EFFECT OF NITROGEN FERTILIZATION ON THE DYNAMICS OF GROWTH AND YIELD OF SOME WHITE MAIZE HYBRIDS

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ABSTRACT

Two field experiments were carried out at the Experimental Farm, Fac. of Agric., Tanta Univ. at Kafr El-Sheikh, Egypt during 2000 and 2001 seasons to investigate the effect of five N levels (60, 90, 120, 150 and 180 kg N/fed) and five maize cultivars namely S.C.10, S.C.122, S.C.129, T.W.C.310 and T.W.C.321 (white hybrids) on growth and yield and its components. The experiments were performed in a split plot design with four replicates. The main plots were assigned to maize cultivars, while sub plots were allocated to N-levels. The important findings could be summarized as follows: The results showed that maize cultivar S.C.10 differed in its growth, yield and attributing characteristics.

The results obtained indicated that maize cultivars differed significantly in growth, yield and most of yield components. Single cross-10 exceeded the other maize cultivars. Number of leaf, leaf area per plant, leaf area index, crop growth rate, total dry matter accumulation per plant, ear attributes, as well as grain yield per feddan were significantly increased as nitrogen level increased up to 180 kg per feddan (one feddan = 4200 m^2).

INTRODUCTION

The growth and yield of maize depend on many factors. From the major factors are genotypes and nitrogen fertilization.

Mosalem (1998) studied the effect of nitrogen levels i.e. 95, 110, 125 and 140 kg/fed. on maize hybrid S.C. 122. He found that there was a trend of increase in leaf area per plant, leaf area index, and dry matter accumulation per plant, El-Mursy and Badawi (1998) postulated that raising nitrogen levels up to 90 g/fed. significantly increased ear leaf area, plant height, stem diameter and ear height, while it decreased number of days to 50% tasseling and silking. Said and Gaber (1999) found that raising nitrogen levels up to 120 kg/fed. significantly decreased number of days from planting date to 50% tasseling.

Atta-Allah (1996) and El-Zeir *et al.* (1998) stated that grain yield per unit area increased as well as the nitrogen levels increased up to 140 kg/feddan. Mosalem and Shady (1996) found that there was a trend of increase in shelling percentages most era attributes as well as grain yield per fed. as nitrogen level increased.

El-Moursy and Badawi (1998) indicated that raising nitrogen levels increased earl length, diameter, number of grains/row, 100-grain weight, number of ears/plant, shelling percentage, and grain yield/feddan.

Faisal *et al.* (1996), Kamel (1997), Eisa, N.M.A. (1998), El-Zeir *et al.* (1998) and Said and Gaber (1999) reported that maize varieties differed significantly for most ear characters and grain yield. Hassan (2000) concluded that hybrids differed significantly from each other in ear length, ear diameter, number of rows/ear, number of grains/row, 100-grain weight and grain yield/feddan however, single cross 10 gave the highest grain yield and did not differ significantly from either S.C. 122 or S.C. 124, while, T.W.C. 321 gave the lowest grain yield.

The purpose of this work was to investigate the effect of nitrogen fertilization levels and their interactions with five maize cultivar on yield and its components.

MATERIALS AND METHODS

This study was carried out through two field experiments at the Experimental Farm, Fac. of Agric., Tanta Univ. at Kafr El-Sheikh during 2000 and 2001 summer seasons. The soil type of the experimental fields was clay in texture. The organic matter content was 1.9% and the soil pH was 8.27 and 8.12, respectively. The preceding crop was Egyptian clover in both seasons.

The experiments were performed in a split-plot design with four replications. Each experiment included 25 treatments which were the combinations of:

1. Five maize hybrids: (S.C. 10, S.C. 122, S.C. 129, T.W.C. 310 and T.W.C. 321) occupied the main plots.
2. Five N-levels: 60, 90, 120, 150 and 180 kg N/fed-Laid out in the sub-plots.

Each experimental plot consisted of grains of maize were sown on June 4th in the first season and on June 12th in the second season. The following growth attributes were recorded: 1- Number of green leaves per plant at 35, 50, 65 and 80 days from sowing. 2- leaf area per plant at 35, 50, 65 and 80 days from sowing. 3- LAI, CGR, 4- Total dry matter per plant at 35, 50, 65 and 80 days form sowing. 5- Plant height at 35, 50, 65 and 80 days from sowing, 6- Ear height, 7- Ear weight in grains, 8- Ear length in cm, 9- ear diameter in cm, 10- number of rows per ear and number of kernels per row.

The two middle ridges for each sub plot were harvested to estimate the following characters:

1. Percentages of two ear/plant.
2. Percentages of barren and infertile plants.
3. Moisture grain content %.
4. Grain yield as adjusted to 15.5% moisture content.

All data were statistically analyzed according to procedures outlined by Gomez & Gomez (1984). Treatment means were compared by Duncan's Multiple Range Test (Duncan, 1955).

Table (1): Mechanical and chemical analysis of the field soil in the growing seasons.

Variable	Seasons	
	2000	2001
Mechanical analysis		
Sand %	21.01	20.97
Silt %	20.89	21.68
Clay %	57.12	56.73
Textural class	Clay	Clay
Chemical analysis		
Soil reaction pH	8.27	8.12
Organic matter %	1.12	1.09
Available N ppm	135.32	128.54
Available P ppm	8.93	8.05
Available K ppm	226.00	219.00

RESULTS AND DISCUSSIONS

1. Number of green leaves per plant:

Increasing nitrogen rate significantly increased number of green leaves/plant at all sampling dates in both season (Table 2). The effect of nitrogen on increasing number of green leaves per plant of corn may be due to the vital role of N in plant growth as it is necessary for cell prodoplasm formation. Photosynthesis activity in all plants and necessary for cell division and meriestimic activity in plant organs.

Table (2): Average number of leaf as affected by nitrogen fertilization and maize hybrids at different stages of growth in 2000-2001 seasons.

Days form sowing	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	2000 season												
35	**	7.32 d	7.61 d	7.95 c	9.17 b	10.15 a	**	8.42 a	8.35 a	8.17 ab	8.04 b	7.81 c	N.S
50	**	10.61 c	10.98 b	11.14 b	12.97 a	13.41 a	**	12.13 a	12.08 a	11.88 ab	11.65 b	11.36 c	*
65	*	12.99 b	13.15 b	13.29 b	13.74 a	13.67 a	**	13.92 a	13.76 ab	13.44 b	13.06 c	12.65 d	**
80	*	15.15 b	15.56 a	15.59 a	15.75 a	15.86 a	**	16.29 a	16.13 a	15.59 b	14.89 c	14.26 d	N.S
	2001 season												
35	**	7.94 c	8.95 b	9.91 b	10.89 a	11.45 a	**	11.03 a	10.92 a	10.12 b	9.72 c	9.46 c	*
50	**	13.71 c	14.34 bc	14.64 b	15.27 a	15.33 a	**	15.07 a	14.90 ab	14.89 ab	14.72 b	13.98 c	*
65	*	15.46 d	16.10 c	16.33 bc	16.71 ab	17.04 a	**	17.00 a	16.52 b	16.38 b	15.88 c	15.85 c	**
80	**	16.55 c	16.80 bc	17.05 ab	17.23 a	17.49 a	**	18.30 a	17.40 b	16.84 c	16.24 d	16.13 d	*

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

Table (3): Average of leaf area as affected by nitrogen fertilization and maize hybrids at different stages of growth in 2000 and 2001 seasons.

Period of growth	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	2000 season												
35	**	893.9 c	1352.4 b	1465.3 b	2328.4 a	2631.6 a	**	1996.8 a	1830.2 b	1668.3 c	1445.2 d	1431.6 d	*
50	**	3072 c	4368 b	5775 a	5362 a	5362 a	**	4638 a	4783 a	4206 b	4178 b	4052 b	*
65	**	5298 b	5952 a	6285 a	6433 a	6433a	**	6688 a	6141 b	5687 c	5458 c	5406 c	N.S
80	**	6051 d	6385 bc	6464 b	7696 a	7696 a	**	7480 a	7062 b	5909 c	6196 c	6090	N.S
	2001 season												
35	**	974.27 c	1473.1 b	1592.9 b	2532.5 a	2863.8 a	**	2171.7 a	1992.5 b	1815.1 c	1572.1 d	1554.8 d	*
50	**	3192.9 c	3513.1 c	4540.7 b	5901.0 a	55765 a	**	4825.5 a	4975.0 a	4375.0 b	4345.1 b	4215.1 b	*
65	**	5510.0 b	5627.5 b	6187.0 a	6537.4 a	6682.0 a	**	6946.5 a	6374.6 b	5910.5 c	5656.3 c	5612.2 c	N.S
80	**	6170.0 d	6261.8cd	6510.3 c	6591.3 b	7818.9 a	**	7621.6 a	7201.2 b	6021.2 c	6310.9 c	6152.9 d	N.S

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

The extra produced allows the plant leaves to grow and to have larger surface available for photosynthesis. Similar results were obtained by Gouda *et al.* (1992), Hassan (1995), Samia *et al.* (1995) and El-Habba and Shams El-Din (1996).

The same Table shows significant differences between cultivars in number of green leaves at all different sampling at 35, 50, 65 and 80 days from sowing in both seasons. Data clearly show that SC. 10 cultivar maintained significantly higher number of green leaves at 35, 50, 65 and 80 days from sowing compared with other cultivars in both seasons. These results are mainly due to the differences in the genetical make up of the studied cultivars. Also, these may be attributed to the ability of these cultivars to keep their leaves a long live for longer periods. Similar results were obtained by El-Habbak and Shams El-Din (1996), Esmail (1996), Meky (1997) and Eisa, N.M.A. (1998).

2. Increasing levels of nitrogen fertilizer from 60 to 180 kg per feddan increased significantly maize leaf area per plant at all different sampling dates in both season (Table 3). The increases in leaf area per plant by increasing nitrogen rates. Nitrogen on plant growth of it is necessary for cell protoplasm formation, photosynthesis activity in al plants and necessary for cell division and meristimic activity in plant organs. The extra protein produced allows the plant leaves to grow and to grow and to have a larger surface available for photosynthesis These findings in general, go in line with those of Esmail and El-Sheikh (1994), El-Habbak (1996), El-Habbak and Shams El-Din (1996), Badawi and El-Moursy (1997) and Mosalem (1998).

3. Leaf area index:

Maize cultivars differed significantly in leaf area index at all different sampling dates in both seasons, however, S.C. 10 cultivar gave higher leaf area index than S.C. 122, S.C. 129, T.W.C. 310 and T.W.C. 321 cultivars at the all sampling dates. Similar results were reported by Dawood *et al.* (1992), Esmail (1996), Kamel (1997) and Eissa, N.M.A. (1998).

Data in the same Table show that leaf area index was significantly increased with increasing nitrogen levels form 60 to 180 kg n/feddan in both seasons. This may be due to the increase in number of leaves and leaf area as nitrogen rates were increased. Dawood *et al.* (1992), Hassan (1995) and Mosalem (1998) reported similar results.

Table (4): Average of leaf area index (LAI) as affected by nitrogen fertilization and maize hybrids at different stages of growth in 2000-2001 seasons.

Period of growth	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	2000 season												
35-50	**	0.316 d	0.346 d	0.583 c	1.176 b	1.339 a	**	0.779 a	0.787 a	0.776 a	0.724 b	0.695 b	**
50-65	**	1.581 d	1.841 c	2.083 b	3.019 a	3.121 a	**	2.499 a	2.406 b	2.377 b	2.245 c	2.116 d	**
65-80	**	3.512 c	3.598 bc	3.733 b	4.121 a	4.2144 a	**	4.287 a	4.142 b	3.744 c	3.525 d	3.480 d	**
80-95	**	4.178 c	4.297 b	4.309 b	4.375 ab	4.445 a	**	4.858 a	4.725 b	4.151 c	3.984 d	3.888 d	*
	2001 season												
35-50	**	0.672 c	0.752 b	0.793 b	0.814 b	0.892 a	**	0.823 a	0.821 a	0.784 b	0.753 b	0.750 b	**
50-65	**	1.453 c	1.451 c	1.512 bc	1.533 b	1.657 a	**	1.572 a	1.527 b	1.521 b	1.500 bc	1.491 c	N.S
65-80	**	2.934 d	3.182 cd	3.331 bc	3.552 b	4.202 a	**	3.851 a	3.552 b	3.443 b	3.185 c	3.181 c	N.S
80-95	**	4.172 c	4.301 c	4.492 b	4.531 b	4.942 a	**	4.722 a	4.621 a	4.423 b	4.343 b	4.341 b	N.S

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

4. Dry matter accumulation per plant:

Data shown in Table 5 indicated that total dry weigh /plant was highly significantly increased with increasing nitrogen levels from 60 to 180 kg N/fed. at 35, 50 and 80 days from sowing in the first season and at all sampling in the second season. This may be due to the role of nitrogen in increasing leaf area. Leaf area index and chlorophyll content in leaves. This in turn caused an increase in photosynthetic surface and efficiency, which increased dry matter accumulation per plant with increasing nitrogen levels. Zhou *et al.* (1997)) and Mosalem (1998) obtained similar results.

The obtained results show that highly significant differences were detected between studied cultivars at all sampling date in both seasons.

S.C. 10 cultivar recorded significantly higher dry matter per plant than the other cultivars.

The difference in dry weight among cultivars is mainly attributed to the difference in genetical factors, and type of interaction with environment.

Esmail (1996), Meky (1997) and Eisa, N.M.A. (1998) obtained similar results.

Data in Table (5) show that all orders of interactions have no significant effect on dry weight at all vegetative samples in both seasons.

5. Crop growth rate (C.G.R.):

The data with crop growth rate shown in Table (6) indicate that crop growth rate increased by increasing nitrogen rates which could be due to the vital role of nitrogen on plant growth where it is necessary for cell protoplasm formation, photosynthesis activity in al plants and necessary for cell division and meristimic activity in plant organs. The increase in CGR may be also attributed to higher LAI which it is contributing factor in promoting photosynthesis. Similar results were obtained by Lemcoff and Loomis (1985).

Crop growth rate was significantly affected by hybrids at the first two growth periods in the two seasons. Similar results were obtained by Lemcoff and Loomis (1985).

6. Plant height:

Plant height at different growth stages (35, 50, 65 and 80 days after sowing) as influenced by nitrogen level, maize hybrid and their interaction in 2000 and 2001 seasons are presented in Table (7).

Table (5): Average of total dry mater (g/plant) as affected by nitrogen fertilization and maize hybrids at different stages of growth in 2000-2001 seasons.

Period of growth	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	2000 season												
35	**	6.75 d	7.68 cd	9.43 c	13.13 b	15.15 a	**	14.82 a	14.31 a	12.56 b	10.36 c	10.05 c	N.S
50	**	38.23 d	47.31 c	49.64 c	65.53 b	73.29 a	**	58.47 a	56.39 a	43.15 b	42.90 b	37.63 c	N.S
65	N.S	118.20	122.91	124.89	125.72	126.69	**	109.82 a	101.53 b	94.75 bc	91.82 c	88.54 d	N.S
80	*	160.61 b	176.00ab	176.23ab	183.41ab	195.62 a	**	189.32 a	174.25 ab	171.36 ab	160.95 b	158.46 c	N.S
	2001 season												
35	**	7.11 c	9.94 b	11.06 b	19.89 a	21.38 a	**	15.39 a	15.09 a	13.37 b	11.46 c	11.21 c	N.S
50	**	28.09 d	37.91 c	48.94 b	67.26 a	72.21 a	**	55.83 a	53.75 a	48.53 b	47.47 b	46.17 c	N.S
65	**	74.84 c	102.23 b	103.21 b	126.92 a	134.83 a	**	112.56 a	104.81 b	100.34 bc	95.12 c	92.32 d	N.S
80	**	136.12 d	154.92cd	161.54c	190.13 a	179.14ab	**	143.67 a	131.88 b	122.69 c	122.17 c	120.48 d	N.S

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

Table (6): Average of crop growth rate g/m^2/day (CGR) as affected by nitrogen fertilization and maize hybrids at different stages of growth in 2000 and 2001 seasons.

Period of growth	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	2000 season												
35-50	**	3.15 b	3.57 b	4.30 b	10.94 a	10.35 a	**	6.56 ab	6.89 a	5.81 c	6.79 ab	6.28 bc	**
50-65	**	15.75 c	19.82 b	20.11 b	34.08 a	31.21 a	**	22.33 c	25.27 a	23.57 bc	24.72 ab	25.11 ab	N.S
65-80	**	30.99 a	33.35 a	34.64 a	29.64 ab	2.57 b	N.S	29.49	30.00	31.36	31.11	30.23	N.S
80-95	N.S	30.22	31.00	32.28	21.56	21.77	N.S	28.99	29.03	24.35	28.08	26.38	N.S
	2001 season												
35-50	**	1.88 c	4.45b	5.23 b	8.98 a	8.01 a	**	6.67 a	5.71 b	4.81 c	6.57 a	4.78 c	N.S
50-65	**	11.99 c	13.42 c	19.61 b	25.43 a	22.71 ab	N.S	20.57	18.67	17.73	18.51	17.69	N.S
65-80	*	23.39 b	26.66 ab	28.59 ab	34.81 a	32.67 a	*	33.12 a	29.91 ab	27.51 ab	29.14 ab	26.45 b	N.S
80-95	N.S	22.12	26.36	29.15	30.64	29.35	N.S	30.62	29.74	24.97	28.11	24.19	N.S

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

Increasing levels of nitrogen from 60 to 180 kg N/fed increased significantly the plant height in both seasons, however, the increase in plant height by increasing nitrogen rates, may be due to the vital role of N on plant growth as it is necessary for cell protoplasm formation, photosynthesis activity in all plants and necessary for cell division and meristimic activity in plant orgrans. The extra protein produced allows the plant leaves to grow and to have a larger surface available for photosynthesis. These findings were in harmony with those obtained by Dawood *et al.* (1992), Nawar *et al.* (1992). Esmail and El-Sheikh (1994), Mokadem and Salem (1994), Schmidt *et al.* (2002) and Nofal *et al.* (2005).

Data in Table (7) show clearly that maize hybrids differed significantly in their plant height at all growth stages in two seasons, S.C. 10 recorded the tallest plants without significant differnces with some of maize hybrids in both seasons.

The differences among genotypes in terms of plant height may be attributed to number and or length of their internodes. These results are in agreement with those by Younis *et al.* (1994), El-Habbak (1996), El-Habbak and Shams El-Din (1996).

7. Ear height:

Means of ear height, as affected by nitrogen levels, maize hybrid and their interaction in 2000 season are presented in Table (8) and in 2001 season in Table (9). Increasing levels of nitrogen from 60 to 180 kg N/fed. increase in ear height and may be due to the taller internodes that due to the excessive competition between plants for light. These results are in accordance with those obtained by Khalil (2001).

Data cited in Table (8) and Table (9) show highly significant differences between maize hybrids in ear height in both seasons. The highest values of ear height was recorded by S.C. 10 hybrid in both seasons.

The differences among genotypes in terms of ear height may be attributed to differences in the genetical make up among maize hybrids.

These results are in accordance with those obtained by Said and Gaber (1999) and Khalil (2001).

Table (7): Plant height as affected by nitrogen fertilization and maize hybrids at different stages of growth in 2000 and 2001 seasons.

Period of growth	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	2000 season												
35	**	63.76 d	69.27 d	76..66 c	106.32 b	114.00 a	**	91.60 a	87.09 b	86.97 b	83.06 bc	81.28 c	N.S
50	**	125.81 c	143.40 b	144.25 b	175.81 a	183.23 a	**	159.70 a	156.00 b	153.51 ab	150.62 c	149.70 c	N.S
65	**	208.21 c	218.72 ab	212.81 bc	222.92 ab	225.63 a	**	220.89 a	220.51 a	218.50 ab	214.60 b	213.43 b	**
80	**	235.40 c	235.52 c	241.90 bc	251.60 ab	255.62 a	**	255.10 a	252.50 a	245.40 b	234.70 c	232.30 c	**
	2001 season												
35	**	63.62 c	79.73 b	81.75 b	109.20 a	112.00 a	**	96.84 a	93.29 ab	87.56 bc	86.31 bc	82.31 c	N.S
50	**	126.41 c	141.80 b	155.10 b	185.52 a	188.71 a	**	169.40 a	163.61 b	157.10 c	155.22 cd	151.30 d	N.S
65	**	187.71 c	209.00 b	211.10 b	239.60 a	241.92 a	**	226.10 a	223.11 a	216.80 b	212.79 b	210.61 b	N.S
80	**	244.32 c	256.51 b	257.62 b	258.30 b	267.61 a	**	271.32 a	263.71 b	252.85 c	252.50 c	243.90 d	**

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

Yield and its components:

1. Mean percentages of two ear/plant:

Table (8 and 9) showed that the mean percentages of two ear/plant under different nitrogen levels (60, 90, 120, 150 and 180 kg N/fed.) were not significant in the first season Table (8), but they were significant in the second one Table (9). The highest mean values was obtained at 150 and 180 kg N/fed. in the summer season 2001 (Table 9). These results might be attributed to the effect of nitrogen on the vigor vegetative growth and accumulation of photosynthesis assimilates which produce high number of ears/plant. These results are in accordance with those of Younis *et al.* (1994), Hassan (1995) and Faisal *et al.* (1996).

Data in the same Tables (8 and 9) showed that, there were highly significant differences between hybrids in mean percentages of two ear/plants in the two seasons.

The hybrids; S.C. 10 and S.C. 122 were significantly the highest for mean percentages of two ear/plants compared with the other hybrids in both seasons.

The differences in mean percentages of two ear/plants of maize hybrids under study may be due to the differences in their genetic make up to stress condition and environmental factors affecting developmental processes and ability to thrive and benefit after the available nutrients. Similar results were obtained by Shalaby *et al.* (1994), Atta-Allah (1996), El-Habbak (1996) and Hassan (2000).

2. Mean percentages of barren and infertile plants:

Data in 2000 season (Table 8) and in 2001 season (Table 9) showed that nitrogen fertilization levels significantly affected on the bareness percentage, however, the low level of N (60 kg N/fed.) increased the percentages, while, high N application decreased the percentages, in both seasons. These results are in harmony with those reported by Shams El-Din and El-Habbak (1996).

Data in Tables (8 and 9) showed significant differnces among hybrids on barrenness percentage in 2000 and 2001 seasons.

TWC321 recorded significant higher barrenness percentage than the other studied hybrids in 2000 season. These results are mainly due to the differences in the genetical make up among maize hybrids.

Table (8): Effect of nitrogen fertilization levels, hybrids and their interactions on some yield component characters of maize in 2000 season.

Variable	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
		2000 season											
Ear height (cm)	**	142.7 e	147.3 d	152.0 c	156.5 b	163.0 a	**	159.5 a	155.7 b	152.4 c	148.3 d	145.7 e	*
Mean percentages of two ear-plants	N.S	2.61	2.91	3.01	4.22	4.34	*	4.44 a	4.19 a	3.78 ab	2.68 bc	2.01 c	N.S
Mean percentages of barren and infertile plants	*	5.14 a	3.85 ab	2.99 bc	2.71 bc	2.10 c	*	2.03 c	3.19 b	3.29 b	3.79 ab	4.49 a	*
Ear length (cm)	**	20.79 c	22.06 b	22.98ab	23.72 a	23.55 a	**	23.43 a	23.11 ab	22.66 b	22.01 c	21.91 c	NS
Ear diameter mm	**	40.77 e	41.99 d	43.21 c	45.33 b	47.38 a	**	46.49 a	44.40 b	43.29 c	42.68 c	41.81 d	**
No. of rows/ear	**	12.75 d	13.86 c	14.00bc	14.13 b	14.64 a	**	14.18 a	13.64 c	13.72 bc	13.90 b	13.94 b	**
No. of kernels/row	**	44.79 d	44.60 d	46.17 c	47.52 b	49.42 a	**	48.70 a	46.68 b	45.78 c	45.73 c	45.61 c	N.S
100-kernels weight	**	38.3 e	40.6 d	42.2 c	45.6 b	47.3 a	**	41.6 d	42.2 cd	43.5 ab	44.1 a	42.6 bc	N.S
Ear weight (g).	**	243.7 e	257.8 d	268.1 c	292.4 b	305.1 a	**	296.9 a	281.2 b	272.1 c	262.8 d	254.0 e	N.S
Kernels weigh/ear. (g).	**	205.4 e	217.2 d	225.9 c	249.0 b	256.4 a	**	254.4 a	238.6 b	228.6 c	218.3 d	214.1 d	N.S
Grain yield (ard./fed.)	**	24.4 e	28.4 d	30.3 c	31.1 b	33.6 a	**	33.5 a	31.0 b	29.4 c	27.3 d	26.5 e	**

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

Table (9): Effect of nitrogen fertilization levels, hybrids and their interaction on some yield components character of maize in 2001 season.

	Sig.	Nitrogen levels (kg/fed.)					Sig.	Hybrids					Interaction
		60	90	120	150	180		S.C. 10	S.C. 122	S.C. 129	T.W.C. 310	T.W.C. 321	
	20001 season												
Ear height (cm)	**	137.7 d	146.2 c	157.5 b	164.5ab	167.0 a	**	169.5 a	160.8 b	152.1 c	147.5 cd	143.0 d	*
Mean percentages of two ear-plants	**	2.37d	2.95cd	3.60 c	4.51 a	5.49 b	**	4.87 a	4.21 ab	3.61 b	3.58 b	2.66 c	N.S
Mean percentages of barren and infertile plants	**	3.88 a	2.39 b	1.34 c	1.83 c	1.35 c	*	1.55 b	2.19 a	2.38 a	2.34 a	2.34 a	N.S
Ear length (cm)	**	18.75 e	19.81 d	20.74 c	21.81 b	22.78 a	**	22.19 a	21.17 b	20.51 c	20.30 d	19.72 e	*
Ear diameter (mm)	**	40.55 d	42.99 c	43.03 c	45.90 b	48.15 a	**	46.82 a	45.22 b	43.74 c	42.48 d	42.37 d	**
No. of rows/ear	**	12.57 e	13.01 d	13.56 c	13.77 b	14.24 a	**	14.28 a	13.99 b	13.21 c	13.04 d	12.93 e	*
No. of kernels/row	**	42.7 e	44.7 d	47.7 c	49.5 b	51.1 a	**	51.0 a	47.9 b	46.1 c	45.6 c	44.9 c	NS
100-kernels/weight	**	38.4 e	40.0 d	41.4 c	45.0 b	47.4 a	**	41.3c	41.6 c	42.9 ab	43.5 a	42.7 b	N.S
Ear weight (g)	**	254.8 e	265.3 d	280.2 c	297.9 b	308.4 a	**0	306.8 a	291.7 b	277.5 c	269.9 d	260.8 e	*
Kernels weight/ear (g)	**	216.4 e	225.3 d	238.8 c	252.9 b	261.1 a	**	265.4 a	250.1 b	234.5 c	226.4 d	218.1 e	**
Grain yield (ard./fed.)	**	25.0 e	29.3 d	31.2 c	321.6 b	35.1 a	**	34.5 a	32.3 b	30.5 c	28.6 d	237.2 e	**

Notes: Values followed by the same letters horizontally are not significantly different according to DMRT at 0.05

3. Ear length (cm):

Means of ear length in (cm) as affected by nitrogen level maize hybrid in two seasons are presented in Tables (8 and 9).

Ear length was highly significant with increasing nitrogen levels after 60 up to 180 kg N/fed. The increase in ear length may be due to vital role of N on plant as it is necessary for cell protoplasm formation, photosynthesis activity in plant organs. The extra protein produced allows the plant leaves to grow and to have a lager surface available for photosynthesis. These results are in harmony with those obtained by Adel-Gowad and El-Batal (1996), Ashoub *et al.* (1996), Badawi and El-Moursy (1997), Atta-Allah (1998) and Badr *et al.* (2003).

Data in Tables (8 and 9) show highly significant differences between maize hybrid in ear length in both seasons. The highest value of ear length was recorded by SC10 in both seasons. The differences among maize hybrids in terms of ear length may be due to differences in genetical make up which agreement with those obtained by Younis *et al.* (1994), Hassan (1995) and El-Habbak (1996).

4. Ear diameter (mm):

Ear diameter as affected by nitrogen level, maize hybrid and their interaction are presented in Table (8 and 9) ear diameter was highly significant affected by nitrogen level in both seasons. The differences between maize hybrids were highly significant for ear diameter in both seasons. The highest value noticed with SC10 in both seasons. These differences may be due to the differences in response of their genetic make up to stress condition and environmental factors affecting developmental processes and ability to thrive and benefit after the available nutrients. The results are in harmony with those of Faisal *et al.* (1996), El-Shenawy (2003) and Amer *et al.* (2004).

Interaction between nitrogen level and maize hybrid was highly significant on ear diameter in both seasons.

5. Number of rows/ear:

Data in Table (8 and 9) showed that effect of nitrogen level and maize hybrid on number of rows per ear in both seasons. The number of rows per ear was highly significant affected by N levels in both seasons number of rows per ear show high significant differences between maize hybrid in both season. The highest number or rows per ear obtained from SC10 in both seasons. These results are in harmony with those obtained by Said and Gaber (1999).

6. Number of kernels/row:

Number of kernels per row as affected by N levels was highly significant difference in the two seasons. The results may be due to LAI/plant and meristematic activity of maize plant, which was reflected on increasing the number of kernels/row. These results obtained by Hassan (2000).

Data in the Tables show highly significant differences between maize hybrid in number of kernels per row in the two seasons. SC10 gave the highest values number of kernels/row in both seasons. These results may be due to genetical constitutions of the hybrid which play an important role of high efficiency of these hybrids in photosynthesis, ability. The results are in harmony with that obtained by El-Shenawy (2003) and Amer *et al.* (2004).

7. 100-kernels weight:

100-kernels weight was highly significant in both seasons Tables (8 and 9). Results were obtained by Sid and Gaber (1999).

The difference between maize hybrids were highly significant in both seasons. The highest values were obtained by TWC310 in both seasons. These differences may be due to the genetical differences between hybrids, which play an important role for the uptake of these available nutrients and the photosynthesis process. Results were obtained by Younis *et al.* (1994), El-Zeir *et al.*(1998) and Said and Gaber (1999).

8. Ear weight (g):

Ear weight was highly significant in both seasons Tables (8 and 9). The highest ear weight resulted from application of 180 kg N/feddan. These results reflected the effect of nitrogen on increasing growth attributes and meristematic activity of maize plant, which was reflected on increasing ear weight. These results are in accordance with those of Hammam (1995), Badawi and El-Moursy (1997) and Mosalem (1998).

The highest ear weight was obtained by SC10 hybrid. It may be due to the genetical constitution, which play an important role of higher efficiency of this hybrid in photosynthesis ability, which lead to an increase in dry matter production. Ali *et al.* (1996) and Meky (1997).

9. Kernels weight/ear (g.):

Data in Tables (8 and 9) indicated that kernels weight per ear were highly significant with increasing nitrogen levels up to 180 kg/fed. in both seasons. These results may be due to increasing growth attributes, which was reflected on increasing ear grain weight. El-Habbak (1996) indicated similar results.

S.C10 hybrid produced significantly higher kernel weight per ear compared with the other studied hybrids in both seasons. However, T.W.C. 321 hybrid produced the lowest value of grain weight per ear in both seasons. This may be due to the genetical constitution, which plays an important role of higher efficiency of these hybrids in photosynthesis ability which lead to an increase or decrease in dry matter production. Similar results were obtained by El-Habbak (1996).

10. Grain yield per feddan:

Data in Table (8 and 9) showed that grain yield ard./fed. was highly significant in both seasons. Increasing nitrogen fertilization levels from 60, 90, 120, 150 and 180 kg N/fed. increased grain yield from 24.4 to 33.6 ard./fed. in 2000 season and 25 to 35.1 ard./fed. in 12001 season. These results reflected the effect of nitrogen on increasing growth attributes (such as LAI and dry mater accumulation per plant) meristematic activity of maize plant, which was reflected on increasing yield attributes as well as final grain yield. Thus, the high levels of nitrogen up to 180 kg N/fed. may be considered most effective for maize production than lower levels. These results are in accordance with those obtained by Mosa (1996); Hassan (1995); El-Zeir *et al.* (1998) and Mosalem (1998).

Data indicated highly significant differences between maize hybrids in grain yield per feddan in both seasons. The highest grain yield ard./fed. was recorded by SC10 in both seasons. These differences may be attributed to the genetical differences between hybrids which play an important role for the uptake of the available nutrients and the photosynthesis processes which led to an increase in dry matter production. These results agreed with those obtained by Younis *et al.* (1994), Ali *et al.* (1996), El-Zeir *et al.* (1998) and Said and Gaber (1999).

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الملخص العربى

تأثير التسميد النتروجينى على ديناميكية النمو والمحصول لبعض الهجن البيضاء من الذرة الشامية

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أقيمت هذه الدراسة بمزرعة كلية الزراعة بكفرالشيخ - جامعة كفرالشيخ - مصر فى الموسمين ٢٠٠٠/٢٠٠١م لدراسة تأثير مستويات السماد المعدنى النتروجينى (٦٠ ، ٩٠ ، ١٢٠ ، ١٥٠ ، ١٨٠ كجم نيتروجين/فدان) على ديناميكية النمو وانتاجية الذرة الشامية لخمس هجن بيضاء الحبوب وهى هجين فردى ١٠ وهجين فردى ١٢٢ وهجين فردى ١٢٩ وهجين ثلاثى ٣١٠ والهجين الثلاثى ٣٢١ بيضاء الحبوب. وقد تم عمل ديناميكية النمو عن طريق اخذ عينات خضرية من القطع التجريبية خلال مراحل نمو النباتات المختلفة ٣٥ ، ٥٠ ، ٦٥ ، ٨٠ يوم من الزراعة. أدت زيادة مستوى التسميد النتروجينى من ٦٠-١٨٠ كجم نيتروجين/فدان الى زيادة معنوية فى عدد الاوراق الخضراء ، المساحة الورقية للنبات ، دليل مساحة الاوراق ، المادة الجافة المتجمعة بالنبات ، معدل نمو المحصول ، ارتفاع النبات خلال مراحل النمو ، ارتفاع الكوز ، النباتات الحاملة لكوزين ، نسبة النباتات غير الحاملة لكيزان. كما ادت زيادة مستويات التسميد النتروجينى من ٦٠-١٨٠ كجم الى زيادة معنوية فى صفات الكوز: طول الكوز ، قطر الكوز ، وزن الكوز ، عدد السطور بالكوز ، عدد الحبوب بالسطر ، وزن الـ ١٠٠ حبه ، محصول الحبوب اردب للفدان.

اختلفت الخمسة اصناف من الذرة تحت الدراسة معنويا فى صفات النمو والمحصول ومكوناته وقد اتضح تفوق الهجين فردى ١٠ واتى تابعا له فى التفوق هجين فردى ١٢٢ حيث اظهرا هذين الصنفين تفوقا فى جميع صفات النمو والمحصول ومكوناته على الاصناف الاخرى.