1994), EL-Habbak (1996)** and **Khedr *et al.* (1996).**

9- Grain yield (ardab)/ feddan :

The differences between maize cultivars in grain yield/feddan was significantly confirmed in the two seasons (Table 8). S.C.122 cultivar surpassed the other maize cultivar in grain yield / feddan (29.5 and 30.9 ardab / fed.) in the first and

second season respectively. Where as, Giza 2 cultivar produced the lowest values (28.2 and 28.9 ardab/fed., respectively) On the other hand, no significant difference was obtained between the two maize cultivars namely S.C.122 and T.W.C. 321 cultivars in grain yield / feddan in the first season, It could be concluded that the hybrid maize cultivar significantly surpassed the other varieties of open pollinated superiority of S.C. 122 and T.W.C.321 cultivars might be due to better ear characteristics, more shelling percentage , number of plants / feddan and number of ears/ plant, as well as heterosis of these hybrids.

The same trend was obtained by **Kamel *et al.* (1986), Aly (1988), Matta *et al* ((1990), Gouda *et al.* (1992) , Ibrahim *et al.* (1992), Hefni *et al* (1993 b), Nofal-Fatma (1994), Younis *et al.* (1994), Soliman *et al.* (1995 a and b), EL-Habbak (1996), Esmail (1996), Khedr *et al.* (1996), Abu. Grab *et al* (1997), Gouda (1997), EL-Sheikh (1998), EL-Bana (2001), EL-Hasawy (2001)** and **Khalil (2001).**

B- Effect of plant density :

The effect of hill space treatments (plant density)on the mean values of yield components characters and grain yield of maize per feddan in 2000 and 2001 seasons as shown in Table (9).

1- Ear length and diameter :

Table (9) shows that the mean values of length and diameter of ear were significantly decreased by increasing plant density in both seasons, except ear diameter was not significantly affected by plant density in the first season. Plants grown at a distance of 20 cm between hills gave the tallest ear (16.2 and

Table (9) The average values of grain yield and its components characters of maize plants as affected by plant density in 2000 and 2001 growing seasons .

Characters Treatments	Ear length (cm)	Ear diameter (m.m)	No .of rows /ear	No .of grains/ row	Ear weigh (gm)	Grain weight /ear (gm)	Shelling percentage	100-grain weight (gm)	No-of plants/fed	No-of ears/ plant	Grain yield Ardab/feddan
Plant density	First season										
30000	15.6 b	44.2 a	13.2 a	36.5 a	150.4 ab	126.7 b	84.1 a	33.2 a	27386.8 a	0.9 a	28.7 a
24000	15.9 ab	44.2 a	13.2 a	36.1 a	147.0 b	123.1 b	83.4 a	33.1 a	23154.7 b	0.9 a	29.1 a
20000	16.2 a	44.8 a	13.3 a	37.7 a	160.4 a	136.8 a	84.0 a	33.1 a	19462.9 c	0.9 a	28.9 a
F-test	*	N.S	N.S	N.S	*	*	N.S	N.S	*	N.S	N.S
	Second season										
30000	17.9 b	48.4 b	13.8 b	38.3 b	182.1 c	147.1 c	80.5 a	31.9 b	27872.3 a	0.9 a	29.7 a
24000	18.5 ab	48.5 b	13.8 b	38.5 b	190.2 b	151.2 b	79.1 a	33.6 a	23459.8 b	0.9 a	29.7 a
20000	18.9 a	49.6 a	14.1 a	39.8 a	200.3 a	162.0 a	80.8 b	33.3 a	19280.6 c	0.9 a	30.1 a
F-test	*	*	*	*	*	*	*	*	*	N.S	N.S

* significant at 5 %

18.9 cm in the first and second seasons, respectively). Maximum ear diameter were 44.8 and 49.6 mm, in the first and second seasons respectively whereas plants grown at a distance of 20 cm between hill gave the shortest one (15.6 and 17.9 cm) and minimum ear diameter (44.2 and 48.4mm) in the first and second seasons, respectively. These results could be due to the high competition among plants at high plant population consequently decreased the vigor of plants organs and this might be responsible mainly for the reduction in ear length and diameter at dense planting Some investigators reported that ear length and diameter were decreased by increasing plant population **(Salem *et at*, 1983; Mohamed, 1986; Abdul-Galil *et al*, 1990b; EL-Deeb, 1990; Amin, 1994 ; Soliman *et al.*, 1995; Esmail, 1996; EL-Sheikh , 1998; Hussein *et al.*, 1998; Tantawy *et al.*, 1998; EL- Bana and Gomaa,2000; EL-Koomy, 2000; Ibrahim** and **Abd EL-Maksoud, 2001.**

2- Number of rows per ear:-

Data in Table (9) indicated that plant population significantly affected the number of rows / ear in the second season only. Whereas ear diameter increased by increasing the distance between hills, but differences were not great to reach the level of significance in the first season. The highest number of rows / ear was 13.3 and 14.1 in the first and second seasons, respectively, obtained from the lowest plant density (20000 plants/feddan). These results might be due to the less influence of such environmental condition i.e plant population on this trait These results are in agreement these obtained by **Mohamed (1986), EL-Deeb (1990), Amin (1994), Soliman et al (1995),**

Esmail (1996), Hussein et al. (1998) and EL-Bana and Gomaa (2000) .

3- Number of grains per row:

The mean values of grains number/row increased by increasing the distance between hill or decreasing plant population in both seasons. This increase was not significant in the first season only. The highest number of grains/row was 37.7 and 39.8, produced from plants grown at a distance of 30 cm between hills in the first and second seasons, respectively. Whereas the lowest one was obtained from plants grown at highest density. The increase in number of grains/row when plants grown at distance (30 cm apart between hills) may be due to the increase in ear length. Similar trend was observed by **Mohamed (1986), EL-Hosary** and **Salwau (1989), Abdul-Galil *et al* (1990 b), EL-Deeb (1990),Amin (1994) Soliman *et al.* (1995), EL-Sheikh (1998), Hussein *et al.* (1998), EL-Bana and Gomaa (2000)** and **EL-Koomy (2000).**

4- Ear weight and grain weight per ear:

Table (9) observed that the mean values of ear weight and grain weight / ear were significantly affected by increasing plant density from 20000 to 30000 plants / feddan in the two growing seasons. Decreasing plant population from 30000 to 20000 plants /feddan caused an increase in ear weight and grain weight /ear in both seasons. The highest weight of ear (160.4 and 200.3 gm) and highest grain weight / ear (134.7 and 162.0 gm) were obtained from plants grown in the first and second seasons, respectively at a distance of 30 cm between hills. These results might be due to the higher competition between maize plants by increasing plant

population for light , water and nutrients which affected negatively the growth of plants and consequently depressed ear weight and grain weight /ear in dense planting. Similar findings were mentioned by **Koraim et al (1980), Salem et al, (1983), Mohamed (1986), Abdul – Galil et al (1990 b), Esmail (1996), EL-Sheikh (1998), Hussien et al. (1998), Tantawy et al (1998) and Ibrahim and Abd EL – Maksoud (2001) .**

5- Shelling percentage:

Results in Table (9) indicate clearly that hill spacing had a pronounced effect on the mean values of shelling percentage in both seasons. It was significantly affected in the second season only. A density of 24000 plants/feddan gave the lowest value of shelling percentage (79.1%) , whereas density of 20000 plants / feddan gave the highest value of shelling percentage 80.8%) in the second season. It seems that yield component characters are not greatly influenced by plant density in the first season when compared with the other characters. The results reported from previous studies are also contradictory. **Salem et al (1983), Mohamed (1986)** ***and*** **Tantawy et al (1998)** gave the same trend. **While EL- Deeb (1990), Amin (1994), Esmail (1996)** and **Hussien *et al.* (1998)** found that increasing plant population caused a significant decrease shelling percentage in both seasons.

6- 100 -Grain weight:

Data recorded in Table (9) show that weight of 100-grain was significantly decreased by increasing plant density from 20000 To 30000 plants / feddan in the second season only. The highest mean values of 100-grain weight was 33.6 gm, produced

from widening distance between plants (at 25 cm between hill), whereas the lowest one was 31.9 gm, obtained from plants grown at a distance of 20 cm between hills in 2001 season. On the contrary, no significant difference was obtained between plants grown at a distance of 25 cm and 30 cm between hills in the mean values of 100-grain weight. This might be due to the higher in competition for light, mineral and water in dense plantings. Similar results was found by **EL-Hosary** and **Salwau (1989), Abdul-Galil *et al.* (1990b), Esmail (1996), EL-Sheikh (1998), Hussein et al (1998), Tantawy *et al* (1998), El-Bana and Gomaa (2000)** and **Ibrahim** and **Abd EL-Maksoud (2001)** indicated that increasing hill spacing from 20 to 30 cm gave heavier 100-grain weight. Whereas, **Mohamed (1986)** found that 100-grain weight was not significantly affected by increasing plant density from 20000 to 30000 plants per feddan.

7- Number of plants per feddan :

data in Table (9)revealed that the number of plants/ feddan was significantly increased by decreasing the distance between hills in both seasons. The highest number of plants/feddan was 27386.8 and 27872.3 plants , produced from narrow distance between hills (20 cm apart)in the first and second seasons, respectively. While, the lowest number was 20462.9 and 19280.6 plants/feddan, respectively, obtained from plants grown at a distance of 30 cm between hills in the first and second seasons, respectively. The increase in the number of plants per feddan may be due to plants grown at narrow a distance of 20 cm between hills. Similar results were recorded by **Mahmoud *et a*l (1980), EL-Hosary** and **Salwau (1989), Abdul-**

Galil *et al* (1990b) Murphy *et al* (1996), Hussein *et al* (1998), Tantawy *et al* (1998), El-Koomy (2000) and **Ibrahim** and **Abd EL-Maksoud (2001).**

8- Number of ears per plant:

Data presented in Table (9) show that the number of ears / plant was not significantly affected by plant density in both seasons. These results did not agree with those obtained by **Koraiem et al (1980), Salem et al. (1983), EL-Hosary and Salwau (1989), Amin (1994), Younis et al. (1994), Soliman et al (1995), EL-Sheikh (1998) Tantawy et al (1998), EL-Bana and Gomaa (2000) and Ibrahim and Abd EL-Maksoud (2001)** concluded that increasing plant population caused a significant decrease number of ears/plant.

9- Grain yield (ardab) / feddan :

There was no significance difference between the mean values of grain yield/feddan as affected by increasing plant density from 20000 to 30000 plants /feddan in the Two growing seasons as shown in Table (9). The maximum grain yield/feddan was 29.1 ardab in the first season when plants grown at a distance of 25 cm between hill, but plants grown at distance of 30 cm between hill gave the highest grain yield/feddan (30.1 ardab) in the second season. These results did not reach the level of significance as affected by increasing plant density may be due to increasing yield components characters of maize with decreasing number of ears per unit area at low densities. While at high densities gave the lowest of yield components characters and highest number of ears per unit area. Similar results were also reported by **Koraiem et al (1980), Salem et al. (1983)**

Mohamed (1986) showed that grain yield of maize was not significantly affected by increasing plant density from 15 to 40 thousand plants / feddan. Crowded maize plants in rows resulting in self shading, whereas increased the distance between plants in rows resulted in increasing the plant surface exposed to incoming radiation **(Aubertin and Peters, 1961).** On the other hand, **EL-Deeb (1990) Hussein et al.**

(1998) and Ibrahim and Abd EL-Maksoud (2001) indicated that the reduction in hill spacing (at 20 cm) gave the highest grain yield / feddan .

C- Effect of N level :

The results in Table (10) show the effect of nitrogen fertilizer level on some characters of yield component and grain yield of maize per feddan in 2000 and 2001 growing seasons.

1- Ear length and diameter:

Nitrogen application up to 135 kg N/feddan caused a significant increase in ear length and diameter in both seasons are presented in Table (10). The application of 45, 90 and 135kg N/feddan increased ear length over unfertilized treatment by 16.3,33.3and43.4% respectively, in the first season. However in the second season, applying the same subsequent N Levels increased ear length by 14.6, 24.8,and 29.9% , respectively. Also, the maximum mean values of ear diameter was 49.1 and 51.4 mm, produced from adding 135 kg N/ feddan in the first and second seasons, respectively. Whereas the minimum one were 40.3 and 45.2 mm, respectively, obtained from without application of nitrogen fertilization. These results might be

Table (10) The average values of grain yield and its components characters of maize plants as affected by N level in .2000 and 2001 growing seasons .

Characters Treatments	Ear length (cm)	Ear Diametr (m.m)	No .of rows /ear	No .of Grains/ row	Ear weigh (gm)	Grain weight/ ear (gm)	Shelling percentage	100-grain weight (gm)	No of plants/fed at harvest	No-of ears/ plant	Grain yield Ardab/ feddan
N- level	First season										
Zero	12.9 d	40.3 d	12.6 d	29.1 d	103.8 d	86.4 d	81.7 c	28.4 d	23023.4 a	0.8 d	17.2 d
45 kg N/fed	15.0 c	44.0 c	13.1 c	34.1 c	139.2 c	117.2 c	83.8 b	32.0 c	23159.3 a	0.9 c	25.7 c
90 kg N /fed	17.2 b	46.1 b	13.5 b	40.6 b	175.1 b	148.3 b	84.5 b	35.1 b	23331.3 a	1.0 b	33.7 b
135 kg N/fed	18.5 a	47.1 a	13.9 a	43.3 a	192.2 a	163.6 a	85.5 a	36.9 a	22491.9 a	1.0 a	39.0 a
F-test	*	*	*	*	*	*	*	*	N.S.	*	*
N- level	Second season										
Zero	15.7 d	45.2 d	13.1 d	32.2 d	144.6 d	114.7 d	76.7 d	30.2 d	23373.7 a	0.7 d	20.9 d
45 kg N/fed	18.0 c	48.8 c	13.9 c	37.6 c	192.5 c	154.5 c	79.9 c	32.2 c	23670.6 a	0.9 c	26.8 c
90 kg N /fed	19.6 b	50.0 b	14.1 b	41.5 b	205.0 b	163.6 b	81.3 b	33.9 b	23494.1 a	1.0 b	33.5 b
135 kg N/fed	20.4 a	51.4 a	14.6 a	44.2 a	221.4 a	180.8 a	82.8 a	35.6 a	23611.8 a	1.1 a	38.1 a
F-test	*	*	*	*	*	*	*	*	N.S.	*	*

* significant at 5 %

attributed to pronounced effect of nitrogen on the flow of assimilates and foods for wards the developing ears. These results are in accordance with those obtained by **Shafshak *et al.* (1981) Salem *et al* (1983), EL-Maghraby *et al.* (1986), Prusty** and **Dayand (1987), Saleh** and **Wali (1988), EL-Deeb (1990) Gouda *et al* (1992), Amin (1994), Gouda** and **EL-Banna (1995), Soliman *et al* (1995), EL- Gezawy (1996), EL-Habbak (1996), Salem (1999)** and **EL-Bana (2001).**

2- Number of rows per ear:

Results in Table (10) indicated that the mean values of rows number / ear was significantly increased by increasing level of nitrogen up to 135 kg N/feddan in both seasons. The application of 45,90 and 135 kg N/feddan increased the number of rows /ear over untreated plants by 4.0, 7.1 and 10.3% respectively in the first season, the corresponding increases in number of rows /ear were 6.11 , 7.6 and 11.45%, respectively in the second season. Such increases are manifestation of active metabolism and improved plant growth. These results are in agreement with those reported by **Shafshak *et al.* (1981), Salem *et al* (1983) , El-Maghraby *et al.* (1986), Saleh** and **Wali (1988), EL- Hosary** and **Salwau (1989), EL-Deeb (1990), Gouda *et al.* (1992), Amin (1994), Nofal- Fatma (1994), Gouda** and **EL-Banna (1995), Soliman *et al* (1995) and EL-Gezawy (1996).**

3- Number of grains per row :

There was a significant difference in the number of grains per row due to application of nitrogen fertilizer in the two growing seasons as shown in Table (10). The increase in N level

from zero to 45, 90 and 135 kg N/feddan significantly increased number of grains/row by 17.2, 39.5 and 48.8 % , respectively in the first season. The corresponding increase in the second season were 16.8 ,28.9 and 37.3%, respectively. These results might be attributed to the increase in merestemic activity, vegetative growth and photosynthetic accumulation of maize plants resulted from increasing nitrogen fertilization. These findings are in accordance with those reported by **EL-Maghraby *et al.* (1986), EL-Deeb (1990), Gouda *et al* (1992),Amin (1994), Gouda** and **EL-Banna (1995), Soliman *et al.* (1995), EL-Gezawy (1996), EL-Habbak (1996)** and **EL-Bana (2001)** found that the number of grains per row was significantly increased by increasing N level up to 90,92,150,140,125,135,130,120 and 150 kg N/feddan, respectively.

4- Ear weight and grain weight per ear:

The results in Table (10) revealed that raising N levels up to 135 kg N /feddan significantly increased ear weight and grain weight per ear in 2000 and 2001 seasons.

In the first season, the maximum mean values of ear weight and grain weight/ ear were 192.2 and 163.6 gm, produced from applied 135 kg N/ feddan, respectively while the maximum ones were 221.4 and180.8 gm, respectively, obtained from adding 135 kg N/feddan in the second season. These increment reflect from the increase in ear length and diameter, number of grains/row, 100-grain weight. These results may be attributed that N fertilization create strong and healthy plants resulted from vigor vegetative growth related to source and consequently sink capacity of maize plants. These results are in line with those

obtained by **Shafshak *et al* (1981), Salem *et al* (1983), Khalil (1992),Younis *et al*.(1994), Abdullah (1995), EL-Gezawy (1996), Salem (1999)** and **EL-Bana (2001).**

5- Shelling percentage :

The mean values of shelling percentage significantly increased as the N- level increased up to 135 kg N/ feddan in the two growing seasons (Table 10). The highest value of shelling percentage were 85.5 and 82.8%, in the first and second seasons respectively, obtained when applied 135kg N/ feddan. However, the differences between the mean values of shelling percentage by application of nitrogen at 45 and 90 kg N/feddan were not significant in the first season. On the other hand, the lowest value of shelling percentage was 81.7 and 76.7% in the first and second seasons respectively, produced from without application of nitrogen fertilizer. These results might be attributed to the fact that shelling percentage is a genetic character that is less affected by environmental conditions. The same trend was obtained by **EL-Deeb (1990), EL-Gezawy (1996) and EL-Habbak (1996)** found that increasing nitrogen levels significantly increased shelling percentage. On the contrary, **Salem *et al* (1983)** and **EL-Hosary** and **Salwau (1989)** reported that increasing N level did not significantly affected the shelling percentage.

6- 100 - Grain weight:

The results in Table (10) show that the mean values of 100-grain weight significantly increased by increasing N level up to 135 kg N/feddan when compared with the control treatment. The application of 45,90 and 135 kg N/feddan increased 100-grain weight over the untreated plants by 12.7, 23.6 and 29.9%,

respectively in the first season , whereas the corresponding increase were 6.6 , 12.2 and 17.9 % , respectively in the second season. The nitrogen fertilizer increased the amount of photosynthetic accumulation by plants to which the dry matter content is a reliable index and this in turn might account much for the superiority of 100-grain weight. These results are in harmony with those obtained by **Prusty** and **Dayand (1987), Saleh** and **Wali (1988) El-Deeb (1990), Gouda *et a*l (1992) , Khalil (1992) ,El- Gezawy (1996) , El- Habbak (1996)** and **El-Bana (2001) .**

7- Number of plants per feddan :

Data in Table (10) show that N application had no significant effect on number of plants per feddan in 2000 and 2001 seasons. Each increments in nitrogen application led to small increase in number of plants at harvest. Similar trend was obtained by **Koraiem et al (1980).**

8- Number of ears / plant :

Results in table (10) indicated clearly that the mean values of ears number / plant was significantly increased by increasing N level up to 135 kg N / feddan in both seasons. Application of 135 kg N/ feddan to maize plants gave the highest number of ears/ plant which equal to 1.0 and 1.1 ears/ plant in the first and second seasons, respectively. Whereas the lowest one was 0.8 and 0.7 ears/ plant , produced from untreated plants of nitrogen fertilizer. The effect of N on the number of ears/ plant may be due to its role in increasing the meristematic activity and fertility of maize plants. These results agree with several results obtained by **Shafshak et al (1981), Salem et al,**

(1983), Khalil (1992), Amin (1994), Nofal-Fatma (1994) and El-Habbak (1996).

9- Grain yield (ardab) per feddan :

The average values of grain yield per feddan was significantly increased by increasing N level up to 135 kg N/ feddan in both seasons. In the first season, the application of 45,90 and 135 kg N/feddan increased significantly the grain yield/ feddan over untreated plants by 49.4,95.9 and 126.7%, respectively. The corresponding significant increase in grain yield in the second season were 28.2, 60.3 and 82.3%, respectively.

This result indicate that grain yield of maize plants response to N application more than 135 kg N/ feddan. These results may be due to the effect of N on the previous yield components. Data previously mentioned that N level had positive effect on ear length, ear diameter, number of rows/ear, number of grains / row, ear weight, grain weight/ ear, shelling percentage, 100- grain weight and number of ears/ plant. Morever, the effect of N was clear on the vegetative growth of maize plants, which in turn has beneficial effect on increasing the grain yield. Also, the application of N increased leaf area, photosynthetic potential and true photosynthetic productivity. These results are in accordance with those obtained by **Salem *et al* (1983), El-Maghraby *et al* (1986), Lucas (1985), Saleh and Wali (1988), El-Hosary** and **Salwau (1989), El-Deeb (1990), Gouda *et al* (1992), Khalil(1992), Salwau (1993),Amin (1994),Nofal-Fatma (1994), Younis et al (1994), Gouda and El-Banna (1995), El-Gezawy (1996), El-Habbak (1996),**

Gouda (1997), Zaghloul (1999), Salem (1999), El-Banna and **Gomaa (2000), Sobh**

et al **(2000) and EL-Bana (2001)** pointed out that there was significant increase in grain yield due to increasing N level up to 45, 90, 62.5 ,66.7, 135, 92, 150, 90, 120, 140, 135, 125, 130, 135, 130, 135, 100, 120, 125, 180 and 120 kg N/ feddan, respectively.

D-Interaction effects:

D-a - Interaction effect between maize cultivars and plant density:

The effect of the interaction between maize cultivars and plant density were not significant on all characters of yield components and grain yield of maize in 2000 and 2001 season. This means that each of this factors act independently on their effect on these characters, consequently, the data were excluded. Similar results were obtained by **Soliman et al (1995)** noticed that the characters of yield components and grain yield were not significant as affected by the interaction between plant population densities and maize hybrids. On the other hand, **El-Habbak (1996) and El-Sheikh (1998)** showed that the interaction between maize variety and density significantly affected ear length, number of grains/ row, grain weight/ ear, 100- grain weight and grain yield/ feddan.

D-b- Interaction effect between maize cultivars and N level:

There was a significant difference on the mean values of ears number in the second season only due to the interaction between maize cultivars and N level as shown in Table (11).S.C 122 or Giza 2 cultivar with 135 kg N/ feddan produced the

Table (11) : Interaction effect between maize cultivars and N level on Number of ears/plant in 2000 and 2001 seasons.

Character	Number of ears/plant					
Season	First season			Second season		
cultivars	S.c 122	T.w.c 321	Giza 2	S.c 122	T.w.c 321	Giza 2
N - level						
zero	0.8 a	0.8 a	0.9 a	0.7 fg	0.7 g	0.7 g
45 kg N/fed.	0.9 a	0.9 a	0.9 a	0.9 c	0.8 cf	0.8 df
90 kg N/fed.	1.0 a	1.0 a	1.0 a	1.0 b	0.9 cd	1.0 b
135 kg N/fed	1.0 a	1.0 a	1.0 a	1.2 a	1.0 b	1.2 a
F test	N.S			*		

* significant at 5 %

maximum number of ears / plant (1.2 ears/ plant) in the second season, whereas the minimum one was 0.7 ears/ plants, obtained from Giza 2 cultivar without nitrogen application. the same trend was obtained by **El-Sheikh (1998)** showed that S.C 10 produced the higher values of ears number/ plant with application of 120 kg N/ feddan. On the other hand, **Ahmed (1989), Gouda et al (1992), Nofal-Fatma (1994) and El-Habbak (1996)** found that the other characters of yield components and grain yield of maize were not significantly affected by the interaction between maize cultivars and N-level.

D-c- Interaction effect between plant density and N level:-

The effect of the interaction between plant density and N level was significant on number of rows/ ear (in the first season) and ear weight (in the second season) as shown in Tables (12 and 13). The higher number of rows/ ear and ear weight were 14.0 and 226.9 gm, respectively produced from plants grown at a distance of 25 cm between hill with applied 135 kg N/ feddan. Whereas the lower ones were 12.3 and 131.8 gm , respectively for the same characters, obtained from plants grown at a distance of 25 cm between hill without application of nitrogen fertilizer .On the contrary , no significant difference was obtained between the interaction of 25 cm and 30 cm apart between hill with application of 135 kg N / feddan on the mean values of ears number / plant and ear weight in the first and second season, respectively .Similar results were reported **by El- Habbak (1996)** who showed that the interaction between plant density X N level had significant effect on ear weight .

Table (12) : Interaction effect between plant density and N level on Number of rows/ear in 2000 and 2001 seasons.

Character	Number of rows/ear					
Season	First season			Second season		
plant density	30000	24000	20000	30000	24000	20000
N - level						
zero	12.7 g	12.3 h	12.7 g	13.0 a	13.0 a	13.3 a
45 kg N/fed.	13.1 ef	13.1 ef	13.1 f	13.7 a	13.8 a	14.1 a
90 kg N/fed.	13.3 de	13.5 cd	13.6 bc	13.9 a	14.1 a	14.4 a
135 kg N/fed	13.8 ab	14.0 a	13.9 a	14.5 a	14.5 a	14.7 a
F test	*			N.S		

* significant at 5 %

Table (13) : Interaction effect between plant density and N level on Ear weight in 2000 and 2001 seasons.

Character	Ear weight (gm)					
Season	First season			Second season		
plant density	30000	24000	20000	30000	24000	20000
N - level						
zero	104.1 a	96.8 a	110.4 a	141.3 g	131.8 h	160.6 f
45 kg N/fed.	132.0 a	135.2 a	150.6 a	181.6 e	195.5 d	200.3 cd
90 kg N/fed.	171.0 a	170.2 a	184.2 a	195.3 d	206.6 bc	213.3 b
135 kg N/fed	194.5 a	185.9 a	196.3 a	210.4 b	226.9 a	226.8 a
F test	N.S			*		

* significant at 5 %

The interaction between two factors did not affect significantly the other characters of yield and its components of maize under study in the two seasons. This means that each of this factors act independently on there effect on these characters, consequently the data were excluded **Koraiem et al (1980) and El- Hosary and Salwau (1989)** gave the same trend .

D-d Interaction effect between maize cultivars, plant density and N level :

The interaction between the three factors did not affect significantly all characters of yield and yield components of maize in both seasons, consequently the data were excluded.

III- Chemical analysis :

A-Varietal differences :

Table (14) show that no any marked difference was detected in the content of protein, oil and carbohydrate in maize grains due to maize cultivars in the two growing seasons. These results are in agreement with those obtained by **Kamel et al (1986) , Aly (1988) Nofal –Fatma (1994), Hassan (1999) ,and El-Hasawy (2001)** found that the differences among maize varieties in protein content were not significant .**Also Hefni et al (1993 b) , El-Gezawy (1996) ,Esmail (1996) and El-Hasawy (2001)** indicated that no significant difference was obtained between maize cultivars on oil and carbohydrate content in maize grains .

B- Effect of plant density :

Data in Table (15) indicated that increasing distance between hills had no significant effect on the mean values of

protein, oil and carbohydrate content in grains of maize in both seasons. These results are in accordance with those obtained by **Tantawy et al (1998)**.On the contrary ,**Amin (1994) and Esmail (1996)** showed that increasing plant density from 20to 30 thousand plants / feddan induced significant decrease in grain content of carbohydrate and protein

C-Effect of N level :

The results in Table (16) show the effect of N- level on the mean values of protein, oil and carbohydrate content in maize grains in the two growing seasons.

There was a significant difference in protein content in maize grains due to application of nitrogen fertilizer in both seasons. Application of 45 kg N/ feddan gave the maximum content of protein (15.9%) in the first season, whereas the highest values was 14.0, obtained from adding 90 kg N/feddan in the second season . The same trend was obtained by **Amin (1994), Nofal-Fatma (1994), EL-Gezawy (1996), Abu-Grab et al (1997), Zaghloul (1999) and Salem (1999).**

Regarding to oil and carbohydrate content, it was clear that no any marked difference was detected in the mean values of oil and carbohydrate content in maize grains due to increasing N level in both seasons . These results are not agreement with those obtained by **Amin, (1994) and Zaghloul (1999)** who found that oil and carbohydrate content in maize grains were marked difference due to increasing N level in both seasons .

Table (16) :The average values of protein, oil and carbohydrate content in maize grain as affected by nitrogen level in 2000 and 2001 growing seasons.

Characters Treatments	Protein content (%)	Oil content (%)	Carbohydrate content (%)
N- level		**First season**	
zero	11.5 d	5.5 a	70.0 a
45 kg N/fed	15.9 a	5.6 a	69.8 a
90 kg N /fed	12.6 c	5.6 a	70.4 a
135 kg N/fed	13.5 b	5.5 a	70.8 a
F-test	*	**N.S**	**N.S**
N- level		**Second season**	
zero	12.5 c	6.1 a	70.5 a
45 kg N/fed	13.4 b	5.9 a	70.4 a
90 kg N /fed	14.0 a	6.0 a	69.9 a
135 kg N/fed	12.1 d	6.3 a	71.2 a
F-test	*	**N.S**	**N.S**

* significant at 5 %

D- Interaction effects :-

The interaction between maize cultivar and plant density or between maize cultivar and N-level or between plant density and N level as will as between the three factors on chemical constituents of maize grain under study were not significant in both seasons, This means that the three factors in this study acted independently.