RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

I. Maize crop :

1. Growth characters :

1.1. Maize varietal differences :

The effect of maize varieties on some growth characters of maize under intercropping mungbean with maize during 2003 and 2004 growing seasons are presented in Table (5).

1.1.1.Plant and ear height :

The tested varieties of maize differed significantly in plant and ear height in both seasons.

Giza 2 maize variety was the shortest with lowest ear position with significant differences as compared with the two other varieties, whereas S.C 10 maize variety was the tallest with highest ear position T.W.C. 321 maize variety come in between both seasons. On the other hand, no significant differences were obtained between S.C. 10 and T.W.C. 321 maize varieties in plant height in the second season.

Generally the three tested varieties could be arranged in a descending order according to their height as follow: S.C.10, T.W.C. 321 and Giza 2. The results are mainly due to the differences in the genetical constitution of the evaluated varieties. These results agreed with those reported by **Mahmoud and Khalifa (1983), Assey *et al.*, (1992c), Badr *et al.*, (1993), Abd-Alla (1996), Aly *et al.*, (1996), El-Habbak and Shams El-**

Table (5): Effect of maize varieties on some growth characters of maize during 2003 and 2004 seasons.

Characters / Maize Varieties	Plant height (cm)	Ear height (cm)	Stem diameter (m.m)	No. of green leaves at harvest	Ear leaf area (cm^2)	Tasseling date days	Silking date days
	2003 season						
S.C. 10	307.7	148.2	21.8	14.7	832.8	64.4	66.8
T.W.C. 321	300.8	148.3	21.6	14.3	810.2	65.6	67.3
Giza 2	288.4	143.9	19.2	13.8	822.1	62.8	66.1
L.S.D. at 5%	4.0	1.6	0.7	0.3	N-S	0.6	0.4
	2004 season						
S.C. 10	301.6	146.6	23.9	14.7	789.5	64.2	66.4
T.W.C. 321	301.5	147.3	24.3	14.5	807.8	65.3	67.3
Giza 2	283.4	142.9	18.5	13.9	729.6	61.4	65.2
L.S.D. at 5%	3.1	1.5	0.5	0.3	36.2	0.7	0.6

N-S : No Significant .

Table (5R):Growth characters of maize varieties pure stand during 2003 and 2004 seasons.

Characters / Maize	Plant height (cm)	Ear height (cm)	Stem diameter (m.m)	No. of green leaves at harvest	Ear leaf area (cm^2)	Tasseling date days	Silking date days
	2003 season						
S.C. 10	317.5	156.0	25.5	14.8	908.2	62.2	66.2
T.W.C. 321	202.5	146.4	26.2	14.4	831.6	60.8	65.3
Giza 2	287.0	138.6	19.6	14	720.7	61.4	66.0
	2004 season						
S.C. 10	315	149.5	24.2	14.2	850.8	60.2	64.2
T.W.C. 321	296	147.0	22.3	14.6	864.2	60.6	65.0
Giza 2	287	136.0	18.8	14.0	767.0	60.4	66.0

Din (1996), Abdalla *et al.*, (1999a), Said and Gabr (1999), El-Danasoury (2003) and Lamloum (2006).

1.1.2. Stem diameter:

There were significant differences in stem diameter among maize varieties under study in both seasons (Table 5). T.W.C. 321 maize variety surpassed the other varieties in stem diameter (21.75 and 23.94 mm) in the first and second seasons, respectively. Whereas, no significant difference was obtained between S.C. 10 and T.W.C. 321 in both seasons. While Giza 2 maize variety gave the minimum one (19.24 and 18.53 mm) in the first and second seasons, respectively. In this connection, it could be noticed that these differences may be due to genetical differences between varieties. These results confirm well those obtained by **Badr *et al.* (1993), Abd-Alla (1996), Aly *et al.* (1996), Said and Gabr (1999) and El-Danasoury (2003).**

1.1.3. Number of green leaves/plant :

The results in Table (5) indicated that the differences between the three mentioned varieties in number of green leaves/plant at harvest were significant in both seasons. S.C.10 maize variety surpassed T.W.C. 321 maize variety which was better than Giza 2 maize variety. Differences among S.C. 10 and T.W.C. 321 maize varieties were not significant in the second season.

These differences may be due to genetically differences the three varieties. Results are in general agreement with between those reported by **El-Habbak and Shams El-Din (1996) and El-Danasoury (2003).**

1.1.4. Leaf area of the topmost ears:

The data presented in Table (5) show that the mean values of leaf area was significantly affected by maize varieties in the second season only.T.W.C.321 maize variety gave the highest value of leaf area of the topmost ear (807.84 cm^2). On the contrary, Giza 2 maize variety was inferior in this character when compared with the other two varieties in the second season. In the first season, the three varieties under study could be arranged according to leaf area in a descending order as follows: S.C. 10, Giza 2 and T. W.C. 321 maize varieties without significant differences between the tested varieties.

It could be concluded that S.C. 10 and T.W.C. 321 maize varieties were superior as compared to Giza 2 maize variety in leaf area of the topmost ear, which was in line with data obtained by **Mahmoud and Khalifa (1983), Badr *et al.* (1993), El-Habbak and Shams El-Din (1996), Said and Gabr (1999), El-Danasoury (2003) and Lamloum (2006).**

1.1.5. Time of tasseling and silking :

The results in Table (5) revealed that tested varieties differed significantly in number of days to 50% tasseling and silking in both seasons. Giza 2 maize variety was the earlist variety in tasseling and silking dates. S.C. 10 maize variety ranked the second, while T.W.C. 321 maize variety gave the latest variety. These differences may be due to the genetical differences between varieties. Several investigators reported marked differences in tasseling and silking dates of maize

varieties **(Mahmoud and Khalifa, 1983; El-Habbak and Shams El-Din, 1996; Said and Gaber, 1999; Lamlom, 2006).**

1.2. Effect of nitrogen level :

The effect of nitrogen fertilizer level on some growth characters of maize under intercropping mungbean with maize in 2003 and 2004 seasons are shown in Table (6).

1.2.1. Plant and ear height:

Nitrogen fertilization showed highly significant effect on plant and ear height of maize plant in both seasons (Table 6).

The application of 140 kg N/feddan gave the tallest plants and highest ear height and second seasons, respectively. On the other hand, the shortest mean values of plant height and lowest ear height produced from adding 100 kg N/feddan.

The increases in plant height due to adding 120 and 140 kg N/feddan were 1.80% and 6.61, respectively over the control treatment in the first season. However applying the same subsequent N-level increased plant height by 6.60% and 11.88%, respectively in the second season. The increase in plant height may be due to the increase in meristematic activity in maize plant as well as cell elongation. Nitrogen encourage both meristematic activity and auxin production in plant. These results are in accordance with those obtained by **Assey *et al.* (1992b), El-Habbak and Shams El-Din (1996), Shivag *et al.* (1997), El-Douby and Allam (2001) and Shams (2002).**

Table (6): Effect of N-levels on some growth characters on maize during 2003 and 2004 seasons.

Characters / N-levels (kg/fed)	Plant height (cm)	Ear height (cm)	Stem diameter (m.m)	No. of green leaves at harvest	Ear leaf area (cm^2)	Tasseling date days	Silking date days
	2003 season						
100	289.1	142.9	19.2	13.8	765.2	63.6	66.3
120	299.7	146.2	20.8	14.2	826.0	64.1	66.3
140	308.2	151.4	22.6	14.8	874.0	65.0	67.5
L.S.D. at 5%	1.9	1.6	0.3	0.2	15.3	0.4	0.4
	2004 season						
100	278.4	141.7	20.1	14.3	714.5	63.0	65.6
120	296.7	144.8	22.0	14.3	772.3	63.7	66.4
140	311.4	150.4	24.7	14.4	840.3	64.3	66.9
L.S.D. at 5%	4.6	1.3	0.4	0.1	20.7	0.5	0.4

1.2.2. Stem diameter :

Results in Table (6) clearly indicate that stem diameter of the topmost ear significantly increased as the nitrogen level increased up to a higher rate (140 kg N/feddan) in the two growing seasons. The maximum stem diameter was 22.61 and 24.70 mm, produced from applied nitrogen fertilizer at 140 kg N/feddan in the first and second seasons, respectively, whereas, minimum one was 19.24 and 20.14 mm, obtained from adding 100 kg N/feddan, respectively. These results are expected since N increases the vegetative growth of maize plants. The same trend was also realized by **Shivay *et al.* (1997), El-Douby and Allam (2001) and Shams (2002)**.

1.2.3. Number of green leaves/plant:

The mean values of green leaves number per plant was significantly increased by increasing N rate from 100 to 140 kg N/feddan in both seasons (table, 6).

The highest number of green leaves/plant was 14.6 and 14.6, obtained from adding 140 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 **El-Habbak and Shams El-Din (1996) and Shivay *et al.* (1997).**

1.2.4. Leaf area of the topmost ear :

The results illustrated in Table (6) show that the mean values of leaf area significantly increased by increasing N-level

up to 140 kg N/feddan in the two growing seasons. The application of 120 and 140 kg N/feddan increased leaf area by 7.94 and 14.22%, respectively over the check treatment in the first season. The corresponding increases were 8.09 and 17.61%, respectively in the second seasons.

In general N encrouged growth of leaf area as an essential element which plays a prominent role in building new meristematic cells, cell elongation and increasing photosynthesis activity of maize plants. The same trend were observed by **El-Habbak and Shams El-Din (1996), Shivay *et al.* (1997), Attia *et al.* (1999), El-Douby and Allam (2001) and Shams (2002).**

1.2.5. Time of tasseling and silking :

Results in Table (6) indicate clearly that nitrogen fertilizer significant influence on tasseling and silking dates of maize plant in the two growing seasons. The number of days to 50% tasseling and silking were increased significantly when N increased up to 140 kg N/feddan. These results are in harmony with those obtained by **Younis *et al.* (1994) and El-Habbak and Shams El-Din (1996)** indicated that number of days from planting to mid taseling and silking increased by increasing N level up to 90 and 135 kg N/feddan, respectively. On the other hand, **Said and Gabr (1999) and Shams (2002)** found that increasing N level decreased both tasseling and silking except in case of the effect of the heaviest dose on tasseling where number of days were little lower than plant received 90 kg N/feddan.

1.3. Effect of intercropping patterns :

The effect of intercropping patterns on some growth characteristics i.e. plant height and ear height, stem diameter, number of green leaves/plant, ear leaf area of the topmost ear, time of tasseling and silking in the two growing seasons are recorded in Table (7).

1.3.1. Plant and ear height :

Data in Table (7) indicated that intercropping patterns had a significant effect on maize plant and ear height in one season out of two. The tallest plant and highest ear position were 298.89 and 147.38 cm, respectively, produced from maize plants grown on both sides of the ridge (140 cm), 30 cm between hills with mungbean plants grown on the middle ridge, 20 cm between hills and two plants per hill (2 : 1 pattern) in the second season. While, the shortest plant and lowest ear position were 292.53 and 144.06cm, obtained from maize plants grown on both sides of the ridge with mungbean plants grown in three rows of the ridge (2 : 3 patterns) in the second season. The increase in plant and ear height in intercropping pattern (2 : 1) as compared to those intercropping may be due to more competition between plants that among plants in any intercropping pattern. Similar results were obtained by **Hefni *et al.* (1984a), Kamel *et al.* (1990), Khalil (1994), Shafshak *et al.* (1994), Abd-Alla (1996), Girges (1998), El-Douby and Allam (2001), El-Danasoury (2003), Mohamdain (2004) and Lamloum (2006).**

Table (7): Effect of intercropping patterns on some growth characters on maize during 2003 and 2004 seasons.

Characters / Intercropping patterns	Plant height (cm)	Ear height (cm)	Stem diameter (m.m)	No. of green leaves at harvest	Ear leaf area (cm^2)	Tasseling date days	Silking date days
2003 season							
Maize : Mung 2 : 1	298.5	146.4	20.8	14.4	822.7	63.9	66.6
2 : 2	299.0	147.0	21.0	14.1	821.0	64.1	66.7
2 : 3	299.4	147.0	20.9	14.2	821.4	64.7	66.9
L.S.D. at 5%	N-S	N-S	N-S	0.2	N-S	0.5	N-S
2004 season							
2 : 1	298.9	147.4	23.0	14.4	771.7	63.0	65.8
2 : 2	295.1	145.4	22.3	14.4	779.1	63.4	66.0
2 : 3	292.5	144.1	21.4	14.2	776.2	64.6	67.1
L.S.D. at 5%	2.7	0.8	0.3	0.2	N-S	0.7	0.6

N-S : No Significant .

1.3.2. Stem diameter :

It is evident from Table (7) that stem diameter was significantly affected by intercropping patterns in one season only. The highest values was 23.04 mm, obtained when intercropping maize plants with mungbean in (2 : 1) patterns in the second season. On the other hand, intercropping maize plant with increasing plant density of mungbean caused a significant decrease in stem diameter. The results coincided those obtained by **Hefni *et al.* (1984 a and b), Abd-Alla (1996), El-Douby and Allam (2001), El-Nagar *et al.* (2002) and El-Danasoury (2003).**

1.3.3. Number of green leaves/plant:

The results presented in Table (7) showed that the effect of intercropping patterns on number of green leaves/plant was significant in both seasons. Number of green leaves/plant reaches the highest value when maize plants were intercropped with mungbean under (2 :1) pattern in both season as compared with other patterns. Whereas the lowest one was produced when increasing density of mungbean plants intercropped with maize plants (2:3 pattern) in both season. This may be due to high competition between mungbean and maize plants for light, water, space and nutrients mungbean plants provided a space canopy of maize, this may lead to increased photosynthetic activity and the amount of metabolities synthesized. Similar results were observed by **El-Danasoury (2003), Mohamdain (2004) and Lamloum (2006).**

1.3.4. Leaf area of the topmost ear :

The mean values of ear leaf area did not varied significantly among all studied intercropping patterns in both seasons as shown in Table (7). The same trend was obtained by **Khalil (1994)** who showed that leaf area of the topmost ear was not significantly influenced by intercropping patterns.

1.3.5. Time of tasseling and silking :

It is obvious from Table (7) that number of days to 50% tasseling in both seasons and number of days to 50% silking in one season were significantly affected by intercropping patterns.

The data showed that intercropping patterns (2:2) and (2:3) delayed tasseling and silking as compared with pattern (2:1) in both seasons. These results are mainly due to inter and intraspecific competition when maize intercropped with mungbean at high densities. These results are supported by those of **El-Danasoury (2003) and Lamloum (2006).** On the other hand, **Abdalla *et al.* (1999a)** reported that number of days to 50% tasseling and silking were not affected by intercropping patterns.

1.4. Interaction effects :

The interaction between maize varieties and N-levels was significantly affected on plant height and stem diameter in both seasons (Table, 8) and number of green leaves/plant in the second season as well as time of tasseling and silking in the first season (Table 9). On the other hand, the other growth characters of maize under study were not significantly affected by the interaction between maize varieties and N-level in both seasons, the data were excluded.

Table (8): Effect of the interaction between maize varieties and N-levels on plant height and stem diameter in 2003 and 2004 season.

Characters		Plant height (cm)		Stem diameter (mm)	
Seasons		2003	2004	2003	2004
Maize Varieties	N-level Kg N/feddan				
S.C.10	100	301.1	278.0	20.0	21.5
	120	306.3	306.5	21.5	23.4
	140	315.7	320.3	23.8	27.0
T.W.C.321	100	286.1	284.3	19.4	21.3
	120	303.8	302.2	21.6	24.0
	140	312.4	318.2	23.9	27.7
Giza 2	100	279.9	272.9	18.3	17.6
	120	288.9	281.6	19.3	18.5
	140	296.5	295.9	20.2	19.4
L.S.D. at 5%		3.4	8.o	0.5	0.8

Table (9): Effect of the interaction between maize varieties and N-levels on number of green leaves/plant in 2004 season, tasseling and silking date in 2003 season.

Characters		No. of green leaves/plant	Silking date days	Tasslings date days
Seasons		2004	2003	2003
Maize varieties	N. levels (Kg/fed)			
S.C.10	100	14.6	65.9	63.3
	120	14.6	66.8	64.4
	140	14.7	67.5	65.4
T.W.C.321	100	14.6	66.8	64.8
	120	14.4	66.2	65.0
	140	14.5	68.9	66.8
Giza 2	100	13.7	65.9	62.5
	120	13.8	66.2	62.9
	140	14.1	66.2	62.8
L.S.D. at 5%		0.2	0.7	0.8

It was clear that the tallest plants were, produced from S.C.10 maize variety with applied 140 kg N/feddan in both seasons. Whereas no significant difference was obtained between S.C. 10 and T.W.C. 321 maize varieties with applied 140 kg N/feddan. On the other hand, Giza 2 maize variety with applied 100 kg N/feddan gave the shortest plants in both seasons.

Regarding to stem diameter, the results in Table (8) showed that the maximum mean values of stem diameter were, produced from T.W.C.321 maize variety with adding 140 kg N/feddan. Whereas, the minimum ones were, obtained from Giza 2 maize variety with adding 100 kg N/feddan. It could be concluded that S.C. 10 or T.W.C. 321 maize varieties with applied 140 kg N/feddan gave the tallest plant and maximum value of stem diameter in both seasons.

The statistical analysis of data in Table (9) indicated that number of green leaves/plant, time of tasseling and silking were significantly affected by the interaction between maize varieties and N level in one out of two seasons. Increasing N level up to 140 kg N/feddan with S.C. 10 maize variety gave the maximum mean values of green leaves number/plant in the second season. Whereas, Giza 2 maize variety with adding 100 kg N/feddan gave the earliest tasseling and silking dates in the first season.

The average values of plant height, stem diameter, time of tasseling and silking in the second season and ear leaf area in the first season were significantly affected by the interaction between maize varieties and intercropping patterns are presented in Table (10). T.W.C. 321 maize variety when intercropped with

mungbean in (2:1) pattern gave the tallest plants and maximum stem diameter in the second season. Whereas S.C.10 maize variety under (2:1) pattern gave the highest area of ear leaf (837.71 cm) in the first season. On the other hand, the number of days to 50% tasseling and silking were earlier with Giza 2 maize variety under (2 :1) pattern in the second seasons. The interaction between maize varieties and intercropping pattern did not affect significantly the other characters of growth under study in both seasons, consequently the data were excluded.

The effect of the interaction between N-level and intercropping patterns was not significant on all growth characters of maize under study in both seasons, the data were excluded.

Also, the interaction between maize varieties, N-levels and intercropping patterns did not affect significantly all growth characters of maize plant under study except plant height in both seasons and ear height in the second season as shown in Table (11), S.C. 10 maize variety with applied 140 kg N/feddan when intercropped with mungbean in (2:1) pattern gave the tallest plant (317.38 and 322.88 cm) in the first and second season, respectively. Whereas, the highest ear height was 153.88cm, produced from T.W.C. 321 maize variety with adding 140 kg N/feddan when intercropped with mungbean under (2 : 1) pattern in the second season.

Similar trend was obtained by **Mohmoud and Khalifa (1988), Assey *et al.* (1992) and Lamloum (2006).**

Table (10): Effect of the interaction between maize varieties and intercropping patterns on plant height, stem diameter in 2004 season, ear leaf area in 2003 season, tassling and silking date days in 2004 season.

Characteristic		Plant height	Stem diameter	Ear leaf area (cm^2)	Tassling date days	Silking date days
Season		2004	2004	2003	2004	2004
Maize varieties	Intercropping patterns					
S.C. 10	2 : 1	300.1	25.0	837.7	64.1	66.4
	2 : 2	300.8	23.9	832.7	64.0	66.1
	2 : 3	303.8	22.9	828.0	64.6	66.8
T.W.C. 321	2 : 1	306.3	25.0	822.7	65.1	67.1
	2 : 2	301.6	24.7	805.6	64.8	66.8
	2 : 3	296.8	23.3	802.3	66.1	67.8
Giza 2	2 : 1	290.3	19.1	807.8	59.8	63.8
	2 : 2	283.0	18.5	824.6	61.3	65.0
	2 : 3	277.1	18.0	833.9	63.1	66.8
L.S.D. at 5%		4.8	0.5	19.5	1.2	1.0

Table (11) :Effect of the interaction between maize varieties, N-levels and intercropping patterns on plant height and ear height in 2003 and 2004 season.

Characters			Plant height		Ear height
Seasons			2003	2004	2004
Maize varieties	N-levels (Kg/fed.)	Intercropping patterns			
S.C. 10	100	2 : 1	299.0	273.0	146.0
		2 : 2	302.3	276.3	143.6
		2 : 3	302.0	284.6	140.1
	120	2 : 1	306.3	304.4	147.8
		2 : 2	306.8	307.6	146.3
		2 : 3	305.9	307.4	144.3
	140	2 : 1	317.4	322.9	150.3
		2 : 2	312.3	318.6	149.6
		2 : 3	317.4	319.4	151.6
T.W.C. 321	100	2 : 1	284.0	293.1	146.6
		2 : 2	281.9	284.3	143.4
		2 : 3	292.5	275.3	141.1
	120	2 : 1	305.0	306.8	148.8
		2 : 2	303.6	300.4	146.4
		2 : 3	302.8	299.5	145.1
	140	2 : 1	317.3	319.0	153.9
		2 : 2	313.0	320.0	150.5
		2 : 3	309.9	315.5	149.9
Giza 2	100	2 : 1	277.9	286.1	137.1
		2 : 2	282.9	271.9	139.1
		2 : 3	279.1	260.6	138.4
	120	2 : 1	288.5	287.1	144.3
		2 : 2	288.1	281.1	141.5
		2 : 3	290.1	276.5	138.5
	140	2 : 1	294.4	297.8	151.6
		2 : 2	300.1	295.9	148.3
		2 : 3	294.9	294.0	147.5
L.S.D. at 5%			3.4	8.2	2.5

2. Yield and yield components :

2.1. Maize varietal differences :

The effect of maize varieties on yield and yield components of maize in the two growing seasons are shown in Table (12).

2.1.1. Percentage of double eared plants :

Table (12) indicated that the differences between the three maize varieties on the percentage of double eared per plant were significant in 2003 and 2004 seasons. It was obvious that T.W.C. 321maize variety gave the maximum mean values of double eared percentage per plant. Whereas, no significant difference was obtained between S.C. 10 and T.W.C. 321 maize varieties in the percentage of double eared per plant. On the other hand, Giza 2 maize variety produced the lowest one in both seasons. The differences between maize varieties were mainly due to genetical constituents. These results are in good agreement with those obtained by **Abd-El-Lateaf (1993) and Lamloum (2006).**

2.1.2. Ear characters :

Results showed that the differences among ear characters namely; ear length, ear diameter, number of rows/ear, number of grains per row and per ear and ear weight as affected by maize varieties were significant in the two growing seasons (Table 12).

It is clear that T.W.C. 321 maize variety gave the highest mean values of ear length (22.26cm), ear weight (284.83 gm) and grain weight/ear (223.24 gm) in the first season. On the other hand, S.C.10 maize variety produced the maximum mean

Table (12): Effect of maize varieties on yield and yield components of maize during 2003 and 2004 seasons.

Characters / Maize varieties	Double eared plants	Ear length (cm)	Ear diameter (m.m)	No. of rows / ear	No. of grains / row	Ear weight (g)	Weight of grains /ear	Shelling percentage	Weight of 100-grains (g)	Yield fed/ ardab
	2003 season									
S.C. 10	9.0	22.1	49.1	14.5	46.4	278.5	217.3	78.0	44.1	18.4
T.W.C. 321	9.4	22.3	47.8	14.4	46.0	284.8	223.2	78.4	43.4	17.8
Giza 2	6.7	19.0	39.7	12.9	39.1	231.3	181.0	78.3	36.1	16.0
L.S.D. at 5%	1.8	0.3	1.4	0.6	1.3	11.4	8.9	N-S	1.1	0.4
	2004 season									
S.C. 10	9.0	22.6	45.7	14.4	45.6	277.3	219.5	79.3	44.7	19.1
T.W.C. 321	9.4	21.8	44.3	14.2	45.9	268.4	211.6	78.6	43.7	18.7
Giza 2	7.0	19.1	37.6	12.9	37.6	183.4	141.8	77.9	37.6	16.0
L.S.D. at 5%	1.2	0.6	1.3	0.5	1.5	11.4	11.4	0.8	1.4	0.2

N-S : No Significant .

Table (12R): Yield and yield components of maize varieties pure stand during 2003 and 2004 seasons.

Characters / Maize varieties	Double eared plants	Ear length (cm)	Ear diameter (m.m)	No. of rows / ear	No. of grains / row	Ear weight (g)	Weight of grains /ear	Shelling percentage	Weight of 100-grains (g)	Yield fed/ ardab
	2003 season									
S.C. 10	12	24.0	50.3	14.6	50.8	284.0	240.0	85.0	46.9	22.7
T.W.C. 321	14	22.5	48.8	14.4	44.6	288.0	235.0	82.0	47.2	21.8
Giza 2	9	18.6	41.2	12.6	38.2	256.0	192.0	75.0	38.7	19.7
	2004 season									
S.C. 10	14	23.4	52.7	14.8	48.5	295.0	242.0	82.0	48.4	23.0
T.W.C. 321	10	20.0	47.3	14.0	42.6	282.0	238.0	85.0	43.9	21.3
Giza 2	8	19.2	43.3	12.2	42.7	267.0	198.0	75.0	36.6	19.2

values of ear diameter (49.06 and 45.69 mm), number of rows per ear (14.51 and 14.41) and number of grains per row (46.4 and 45.93) in the first and second seasons, respectively. The differences between S.C.10 and T.W.C. 321 maize varieties for number of rows per ear, number of grains per row, ear weight and weight of grains per ear were insignificant in both seasons. On the contrary, the lowest values of ear characters under study were produced from Giza 2 maize variety in the two growing seasons. The increase in ear weight and grain weight per ear of S.C.10 and T.W.C. 321 maize varieties may be due to the increase in ear length, number of rows/ear and number of grains per row and ear diameter. These results are in fit with the results obtained by **Abu-Kresha (1993), Badr *et al.* (1993), Aly *et al.* (1996), Abdalla *et al.* (1999a), Said and Gaber (1999), El-Danasoury (2003) and Lamloum (2006).**

2.1.3. Shelling percentage :

Single Cross 10 variety significantly exceeded the other maize varieties in shelling percentage followed by Three Way Cross 321 and Giza 2 maize varieties in the second seasons only (Table 12). Whereas, the varietal differences in shelling percentage did not reach the level of significance in the first season. These results may be due to the fact that this character is genetically controlled. The same trend was reported by **Badr *et al.* (1993), Abd-Alla (1996), Aly *et al.* (1996), Said and Gabr (1999) and El-Danasoury (2003).**

2.1.4. 100-grain weight :

The data illustrated in Table (12) show that 100-grain weight was significantly different among varieties under study in both seasons. S.C.10 maize variety surpassed significantly the other maize varieties in the mean values of 100-grain weight (44.05 and 44.71 gm) in the first and second seasons, respectively. While Giza 2 variety gave the lowest one (36.11 and 37.59gm, respectively). No significant difference was obtained between S.C. 10 and T.W.C. 321 varieties in 100 grain weight in both seasons. The present results showed marked differences in the genetically make up of the tested varieties and are in good agreement with those reported by **Abu-Kresha (1993), Aly *et al.* (1996), Said and Gaber (1999), El-Danasoury (2003) and Lamloum (2006).**

2.1.5. Grain yield (ardeb)/feddan :

Results in Table (12) showed that the tested maize varieties significantly differed in grain yield/feddan in both seasons. Single Cross 10 (S.C.10) maize variety was superior to the other varieties in grain yield/feddan followed by T.W.C. 321 and Giza 2 maize varieties in a descending order. These results hold true in both seasons. S.C.10 maize variety out yielded T.W.C. 321 and Giza 2 maize varieties by 3.05 and 12.68%, respectively in the first season. While it was 1.89 and 16.20%, respectively in the second season.

The superiority of the hybrid varieties is mainly due to the increase in yield components (ear length, ear diameter, number of rows/ear, number of grains/row, 100-grain weight and weight

of grains/ear). The superiority of growing hybrid maize varieties was also indicated by several investigators **(Kamel *et al.* 1992; Abd El-Lateaf, 1993; Badr *et al.* 1993; Abd-Alla, 1996; Aly *et al.* 1996; Abdalla *et al.* 1999a; El-Danasoury, 2003 and lamloum, 2006).**

2.2. Effect of nitrogen level:

The effect of N-levels on the mean values of double eared plants percentage, ear characters, shelling percentage and grain yield of maize per feddan in 2003 and 2004 seasons as shown in Table (13).

2.2.1. Percentage of double eared plants :

Nitrogen application up to 140 kg N/feddan caused a significant increase in the percentage of double eared plants in both seasons are presented in Table (13). Application of 140 kg N/feddan to maize plants gave the highest percentage of double eared plants which equal to 9.14 and 9.52% in the first and second seasons, respectively. The effect of nitrogen on the number of ears/plant may be due to its role in increasing the meristematic activity and fertility of maize plants. These results are in accordance with those obtained by **El-Habbak and Shams El-Din (1996), Attia *et al.* (1999) and Shams (2002).**

2.2.2. Ear characters :

Results showed that the differences among the mean values of ear characters namely; ear length, ear diameter, number of rows per ear, number of grains per row, ear weight and weight of grains per ear as affected by nitrogen fertilizer levels were significantly in 2003 and 2004 seasons (Table 13). Adding 140

Table (13): Effect of N-levels on yield and yield components of maize during 2003 and 2004 seasons.

Characters / N-levels (kg/fed)	Double eared plants percentage	Ear length (cm)	Ear diameter (m.m)	No. of rows /ear	No. of grains / row	Ear weight (g)	No. of grains /ear (g)	Shelling percent age	Weight of 100-grains (g)	Yield fed/ ardab
	2003 season									
100	8.0	20.8	42.8	13.5	40.9	231.1	181.0	78.4	38.2	15.8
120	7.9	20.8	45.7	13.8	43.5	266.5	208.1	78.1	41.0	17.1
140	9.1	21.8	48.1	14.6	47.1	297.1	232.3	78.2	44.4	19.2
L.S.D. at 5%	1.1	0.3	0.8	0.1	0.6	7.7	7.2	N-S	0.6	0.3
	2004 season									
100	7.8	19.7	39.1	13.4	40.0	225.0	176.4	78.5	39.2	16.8
120	8.3	21.0	42.2	13.6	42.8	242.0	189.3	78.5	41.5	17.6
140	9.5	23.0	46.3	14.4	46.5	262.1	207.2	78.7	45.3	19.4
L.S.D. at 5%	0.5	0.6	0.7	0.3	0.6	4.5	3.8	N-S	0.5	0.3

N-S : No Significant .

kg N/feddan recorded the highest mean values of ear characters in both seasons. These results may be due to the role of nitrogen as an essential element in building maize ear characters due to its effect on photosynthetic activity in plants and to its positive effects on growth of maize plants. Also, the increase of ear grains weight with adding nitrogen fertilization might be due to the role of N in activating the development of grains owing to the great amount of metabolites synthesized in the plants and translated in the ears reflected increases in ear length, thus leading to increase in grains weight. These results agree with several results obtained by **Assey *et al.* (1992b), El-Habbak and Shams El-Din (1996), Attia *et al.* (1999) and Shams (2002)**.

2.2.3. Shelling percentage :

Data in Table (13) show that N application had no significant effect on shelling percentage in the two growing seasons. 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 **Salem *et al.* (1983) and El-Hosary and Salwau (1989)** reported that increasing N level did not significantly affected the shelling percentage .

2.2.4. 100-grain weight :

The results in Table (13) revealed that increasing N level up to 140 kg N/feddan significantly increased 100-grain weight in both seasons. The application of 140 kg N/feddan increased 100-grain weight over application 100 kg N/feddan by 16.38 and 15.67% in the first and second seasons, respectively. 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 accordance with those reported by **El-Habbak and Shams El-Din (1996) and El-Wakil (2002).**

2.2.5. Grain yield (ardab)/feddan :

The results in Table (13) show clearly that the mean values of grain yield/feddan were significantly increased by increasing N-level from 100 kg to 120 kg up to140 kg N/feddan in the two growing seasons. In the first season, the application of 120 and 140 kg N/feddan increased the grain yield over the control treatment (100 kg N/fed.) by 8.21 and 21.59%, respectively. The corresponding significant increase in grain yield in the second season were 4.89 and 15.43%, respectively. The present results clearly indicated the increase in grain yield due to application of higher level of nitrogen fertilizer and this may be attributed to the increase in ear length, ear diameter, number of rows/ear, number of grains per row and grain weight per ear as well as 100-grain weight. Moreover, 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 agreement with those mentioned by **Assey *et al.* (1992b), Akhtaruzzaman *et al.* (1993), El-Habbak and Shams El-Din (1996), Shivay *et al.* (1997), Attia *et al.* (1999), Said and Gabr (1999), El-Douby and Allam (2001) and Shams (2002).**

2.3. Intercropping patterns :

Data listed in (14) show the mean value of double eared plants%, ear characters, shelling percentage, 100-grain weight and grain yield/feddan in 2003 and 2004 growing seasons as affected by intercropping patterns.

2.3.1. Percentage of double eared plants :

The data in Table (14) indicated that 2:1 intercropping pattern significantly surpassed the other patterns in the percentage of double eared plants in the second season, but the differences between 2:2 and 2:3 did not reach to the significance level .

It could be concluded that intercropping maize with low density of mungbean plants gave the highest percentage of double eared plants, whereas, when increasing density of mungbean plants with intercropping maize plants produced the lowest percentage of double eared plants in both seasons. The superiority of intercropping pattern (2:1) may be attributed to wider spaces between maize ridge. Similar results were reported by **Abd El-Lateaf (2000)** indicated that intercropping maize with mungbean in 1 : 3, 2 : 4 and 2 : 2 had higher number of ears/plant than soild maize plants.

2.3.2. Ear characters :

Ear length did not varied significantly among all studied intercropping patterns in both seasons as shown in Table (14). Intercropping pattern (2 : 1) had slight increase in ear length than all intercropping patterns in the second season. Whereas, the other characters of ears i.e. ear diameter, number of rows/ear, ear

Table (14): Effect of the intercropping patterns on yield and yield components of maize during 2003 and 2004 seasons.

Characters / Intercropping patterns	% Double eared/ plant	Ear length (cm)	Ear diameter (m.m)	No. of rows /ear	No. of grains / row	Ear weight (g)	No. of grains / ear (g)	Shelling percentage	Weight of 100-grains (g)	Yield fed/ ardab
2003 season										
Maize : Mung 2 : 1	8.5	21.1	46.3	14.4	44.2	264.7	206.9	78.2	41.2	17.5
2 : 2	8.4	21.1	45.8	14.0	44.0	265.7	207.2	78.0	41.0	17.4
2 : 3	8.1	21.3	44.4	13.6	43.4	264.3	207.3	78.5	41.3	17.3
L.S.D. at 5%	N-S	N-S	0.7	0.3	0.6	N-S	N-S	N-S	N-S	N-S
2004 season										
2 : 1	8.9	21.5	42.4	13.9	44.8	249.8	196.3	78.9	43.2	18.1
2 : 2	8.2	21.2	42.3	13.9	43.2	243.5	191.6	78.4	42.0	17.9
2 : 3	8.3	20.9	42.9	13.7	41.2	235.8	185.1	78.3	40.8	17.8
L.S.D. at 5%	0.6	N-S	N-S	N-S	0.6	1.9	2.6	N-S	0.4	0.2

N-S : No Significant .

weight and weight of grains/ear were significantly affected by intercropping patterns in one season out of two. It is apparent that the intercropping system of 2 : 1 significantly exceeded other intercropping patterns in ear diameter, number of rows/ear, ear weight and grain weight/ear in the first season, whereas, no statistical differences were recorded between the three patterns of intercropping in the second season.

In both seasons, number of grains/ear was significantly affected by intercropping patterns. Pattern 2 : 1 gave the highest values of grains number/ear compared the other patterns. This may be due to the low competition, better utilization of the available growth factors and increase in the photosynthesis activity and the amount of metabolites synthesized under 2 : 1 intercropping pattern. In this respect, **Mahmoud and Khalifa (1983), Hefni *et al.* (1984b), Buriro *et al.* (1989), Kamel (1990), Assey *et al.* (1992a), Abd EL-Lateaf (1993), Khalil (1994), Shafshak *et al.* (1994), Abd-Alla (1996), Abd-Alla *et al.* (1999a), El-Nagar *et al.* (2002), El-Danasoury (2003), Mahamdain (2004) and Lamloum (2006)** indicated that all of intercropping patterns had significantly an affect on yield components of maize .

2.3.3. Shelling percentage :

The data of shelling percentage as shown in Table (14) slightly increased by intercropping maize with mungbean in 2 : 2 pattern in both seasons without significant differences among the other intercropping patterns. These results are supported by those

obtained by **Abd Alla (1996), Girges (1998) and El-Danasoury (2003).**

2.3.4. 100-grain weight :

The data in Table (14) revealed that maize intercropping with mungbean in 2 : 1 pattern significantly increased 100-grain weight comparing to the other intercropping patterns in the second season only. These increases may be due to the effect of more light intercepted and low competition between plants for water and minerals reflected increases in ear length and weight and hence increased 100-grain weight. These results are in line with the findings of **Mahmoud and Khalifa (1983), Hefni *et al.* (1984b), Khalil (1994), Shafshak *et al.* (1994), Abd-Alla (1996), Attia *et al.* (1999) and Mohamdain (2004).** On the other hand, **Abdalla *et al.* (1999a) and El-Danasoury (2003)** revealed that maize intercropping with mungbean patterns insignificantly 100-grain weight.

2.3.5. Grain yield (Ardeb)/feddan :

The data collected in Table (14) clearly indicated that intercropping patterns significantly affected grain yield per feddan in one season out of two. The intercropping pattern of 2 : 1 produced the highest grain yield/feddan as compared with the other intercropping patterns which recorded 17.47 and 18.10 ardeb/feddan in the first and second seasons, respectively. Superiority in grain yield/feddan when (2: 1) pattern was applied followed by maize arranged in (2 :2) and (2 : 3) patterns were estimated to 0.21 and 0.33 ardeb, respectively in the second season. It could stated that the intercropping pattern of 2 : 1

could be recommend to maximize the productivity of maize per unit area. The superiority of maize plants under intercropping could be attributed to the lower competition between maize and mungbean plants as well as the better illumination conditions resulted from the deeper spaces created from alternating tall canopy (maize) with shorter canopy (mungbean). Such conditions led to the superiority of maize productivity. These increases may be due to more light penetration reflected the better vegetative growth and most yield components such as number of grains per row, grain weight/ear, double eared plants% and 100-grain weight resulted increases in grain yield/feddan. These results are in harmony with those obtained by **Putnam *et al.* (1987), Abd-Alla (1996), El-Douby *et al.* (1996), El-Hennaway and El-Bially (1997), Girges (1998), Abdalla *et al.* (1999a), El-Nagar *et al.* (2002), El-Danasoury (2003), Lamlom (2006) and Swiffy (2006).** On the other hand, **Mutanol (1987), Chowdhury and Rasario (1993) and Khalil (1994)** found that grain yield of maize did not differ significantly among intercropping patterns.

2.4. Interaction effects:

The effect of the interaction among maize varieties and N-level was significant on percentage of double eared/plant, and ear length in 2004 season as well as ear weight, weight of grains/ear and 100-grain weight in both seasons as shown in Table (15). Whereas, the other characters of yield and yield components of maize under study were not significantly affected by the interaction between maize varieties and N-level in both seasons, the data were excluded. The highest values of double

Table (15): Effect of the interaction between maize varieties and N- levels on Double eared/plant, ear length in 2004, ear weight (g), grain weight /ear (g) and 100 grains weight (g) in 2003 and 2004season.

Characters		% Double eared/plant	Ear length	Ear weight (g)		Grain weight/ear (g)		100-grains weight (g)	
Seasons		2004	2004	2003	2004	2003	2004	2003	2004
Maize varieties	N-levels (Kg/fed.)								
S.C. 10	100	8.0	20.8	255.3	264.1	198.9	210.3	40.6	42.0
	120	8.4	22.4	272.1	275.3	213.5	217.8	43.9	44.1
	140	10.6	24.8	308.3	292.7	239.4	230.5	47.7	48.0
T.W.C.321	100	8.7	19.8	256.0	249.5	200.4	194.9	40.0	40.3
	120	9.3	21.3	288.8	269.1	225.5	211.8	43.0	42.9
	140	10.1	24.4	309.7	286.5	243.8	228.3	47.3	47.8
Giza 2	100	6.8	18.6	181.9	161.4	143.9	123.9	33.9	35.3
	120	7.2	19.1	238.5	181.6	185.4	138.4	36.2	37.4
	140	7.1	19.7	273.4	207.3	213.7	162.9	38.2	40.1
L.S.D. at 5%		0.9	1.0	13.3	7.8	12.5	6.7	1.1	0.9

eared percentage per plant (10.58%), ear length (24.78cm) and ear weight (292.67g) and weight of grains /ear (230.5g) in the second season as well as 100-grain weight (47.65 and 48.03g) in the first and second seasons, respectively were produced from S.C.10 maize variety with applied 140 kg N/feddan. While, T.W.C. 321 maize variety with adding 140 kg N/feddan gave the highest mean values of ear weight (309.67g), and weight of grains per ear (243.84 g) in the first season. Whereas, no significant differences was detected between S.C.10 and T.W.C. 321 maize varieties with adding 140 kg N/feddan on the percentage of double eared/plant, ear length, ear weight, weight of grains/ear and 100- grain weight in both seasons.

It could be concluded that increasing N level up to 140 kg N/feddan with S.C. 10 or T.W.C. 321 maize varieties gave the greatest mean values of yield attributes of maize in both seasons.

Table (16) indicated that the mean values of ear diameter and number of rows/ear in the first season, number of grains/row in the second season, ear weight and weight of grains/ear in both seasons were significantly affected by the interaction between maize varieties and intercropping patterns. Maximum number of rows/ear (14.82), ear weight (289.67g) and weight of grains/ear (227.07g) in the first season were obtained from T.W.C. 321 maize variety under 2:1 pattern, whereas, S.C. 10 maize variety when intercropped in 2 :1 pattern produced the highest mean values of number of grains/row (47.45), ear weight (284.25g) and weight of grains/ear (226.08g) in the second season. Also, S.C.10 maize variety under 2: 2 pattern gave the maximum mean value of ear diameter (49.75m) in the first season. No significant

Table (16): Effect of the interaction between maize varieties and intercropping patterns on ear diameter, number of rows/ear in 2003, number of grains/row in 2004, ear weight and grain weight /ear in 2003 and 2004 season.

Characters		Ear diameter (m.m)	No. of rows /ear	No. of grains /row	Ear weight (g)		Grain weight /ear (g)	
Seasons		2003	2003	2004	2003	2004	2003	2004
Maize varieties	Intercropping patterns Maize: Mung.							
S.C.10	2 : 1	49.1	14.7	47.5	272.1	284.3	212.2	226.1
	2 : 2	49.8	14.4	45.5	282.7	278.4	219.5	218.9
	2 : 3	48.3	14.4	43.9	280.8	269.3	220.1	213.6
T.W.C. 321	2 : 1	49.2	14.8	46.9	289.7	271.5	227.1	212.5
	2 : 2	48.2	14.5	46.3	284.8	267.8	222.7	214.1
	2 : 3	46.0	14.0	44.6	280.0	265.8	220.0	208.3
Giza 2	2 : 1	40.6	13.5	40.1	232.4	193.6	181.4	150.2
	2 : 2	39.6	13.0	37.7	229.5	184.3	179.6	141.7
	2 : 3	39.0	12.3	35.2	231.9	172.3	181.9	133.4
L.S.D. at5%		1.2	0.4	1.0	7.1	3.3	6.1	4.5

difference was obtained between intercropping maize with mungbean in patterns (2 : 1) and (2 : 2) with maize varieties i.e. S.C. 10 and T.W.C. 321. On the other hand, the lowest ones were produced from Giza 2 maize variety under 2 : 3 pattern. Whereas the other characters of yield and yield component of maize under study were not significantly affected by the interaction between maize varieties and intercropping patterns in both seasons, the data were excluded.

Regarding to the interaction between N-level and intercropping patterns, the data presented in Table (17) show that percentage of double eared/plant in the second season, number of grains/row in both seasons, ear weight and grain weight/ear in the first season were significantly affected by the interaction between N-level and intercropping pattern. The highest mean values of double eared% per plant (10.58%) in the second season and the highest number of grains/row (47.45 and 47.97) in the first and second seasons, respectively were obtained by adding 140 kg N/feddan with intercropped in (2 : 1) pattern. Also, when increasing plant density of mungbean in pattern (2 : 3) with applied 140 kg N/feddan gave the maximum weight of ear (299.33 g) and weight of grains/ear (234.94 g) in the first season. On the other hand, at low level of nitrogen fertilizer at different patterns of intercropping maize with mungbean gave the lowest one of yield component characters. The other data of yield and yield components of maize had no significantly affected by the interaction between N-level and intercropping patterns, the data were excluded.

Table(17):Effect of the interaction between N-levels and intercropping patterns on Double ear/plant in 2004 season, number of grains/row in 2003 and 2004 season, ear weight and grain weight/ear in 2003 season.

Characters		% Double eared/ plant	No. of grains /row		Ear weight (g)	Grain weight /ear (g)
Seasons		2004	2003	2004	2003	2003
N-levels (kg/fed.)	Intercropping patterns Maize : Mung.					
100	2 : 1	7.8	41.4	42.1	234.3	184.1
	2 : 2	7.9	41.9	40.3	234.5	183.1
	2 : 3	7.8	39.4	37.4	224.4	175.9
120	2 : 1	8.4	43.8	44.4	265.3	207.3
	2 : 2	8.1	43.5	43.1	265.1	206.0
	2 : 3	8.4	43.2	40.9	269.0	211.1
140	2 : 1	10.6	47.5	48.0	294.6	229.3
	2 : 2	8.7	46.6	46.1	297.4	232.7
	2 : 3	8.5	47.3	45.3	299.3	234.9
L.S.D. at5%		o.9	1.1	1.0	7.1	6.1

Table (18):Effect of the interaction between maize varieties, N levels and intercropping patterns on number of grains/row, ear weight, weight of grains/ear in 2003 season and grain yield/fed (ardab) in 2004 season.

Characters			No. of grains /row	Ear weight (g)	Grain weight /ear	Grain yield/fed (ardeb)
Seasons			2003	2003	2003	2004
Maize varieties	N-levels (Kg/fed.)	Intercropping patterns				
S.C. 10	100	2 : 1	44.1	244.8	191.7	18.0
		2 : 2	44.8	263.5	202.3	17.7
		2 : 3	43.6	257.5	202.8	17.5
	120	2 : 1	47.4	266.3	206.9	19.0
		2 : 2	45.1	273.3	215.8	18.7
		2 : 3	44.6	276.8	217.9	18.5
	140	2 : 1	49.7	305.3	238.0	20.8
		2 : 2	48.3	311.3	240.5	20.6
		2 : 3	50.2	308.3	239.7	20.9
T.W.C. 321	100	2 : 1	44.8	268.8	211.6	17.9
		2 : 2	43.4	261.5	204.6	17.6
		2 : 3	40.9	237.8	184.9	17.5
	120	2 : 1	45.7	288.3	227.0	18.7
		2 : 2	46.4	287.5	221.4	18.4
		2 : 3	45.1	290.8	228.2	18.1
	140	2 : 1	49.4	312.0	242.6	20.6
		2 : 2	48.8	305.5	242.1	20.0
		2 : 3	49.4	311.5	246.9	19.7
Giza 2	100	2 : 1	35.4	189.3	148.9	14.8
		2 : 2	37.6	178.5	142.4	15.3
		2 : 3	33.7	178.0	140.2	14.9
	120	2 : 1	38.3	241.5	188.0	15.6
		2 : 2	38.9	234.5	180.8	15.6
		2 : 3	40.0	239.5	187.3	15.9
	140	2 : 1	42.8	266.5	207.3	17.7
		2 : 2	42.8	275.5	215.5	17.2
		2 : 3	42.8	278.3	218.3	17.0
L.S.D. at 5%			1.9	12.4	10.5	0.5

There was a significant difference on the mean values of number of grains/row, ear weight and weight of grains/ear in the first season as well as grain yield/feddan in the second season due to the interaction between the three factors as shown in Table (18). Whereas, the interaction between the three factors did not affect significantly on the other characters of yield and yield components of maize in both seasons, consequently the data were excluded. S.C. 10 maize variety with added 140 kg N/feddan when intercropped with mungbean under 2 : 3 pattern gave the greatest mean value of number of grains/row (50.15) in the first season and greatest grain yield/feddan (20.91 ardab) in the second season. Whereas, the maximum mean values of ear weight (311.50 g) and grain weight per ear (246.87 g) in the first season were produced from T.W.C. 321 maize variety with applied 140 kg N/feddan when intercropped with mungbean under (2 : 3) pattern. On the other hand, Giza 2 maize variety recorded the lowest values with applied 100 kg N/feddan when intercropped under (2 : 3) pattern.

It could be concluded that S.C. 10 or T.W.C. 321 maize varieties with added 140 kg N/feddan when intercropped with mungbean at different patterns produced the best yield of grains per feddan may be due to increasing growth of maize plants and yield components of maize.

3. Chemical analysis :

3.1. Maize varietal differences :

Data in Table (19) indicated no marked differenced in the contents of protein, oil and carbohydrate in maize grains between maize varieties in 2003 and 2004 seasons. These results are in agreement with those obtained by **El-Hasawy (2001) and El-Wakil (2002)** who found that the differences among maize varieties in protein content, oil and carbohydrate content were not significant.

3.2. Effect of nitrogen level :

The results in Table (20) 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 and carbohydrate content in maize grains due to application of nitrogen fertilizer in one season out of two. Whereas, the mean values of oil content was not significantly affected by increasing level of nitrogen fertilizer from 100 to 140 kg N/feddan in both seasons. In the first season. Application of 140 kg N/feddan gave the maximum content of protein (12.85 %) and the minimum content of carbohydrate (69.31%). The results obviously indicated the important role of nitrogen on crude protein percentage due to their effect on building up to the protoplasm, amino acids and proteins. These results are confirmed by those obtained by **Assey *et al.* (1992b) and El-Wakil (2002).**

Table (19):Effect of maize varieties on grain chemical analysis of maize during 2003 and 2004 seasons.

Characters / Maize varieties	Protein content %	Oil content %	Carbohydrate content %
	2003 season		
S.C. 10	12.7	6.0	69.9
T.W.C. 321	12.7	5.9	70.3
Giza 2	12.7	5.9	70.2
L.S.D. at 5%	N-S	N-S	N-S
	2004 season		
S.C. 10	12.7	6.0	71.1
T.W.C. 321	12.7	6.2	71.0
Giza 2	12.6	6.0	70.3
L.S.D. at 5%	N-S	N-S	N-S

N-S : No Significant .

Table (20):Effect of N-levels on grain chemical analysis of maize during 2003 and 2004 seasons.

Characters / N-levels (kg/fed)	Protein content %	Oil content %	Carbohydrate content %
	2003 season		
100	12.6	6.0	70.2
120	12.7	5.9	70.8
140	12.9	5.9	69.3
L.S.D. at 5%	0.2	N-S	1.0
	2004 season		
100	12.8	5.9	70.9
120	12.5	6.1	70.8
140	12.7	6.2	70.7
L.S.D. at 5%	N-S	N-S	N-S

N-S : No Significant .

3.3. Effect of intercropping patterns :

The effect of intercropping patterns on the mean values of protein, oil and carbohydrate content in maize grains in the two growing seasons as shown in Table (21). It was clear that intercropping patterns had a significant effect on protein and carbohydrate content in both season and oil content in the first season.

The maximum content of protein and carbohydrate were produced from maize plants grown on both sides of the ridge (140 cm), 30 cm between hills with mungbean plants grown in the three rows on the ridge, 20 cm between hills and two plants/hill (2 : 3 pattern) in both seasons. On the other hand, oil content was decreased with increasing densities of mungbean plants when intercropped with maize (2:3 pattern) in the first season. **Assey *et al.* (1992)** found that when maize population increased from 20000 to 30000 plants/feddan, the oil percentage increased and protein percentage decreased.

3.4. Interaction effects :

There was a significant difference on the mean values of protein and carbohydrate content in maize grain in the second season only due to the interaction between maize varieties and N level as shown in Table (22). T.W.C. 321 maize variety with adding 100 kg N/feddan gave the highest value of protein content (13.22%) in the second season. On the other hand, no significant difference was obtained between maize varieties with different N level in protein content except T.W.C. 321 maize variety with applied 100 kg N/feddan as compared the other treatment. While, S.C.10 maize variety with applied 100 kg N/feddan produced the maximum content of carbohydrate (71.65%)in the second season.

Table (21):Effect of intercropping patterns on grain chemical analysis of maize during 2003 and 2004 seasons.

Characters / Intercropping patterns	Protein content %	Oil content %	Carbohydrate content %
	2003 season		
Maize : Mung 2 : 1	12.5	6.0	68.8
2 : 2	12.7	5.9	70.4
2 : 3	13.0	5.8	71.1
L.S.D. at 5%	0.3	0.1	0.9
	2004 season		
2 : 1	12.0	6.1	70.2
2 : 2	12.6	5.9	70.4
2 : 3	13.5	6.2	71.8
L.S.D. at 5%	0.3	N-S	0.7

N-S : No Significant .

Table (22): Effect of interaction between maize varieties and N levels on protein and carbohydrate contents in maize grains in 2004 season.

Characters		Protein content %	Carbohydrate content %
Seasons		2004	2004
Maize varieties	N-levels (Kg/fed.)		
S.C. 10	100	12.5	71.7
	120	12.1	71.2
	140	12.9	70.4
T.W.C. 321	100	13.2	70.9
	120	12.2	71.5
	140	12.7	70.5
Giza 2	100	12.6	70.0
	120	12.7	69.7
	140	12.5	71.3
L.S.D. at 5%		0.6	1.4

The effect of the interaction between maize varieties and intercropping patterns were not significant on all characters of chemical analysis under study in both seasons. This means that each of this factors act independently on their effect on these characters, consequently, the data were excluded.

Data in Table (23) indicated that the mean values of oil content in the first season and carbohydrate content in the second season were significantly affected by the interaction between N-level and intercropping patterns. Whereas, protein content in both season, oil content in the second season and carbohydrate content in the first season were not significantly affected by the interaction. Consequently the data were excluded. It was clear that the highest content of oil in maize grains (6.14%), produced from adding 120 kg N/feddan when intercropping mungbean with mazie under (2 : 1) pattern in the first season, whereas, when increasing plant density of mungbean in 2 : 3 pattern with adding 120 k N/feddan gave the highest content of carbohydrate (72.44%) in the second season.

It could be concluded that when intercropping maize with increasing plant density of mungbean at different level of nitrogen level caused a significant decrease in oil content and increase carbohydrate content in maize grains.

The interaction between the three factors under study on protein and oil content in one season out of two and carbohydrate content in both seasons were significant as shown in Table (24). T.W.C. 321 variety surpassed the other varieties with adding 120 kg N/feddan when intercropped mungbean under 2 : 3 pattern in protein, carbohydrate and oil content in maize grains.

Table (23):Effect of interaction between N levels and intercropping patterns on oil content and carbohydrate content in Maize grain in 2003 and 2004 seasons.

Characters		Oil content %	Carbohydrate content %
Seasons		2003	2004
N-levels (Kg/fed.)	Intercropping patterns		
100	Maize : Mung. 2 : 1	5.9	70.3
	2 : 2	6.1	71.2
	2 : 3	5.8	71.1
120	2 : 1	6.1	69.9
	2 : 2	5.9	70.0
	2 : 3	5.8	72.4
140	2 : 1	6.1	70.3
	2 : 2	5.8	70.1
	2 : 3	5.9	71.7
L.S.D. at 5%		0.3	1.2

Table (24): Effect of the interaction between maize varieties, N levels and intercropping patterns on protein content in 2003 season, oil content in 2004 season and carbohydrate content in maize grain in 2003 and 2004 season.

Characters			Protein content %	Oil content %	Carbohydrate content %	
Seasons			2003	2004	2003	2004
Maize varieties	N-levels (Kg/fed.)	Intercropping patterns Maize : Mung				
S.C. 10	100	2 : 1	12.6	6.1	68.1	69.6
		2 : 2	12.6	6.3	72.0	72.8
		2 : 3	12.2	5.8	70.6	72.6
	120	2 : 1	11.7	5.7	67.6	71.6
		2 : 2	13.1	5.5	70.5	69.5
		2 : 3	13.5	6.0	73.0	72.3
	140	2 : 1	12.6	6.7	68.3	70.5
		2 : 2	13.0	6.1	69.3	69.5
		2 : 3	13.4	6.2	69.5	71.2
T.W.C. 321	100	2 : 1	12.6	5.6	70.1	70.4
		2 : 2	12.5	6.1	68.2	70.5
		2 : 3	12.8	6.4	72.4	71.8
	120	2 : 1	12.1	6.3	70.5	70.5
		2 : 2	12.3	6.2	71.0	71.3
		2 : 3	13.2	6.8	73.1	72.8
	140	2 : 1	12.5	6.4	66.8	71.3
		2 : 2	12.9	5.7	69.8	69.2
		2 : 3	13.1	6.2	70.4	70.8
Giza 2	100	2 : 1	12.3	5.8	71.0	70.9
		2 : 2	12.3	5.6	69.8	70.2
		2 : 3	13.1	6.0	69.6	69.0
	120	2 : 1	13.2	6.7	69.0	67.6
		2 : 2	12.6	6.0	72.9	69.3
		2 : 3	12.8	5.7	69.4	72.2
	140	2 : 1	12.8	5.7	67.8	69.2
		2 : 2	12.8	6.0	69.7	71.6
		2 : 3	12.6	6.4	72.1	73.1
L.S.D. at 5%			0.8	0.7	2.7	2.1

II. Mungbean crop

1. Growth characters :

1.1. Maize varietal differences :

The effect of maize varieties on some growth characters of mungbean in (2003 and 2004 seasons) are recorded in Table (25).

1.1.1. Plant height :

It was clear that the differences between maize varieties were significant on plant height of mungbean in both seasons. S.C.10 maize variety recorded the highest values of plant height (98.48 and 98.40 cm) in the first and second seasons, respectively. Whereas, Giza 2 maize variety recorded the lowest ones (90.30 and 92.28 cm) in 2003 and 2004 seasons, respectively. On the other hand, no significant difference was obtained between S.C. 10 and T.W.C 321 maize varieties in plant height of mungbean. It seemed that there was a tendency for mungbean plant height when it was intercropped with the tallest maize plants (S.C.10) maize variety comparison to the other maize varieties, this may be led to competition for light might enlarge stem internodes of mungbean plants and caused elongation in plant height. The differences between the three tested varieties of maize under study in plant height of mungbean are mainly due to the differences in their genetically make up. Similar results were obtained by **El-Dansoury (2003) and Lamlom (2006)** found that S.C.10 maize variety surpassed the other varieties of maize in plant height of mungbean or soybean, respectively.

1.1.2. Number of branches/plant:

The variation among maize varieties on number of branches/plant of mungbean was significant in one season out of two as shown in Table (25). In the second season S.C.10 maize variety exceeded all studied maize varieties in number of branches/plant (8.14). while no significant differences was obtained between T.W.C. 321 and Giza 2 maize varieties. The same trend was obtained by **AbdEl-lateaf, (1993), El-Danasoury (2003) and Lamloum (2006)** indicated that intercropping mungbean or soybean with S.C.10 maize variety increased significantly number of branches/plant in one season out of two.

II.1.1.3. Number of leaves/plant :

The data in Table (25) showed that mungbean planted under T.W.C. 321 maize variety surpassed that planted under S.C.10 or Giza 2 maize varieties in number of leaves per plant in both seasons. Whereas, the results did not reach the level of significance in the first season. This may be due to the low competition between mungbean and maize varieties for light, water, space and nutrients .

1.1.4. Leaf area index :

In significant variation among the three studied maize varieties in leaf area index of mungbean in the two growing seasons. It could be concluded that there is no differences between maize varieties in their effect on leaf area index of mungbean. Similar results were obtained by **Kamel, *et al.*, (1992), Abd El-Lateaf (1993) and Abu-Kresha (1993).**

Table(25): Effect of maize varieties on some growth characters of mungbean during 2003 and 2004 seasons.

Characters	Plant height (cm)	No. of branches /plant	No. of leaves/ plant	L.A.I
	2003 season			
Maize varieties				
S.C. 10	98.5	8.6	33.9	2.6
T.W.C. 321	96.6	8.7	34.1	2.6
Giza 2	90.3	8.4	33.3	2.6
L.S.D. at 5%	2.6	N-S	N-S	N-S
	2004 season			
S.C. 10	98.4	8.1	32.4	2.5
T.W.C. 321	96.9	7.5	33.7	2.6
Giza 2	92.3	7.6	32.1	2.6
L.S.D. at 5%	2.1	0.3	1.1	N-S

N-S : No Significant .

Table(25R): Growth characters of mungbean variety pure stand during 2003 and 2004 seasons.

Characters / Mungbean	Plant height (cm)	No. of branches/ plant	No. of Leaves/ plant	L.A.I
	2003 season			
Kawmy-1	99.8	9.2	36.8	2.8
	2004 season			
Kawmy-1	90.5	8.6	34.4	2.4

1.2. Effect of nitrogen level :

The mean value of the parameters studied for growth of mungbean as affected by maize varieties in the two growing seasons are presented in Table (26).

1.2.1. Plant height :

Data revealed that plant height of mungbean significantly increased by increasing N-level from 100 to 140 kg N/feddan in both seasons. The tallest plant of mungbean was 102.43 and 103.74, produced from adding 140 kg N/feddan in 2003 and 2004 seasons, respectively. The increase in plant height may be due to the increase in meristematic activity in mungbean 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 **Attia, *et al.* (1999) and El-Douby and Allam (2001).**

1.2.2. Number of branches/plant :

The data illustrated in Table (26) show that the mean values of number of branches/plant significantly increased by increasing N-level up to 140 kg N/feddan in both seasons. The maximum number of branches/plant was 9.70 and 9.27, produced from applied nitrogen fertilizer at 140 kg N/feddan in the first and second seasons, respectively. The increase in number of branches/plant might be attributed increasing N-level caused a favour photosynthetic activity and this in turn resulted in encourage the meristematic activity and building more tissues and organs of the plant. Similar results were obtained by **El-Douby and Allam (2001)** revealed that increasing N-level from 90 to 120 and 150 kg N/feddan increased number of branches/plant.

Table(26): Effect N-levels on some growth characters of mungbean during 2003 and 2004 seasons.

Characters	Plant height (cm)	No. of branches/ plant	No. of leaves/ plant	L.A.I
	2003 season			
N-level Kg/fed				
100	88.2	7.6	30.4	2.6
120	94.8	8.4	33.7	2.6
140	102.4	9.7	37.3	2.6
L.S.D. at 5%	2.2	0.3	0.8	N-S
	2004 season			
100	87.8	6.4	30.2	2.5
120	96.0	7.6	32.3	2.6
140	103.7	9.3	35.8	2.6
L.S.D. at 5%	1.9	0.3	0.8	N-S

N-S : No Significant .

1.2.3. Number of leaves/plant :

The data in Table (26) indicated that the differences in number of leaves/plant of mungbean were significantly affected by nitrogen fertilization in both seasons. The application of 120 and 140 kg N/feddan increased number of leaves by 10.72 and 23.83%, respectively, over the control treatment (100 kg N/feddan) in the first season. The corresponding increases were 6.82 and 18.44%, respectively in the second season. This result might be attributed to the effect of nitrogen in increasing vegetative growth and meristematic activity of mungbean plant. The number of leaves could be considered on external expression of the meristimic activity in plants, **El-Douby and Allam (2001)** supported these results.

1.2.4. Leaf area index :

Table (26) shows that the differences between the mean values of leaf area index were not significant when received nitrogen level up to 140 kg N/feddan when compared with the control treatment (100 kg N/feddan) in the two growing seasons (2003 and 2004 seasons). In general N encouraged growth of leaf area as an essential element which plays a prominent role in building new meristematic cell, cell elongation and increasing photosynthesis activity of mungbean plant. Also, **Badr (1998) and Attia, *et al.* (1999)** reported that application of 120 kg N alone or together with phosphorus at 15 or 30 kg P_2O_5/feddan significantly increased leaf area index.

1.3. Effect of intercropping patterns :

Data in Table (27) show the effect of intercropping patterns on some growth characters of mungbean plants in 2003 and 2004 growing seasons.

1.3.1. Plant height :

Data presented in Table (27) showed that plant height was significant affected by intercropping patterns in both seasons. The tallest plant was 98.83 and 92.28cm, obtained when (2 :1) pattern was applied compared with the other patterns in the first and second seasons, respectively. These results may be due to the elongation of internodes as a result of shade effect of maize and also led to competition for light might enlarge stem internodes of mungbean plants and caused elongation in plant height. These results are in agreement with those obtained by **Hefni, *et al.* (1984a), Abd El-Gawad, *et al.* (1985), Kamel, *et al.* (1992), Abd El-Lateef (1993), Khalil (1994), Abd- Alla (1996), El-Hennawy and El-Bially (1997), Abd-Alla, *et al.* (1999a), El-Douby and Allam (2001), Zeidan, *et al.* (2001), El-Danasoury (2003), Mohamdain (2004) and Lamloum (2006)**.

1.3.2. Number of branches/plant :

Data in Table (27) indicated that intercropping patterns had a significant effect on number of branches/plant in both season. It was clear that number of branches/plant of mungbean was decreased by increasing plant density of mungbean when intercropping with maize. The highest values of branches number were 9.0 and 8.44, produced from 2:1 pattern in the first and second seasons, respectively. Whereas the lowest ones were

8.19 and 7.09, obtained from 2:3 pattern, respectively. The reductions indicated clearly that breat competition resulting for maize plants through their shading of interspecific competition among mungbean plants. These results are supported by **Abd El-Gawad, *et al.* (1985), Saxene and Chandel (1986), Khalil (1994), Abd-Alla (1996), Mohamdian (2004) and Lamloum (2006).**

1.3.3. Number of leaves/plant :

It was obvious that intercropping mungbean with maize in different patterns caused depression in number of leaves/plant in both seasons (Table 27). The differences among intercropping patterns were significant. The highest number of leaves/plant was 35.49 and 35.28, obtained from 2:1 pattern in the first and second seasons, respectively. Whereas the lowest one was 31.82 and 30.08, respectively, produced from 2:3 pattern. It could be concluded that the reduction number of leaves/plant by increasing plant density of mungbean plant when intercropping with maize may be attributed to the competition mungbean and maize plants for the nutritive, element, light, water and other edaphic factors. Similar results were reported by **Hefni, *et al.* (1984a), Kamel, *et al.* (1992), Abd-Alla, *et al.* (1999b), El-Douby and Allam (2001) and Mohamdain (2004).**

1.3.4. Leaf area index:

Leaf area index of mungbean was significantly influenced by the intercropping pattern in one season out of two as shown in Table (27). The intercropping pattern of 2:1 increased LAI compared with the other pattern of intercropping in the first

Table (27): Effect of intercropping patterns on some growth characters in mungbean during 2003 and 2004 seasons.

Characters / Intercropping patterns	Plant height (cm)	No. of branches/ plant	No. of leaves/ plant	L.A.I
	2003 season			
Maize : Mung				
2 : 1	98.9	9.0	35.5	2.7
2 : 2	95.3	8.5	34.1	2.5
2 : 3	91.2	8.3	31.8	2.6
L.S.D. at 0.05%	0.6	0.2	0.6	0.1
	2004 season			
2 : 1	99.4	8.4	35.3	2.6
2 : 2	95.9	7.7	32.9	2.5
2 : 3	92.3	7.1	30.1	2.5
L.S.D. at 0.05%	0.7	0.1	0.6	N-S

N-S : No Significant .

season which was 2.70. The increases in LAI values due to the intercropping pattern of 2 : 1 compared the other intercropping patterns may be attributed to increasing number of leaves/plant and low competition between plants on light, water and nutrients which reflected increases in vegetative growth such as plant resulted more LAI values. These results are in good accordance with those obtained by **Badr (1998) and Mohamdain (2004).**

1.4. Interaction effects:

The effect of the interaction between maize varieties and N-level was significant on plant height in the second season, number of branches and leaves per plant in the first season and leaf area index in the second season as shown in Table (28), whereas, the other growth character of mungbean under study were not significantly affected by the interaction between maize varieties and N-level, consequently the data were excluded. S.C.10 maize variety with applied 140 kg N/feddan gave the tallest plant (106.14 cm) and maximum number of branches/plant (10.13). whereas no significant difference was obtained between S.C.10 and T.W.C. 321 maize varieties with received 140 kg N/feddan on plant height and number of branches/ plant of mungbean. Also, T.W.C. 321 maize variety with applied 140 Kg N/feddan gave the highest number of leaves/plant (37.88) in the first season. Whereas, the greatest leaf are index was 2.65, produced from Giza 2 maize variety with adding 140 kg N/feddan. On the contrary, the lowest mean values of plant height (83.40 cm), number of branches/plant (7.38), number of leaves/plant (28.37) and LAI (2.42) were produced from intercropping Giza 2 maize variety with adding

Table (28):Effect of the interaction between maize varieties and N levels on plant height in 2004 season, number of branches/plant, number of leaves/plant in 2003 season and LAI in 2004 season.

Characters		Plant height (cm)	No. of branches /plant	No. of leaves /plant	LAI
Seasons		2004	2003	2003	2004
Maize varieties	N-levels (Kg/fed.)				
S.C.10	100	89.8	7.7	31.7	2.5
	120	99.2	7.9	34.0	2.5
	140	106.1	10.1	36.1	2.6
T.W.C. 321	100	90.1	7.7	31.2	2.6
	120	94.4	8.9	33.3	2.6
	140	106.0	9.5	37.9	2.5
Giza 2	100	83.4	7.4	28.4	2.4
	120	94.4	8.5	33.7	2.6
	140	99.1	9.5	37.9	2.7
L.S.D. at 5%		3.3	0.6	1.4	0.1

100 kg N/feddan. It could be concluded that intercropping S.C.10 or T.W.C. 321 maize varieties with increasing level of nitrogen up to 140 kg N/feddan gave the greatest growth characters of mungbean plant.

There was a significant differences on the mean values of branches number/plant in both season and leaf area index in the first season due to the interaction between maize varieties and intercropping patterns as shown in Table (29). The other growth characters of mungbean under study were not affected by the interaction between maize varieties and intercropping patterns in both seasons. This means that each of this factors act independently on there effect on these characters, consequently the data were excluded. The highest number of branches/plant was 9.21 and 8.71, produced from intercropping S.C.10 maize variety under pattern 2:1 in the first and second seasons, respectively. In 2003 season, Giza 2 maize variety under pattern 2:1 gave the maximum mean values of leaf area index (2.78). On the other hand, no significant difference was detected between T.W.C. 321 and Giza 2 maize varieties when plants grown in 2 : 1 pattern in leaf area index. These results were in accordance with those of **Abd-Alla, *et al.* (1999b) and Lamloum (2006).**

Results in Table (30) showed the effect of the interaction between N level and intercropping patterns was significant on plant height and number of leaves per plant in the two growing seasons. The tallest plants (104.83 and 105.63 cm) and maximum number of leaves/plant (38.91 and 38.39) were obtained from intercropping mungbean with maize under 2 :1 pattern with application of 140 kg N/feddan in the first and

Table(29):Effect of the interaction between maize varieties and intercropping patterns on number of branches/plant in 2003 and 2004 season and L.A.I in 2003 season.

Characters		No. of branches /plant		LAI
Seasons		2003	2004	2003
Maize varieties	Intercropping Maize : Mung.			
S.C.10	2 : 1	9.2	8.7	2.6
	2 : 2	8.5	8.1	2.7
	2 : 3	8.1	7.6	2.5
T.W.C. 321	2 : 1	9.1	8.3	2.7
	2 : 2	8.7	7.5	2.5
	2 : 3	8.4	6.6	2.4
Giza 2	2 : 1	8.7	8.3	2.8
	2 : 2	8.4	7.5	2.6
	2 : 3	8.2	7.0	2.1
L.S.D. at 5%		0.3	0.3	0.1

Table (30) : Effect of the interaction between N-levels and intercropping patterns on plant height and No. of leaves / plant on mungbean in 2003 and 2004 season.

Characters		Plant height (cm)		No. of leaves /plant	
Seasons		2003	2004	2003	2004
N-levels (Kg/fed.)	Intercropping Maize : Mung				
100	2 : 1	93.6	92.8	33.1	33.2
	2 : 2	88.1	87.8	31.3	30.7
	2 : 3	82.8	82.8	26.9	26.7
120	2 : 1	98.3	99.7	34.5	34.3
	2 : 2	95.1	96.3	33.9	32.5
	2 : 3	90.9	92.0	32.7	30.0
140	2 : 1	104.8	105.6	38.9	38.4
	2 : 2	102.6	103.5	37.1	35.4
	2 : 3	99.9	102.1	35.9	33.6
L.S.D. at 5%		1.0	1.2	1.0	1.07

second seasons, respectively. However, the shortest plants (82.83 and 82.77 cm) and lowest number of leaves/plant (26.94 and 26.73) were produced from addition 100 kg N/feddan with the intercropping pattern of 2 :3 in the first and second season, respectively. The same trend was obtained by **Badr (1998)**.

The interaction between the three factors did not affect significantly all growth characters of mungbean in both seasons, except plant height and mungbean plant as affected by the interaction between maize varieties N-level and intercropping pattern in 2004 season as shown in Table (31). The other data of growth characters of mungbean plant were excluded. The tallest plants was 108.38cm, produced from intercropping T.W.C.321 maize variety with mungbean under 2:1 pattern with adding 140 kg N/feddan in the second season. Whereas no significant difference was detected between S.C.10 and T.W.C.321 maize varieties with adding 140 kg N/feddan and intercropping pattern (2:1) in plant height. On the other hand, the shortest plant of mungbean was 76.45cm, obtained from intercropping Giza 2 maize variety with mungbean plant and 2:3 pattern with applied 100 kg N/feddan in the second season.

2. Yield and yield components :

2.1. Maize varietal differences :

The effect of maize varieties on some yield components and seed yield of mungbean under intercropping with maize during the two growing seasons (2003 and 2004) are presented in Table (32).

Table (31): Effect of the interaction between the three factors on plant height on mungbean in 2004 season.

Characters		Plant height (cm)		
Intercropping patterns		2 : 1	2 : 2	2 : 3
Maize varieties	N-levels (Kg/fed.)			
S.C.10	100	93.5	89.9	86.1
	120	103.5	99.5	94.8
	140	108.1	105.8	104.5
T.W.C. 321	100	94.9	89.7	85.9
	120	98.7	95.3	89.3
	140	108.4	105.7	104.0
Giza 2	100	90.0	83.8	76.5
	120	97.1	94.2	91.9
	140	100.5	99.0	97.7
L.S.D. at 5%		2.1		

Table(32):Effect of maize varieties on seed yield and some yield components of mungbean during 2003 and 2004 seasons.

Characters / Maize varieties	No. of pods/ plant	No. of seeds/ plant	Pods weight / plant (g)	Seeds weight/ plant (g)	Weight of 100 seeds (g)	Seed yield/ fad. (kg)
	2003 season					
S.C. 10	31.3	305.2	17.1	13.5	4.4	488.0
T.W.C. 321	33.6	333.5	17.1	14.8	4.5	490.1
Giza 2	31.0	294.3	16.7	13.0	4.4	477.1
L.S.D. at 5%	0.8	19.7	N-S	0.8	N-S	N-S
	2004 season					
S.C. 10	30.9	306.8	17.3	13.6	4.4	432.9
T.W.C. 321	34.0	341.3	18.1	15.2	4.5	397.0
Giza 2	30.3	300.3	16.9	13.2	4.4	406.6
L.S.D. at 5%	0.7	16.6	0.5	0.5	N-S	18.3

N-S : No Significant .

Table(32R): Yield and yield components of mungbean variety pure stand during 2003 and 2004 seasons.

Characters / Mungbean	No. of pods/ plant	No. of seeds/ plant	Pods weight / plant (g)	Seeds weight/ plant (g)	Weight of 100 seeds (g)	Seed yield/ fad. (kg)
	2003 season					
Kawmy 1	33.8	340.0	18.9	16.8	4.4	666.9
	2004 season					
Kawmy 1	32.2	310.8	17.8	15.4	4.2	671.5

2.1.1. Number of pods and seeds/ plant :

Mungbean plant intercropped with different maize varieties caused a significant difference on number of pods and seeds/plant in both seasons as shown in Table (32). Number of pods and seeds per plant were higher when mungbean plants intercropped with T.W.C. 321 maize variety than with S.C.10 and Giza 2 maize varieties in the two growing seasons. Whereas no significant differences were obtained between S.C.10 and Giza 2 maize varieties in number of pods and seeds/plant of mungbean. This may be due to more shading and stronger growth characters and tallest effect attributed to S.C.10 and Giza 2 maize varieties and more competition for light and nutrients. These results were in harmony with these finding of **Assey *et al.*, (1992c), Osman and El-Din (1995), Abdalla *et al.*, (1999), El-Danasoury (2003) and Lamloum (2006).**

2.1.2. Weight of pods and seeds/plant :

The data in Table (32) indicated that the differences in weight of pods/plant in the second season and weight of seeds/plant in both seasons were significantly affected by intercropping with the three maize varieties. Mungbean plants grown with T.W.C. 321 maize variety gave the maximum weight of pods and seeds /plant which equal 18.06 and 16.46 gm in the second season, respectively. Whereas, no significant difference between Giza 2 and T.W.C.321 maize varieties in weight of seeds/plant of mungbean in the first season. The increases in seed weight/plant of mungbean plants grown with T.W.C. 321 maize variety may be due to increases in number of pods and seeds per plant. Similar results were obtained by **Assey *et al.*,**

(1992c), Abd El-Lateaf (1993), Osman and El-Din (1995), El-Danasoury (2003) and Lamloum (2006).

2.1.3. Weight of 100-seeds :

The data in Table (32) showed insignificant effect on weight of 100-seeds as affected by intercropping mungbean plants with the three maize varieties under study in the two growing seasons. That effect may be due to less competition between the three maize varieties on 100-seed weight of mungbean and led to more accumulation of carbohydrate and other photosynthetic produced in mungbean seeds. These results are in agreement with those obtained by **Kamel *et al.*, (1992), Abd El-Lateaf (1993), Abu-Kresha (1993) and Abdalla *et al.*, (1999).**

2.1.4. Seed yield (kg)/feddan:

The results in Table (32) revealed that the tested maize varieties differed significantly in seed yield of mungbean in one season out of two. Mungbean plants intercropped with S.C.10 maize variety exceeded mungbean intercropped with T.W.C. 321 and Giza 2 maize varieties by 35.92 and 26.28 kg/feddan in the second season, respectively. While the differences in the first season were not significant. These differences may be due to the genetical differences between maize varieties. These results agreed with those reported by **Mohmoud and Khalifa (1983), Assey *et al.*, (1992c), Osman and El-Din (1995), Shafik and Soliman (1999), Abdalla *et al.*, (1999) and Lamloum (2006)** found that seed yield of soybean or mungbean were significantly affected by intercropping with maize varieties. On the other

hand, **Kamel *et al.*, (1992), Abd El-Lateaf (1993) and Abu-Kresha (1993)** showed that there is no differences between maize varieties in seed yield/ feddan.

2.2. Effect of nitrogen level :

The mean values of some characters of yield components and seed yield of mungbean per feddan as affected by application of nitrogen fertilizer levels in the two growing seasons (2003 and 2004 seasons) as shown in Table (33).

2.2.1. Number of pods and seeds/ plant :

Results in Table (33) showed that number of pods and seeds per mungbean plant were significantly increased by increasing N-level from 100 to 120 up to 140 kg N/feddan in both seasons. Application of 140 kg N/feddan to mungbean plants with intercropping maize plants gave the highest number of pods/plant (36.17 and 35.12) and highest number of seeds/plant (385.75 and 380.30) in the first and second seasons, respectively. The increases in number of pods/plant with increasing N-level might be due to the increase in vegetative growth and dry matter production which reflected in increases in pod set and number of pods/ plant. As a result of multiplying number of pods by number of seeds/ pod to estimate the number of seeds/plant. These results are in line with those obtained by **Assey *et al.*, (1992c) and Badr (1998)**.

2.2.2. Weight of pods and seeds/plant:

The results in Table (33) revealed that raising N-level up to 140 kg N/feddan significantly increased weight of pods and seeds per plant of mungbean in 2003 and 2004 seasons. The

application of 140 kg N/feddan increased weight of pods and seeds per plant by 13.78 and 27.48%, respectively in the first season as well as by 15.72 and 15.66%, respectively in the second season. The results might be due to the fact that N fertilization plays an active role in cell division and metabolic activity as well as vegetative growth, which reflected increases in seed full and resulted heavier seeds. Similar results were found by **Assey *et al.* (1992a), Assey *et al.*(1992c), El-Douby and Allam (2001) and Pand *et al.*(2003).**

2.2.3. Weight of 100-seeds :

There was a significant difference in weight of 100-seeds due to application of nitrogen fertilizer in the two growing seasons as shown in Table (33). The increase in N-level from 100 to 120 and 140 kg N/feddan significantly increased weight of 100-seeds by 10.92 and 19.11%, respectively in the first season. The corresponding increase in the second season were 3.04 and 7.73%, respectively. The increase in this trait reflect the importance of N application as an essential element for fruiting and seed development and increase photosynthetic metabolic which leads to more stored in seeds resulting in heaviest seeds. The same trend was obtained by **Assey *et al.*, (1992c) and El-Douby and Allam (2001)**.

2.2.4. Seed yield kg/feddan :

The results in Table (33) indicated that seed yield of mungbean per feddan was significantly increased by increasing nitrogen fertilizer level up to 140 kg N/feddan in the two growing seasons. The increase in N-level from 100 to 120 and

Table (33) :Effect of N-levels on seed yield and some yield components of mungbean during 2003 and 2004 seasons.

Characters / N-levels (Kg/fed.)	No. of pods/ plant	No. of seeds/ plant	Pods Weight/ plant(g)	Seeds Weight/ plant (g)	Weight of 100 seeds (g)	Seed yield/ fad. (kg)
2003 season						
100	28.1	245.3	15.9	9.9	4.0	426.2
120	31.6	301.9	17.0	15.0	4.5	488.7
140	36.2	385.8	18.1	17.5	4.8	540.3
L.S.D. at 0.5%	0.9	11.5	0.5	0.3	0.1	13.1
2004 season						
100	27.9	249.1	16.0	10.6	4.3	379.0
120	32.2	318.2	17.8	14.0	4.4	407.7
140	35.1	380.3	18.1	17.5	4.6	449.8
L.S.D. at 0.5%	0.7	13.0	0.2	0.2	0.1	5.1