ISSN 1110-0419

Annals Of Agric. Sci., Moshtohor,
Vol. 47(3): Ag. 175-184, (2009).

RESPONSE OF SOME MAIZE INBRED LINES TO NITROGEN FERTILIZER RATES AND PLANT POPULATION DENSITIES

BY

Hassan, M.M.M.; Hoda. Kh. A. El-Mekser and El-Galfy, A.M.K
Maize Res Prog, Field crops Res Inst., Agric Res Center, ARC, Egypt

ABSTRACT

A field experiment was conducted at Ismailia Agricultural Res Stn in 2007 and 2008 growing seasons to study the response of three maize inbred lines (Sd-7, Sd-63, Sd-34) to four nitrogen fertilizer rates; 0, 45, 90 and 135 Kg N fad^{-1} under two plant population densities; 25000 and 30000 plant fad^{-1}. Characters studied were number of days to 50% tasseling and silking, plant and ear height, ear characteristics and grain yield per plant as well as per faddan. Results showed that nitrogen fertilizer rates had significant effect on all studied traits in both growing seasons. Increasing nitrogen fertilizer rates up to 45 Kg N fad^{-1} induced tasseling date early in both seasons and silking date early in first season, while increasing nitrogen fertilizer rates up to 90 Kg N fad^{-1} led to silking data early and increased plant and ear height in the second season. Increasing nitrogen fertilizer rates up to 135 Kg N fad^{-1} increased plant and ear height in the first season, ear length and diameter, row ear^{-1}, grains row^{-1}, grain yield per plant and per faddan in both seasons. Plant densities had no significant effect on all studied traits, except for grain yield per plant in the first season, and grain yield (ard fad^{-1}) in the second season. Increasing number of plants per faddan from 25 to 30,000 plants fad^{-1} significantly decreased grain yield per plant in 2007 season and grain yield in ard fad^{-1} in 2008 season. The three inbred lines significantly differed in most of the studied traits. Inbred line Sd-34 and Sd-7 gave the highest grain yield in 2007 season, whereas, inbred line Sd 7 gave the highest grain yield in 2008 season. However, inbred line Sd-63 was the most inferior regarding grain yield (ard fad^{-1}) in both growing seasons.

INTRODUCTION

Maize (*Zea mays* L.) is a major cereal crop in Egypt covering 28 % of the total area under cereal cultivation. The national average of maize yields was 24.62 ard fad^{-1}. Productivity of maize inbred lines is of great importance to seed producers. Maize recommendations are usually developed for hybrid maize growers. Response of maize inbreds to nitrogen fertilizer might differ from that of hybrids. Therefore, estimating of the response of inbred lines to N and plant density is important to seed producers. The low yield is attributed to factors such as low soil fertility, inappropriate cultural practices, weeds and other pests. Various studies indicated that optimum fertilizer and plant populations provide better crop growth and yield. Response to N fertilizer is, however, variable depending on amount and distribution of moisture, soil fertility and variety. Application of N fertilizer increases leaf area development which increases photosynthetic activity of the leaf (Sallah *et al.*, 1998).

Hybrid maize favors high doses of fertilizer (Gardener *et al.*, 1990; Killorn and Zourarakis, 1992). A study conducted by Killorn and Zourarakis (1992) at Iowa State, USA recorded least yield of hybrid maize from 0-N fertilizer and increased yield from the higher rate of N (196 kg ha^{-1}). Other researchers (Nielsen and Halvorson, 1991, and Sallah *et al.*, 1998) reported similar results. On the other hand, response to plant population is dependent on location, variety, and season. Concerning the effect of plant population density, Ibrahim *et al.* (1992) showed that high stand (30000 plants fad^{-1}) increased plant and ear height. Matta *et al.* (1996), El-Agamy *et al.* (1999), and Soliman *et al.* (2005) reported that increasing number of plants per unit area up to certain levels increased grain yield of all studied hybrids. Badr and Sanaa Othman (2006) studied the effect of plant population density and nitrogen fertilization on growth and yield of some maize single crosses, they found that increasing plant density from 20000 to 30000 plants fad^{-1} led to significant increase in number of days from planting to 50% tasselling, plant height, ear height, and grain yield fad^{-1}. Hassan *et al.* (2008) indicated that plant density of 25 and 30 thousand plants fad^{-1} was associated with the highest grain yield.

Nitrogen fertilizer is the other important factor that encourages photosynthetic and merestimatic activities, and improves maize production. Maximum production could be provided as an adequate sink for photosynthates transfer (Gouda *et al.*, 1993). Increasing nitrogen fertilizer rates up to certain levels delayed pollen shedding and silking dates and increased plant height and grain yield per unit area (Mahgoub *et al.*, 1991, Nawar *et al.*, 1992, Abdrabou, 1996, and Samira *et al.*, 1998). Nofal and Mobarak (2003) recorded significant response of maize plants to nitrogen fertilization on some growth and yield characters. In addition, they noticed that increasing N rates up to 135 Kg N fad^{-1} significantly decreased number of days to 50% tasselling and silking, but significantly increased plant height, ear position and number of ears $plant^{-1}$.

The main objective of this investigation was to study the response of three comercial maize inbred lines used in hybrid seed production to nitrogen fertilization and plant population density. Providing maize seed producers by suitable recommendations to maximize maize response to nitrogen fertilization and plant density.

MATERIALS AND METHODS

A field experiment was conducted at Ismailia Research Station located in the Eastern region of Egypt during the two successive growing seasons of 2007 and 2008. Dates of planting were 21^{st} of may and 7 of june in two growing seasons, respectively. Soil type is sandy loam. Previous winter crop was wheat in both growing seasons. Sprinkler irrigation system was used in this study. Twenty-four treatments were laid out in a randomized complete block design with four replicates, which was the combination of three inbred lines, Sd-7, Sd-63 and Sd-34, four nitrogen fertilizer rates 0, 45, 90, and 135 kg N fad^{-1}, Nitrogen was applied in the form of ammonium nitrate (33.5%), two plant populations, 25000 and 30000 plants fad^{-1}. The different plant populations were achieved by varying within row spacing which were 21 and 17.5 cm (29 and 34 hills per 6m row). Ammonium nitrate was applied weekly after 20 days from planting to flowering (7 equal doses) as side dressing. The plot size was four rows, 6 m long and 80 cm apart with plot size of 19.2 m^2. Two or three grains of each inbred line were planted per hill and later thinned after three weeks to one plant $hill^{-1}$ to produce the required population. Distance between hills was 21 and 17.5 cm, which is equivalent to 25 and 30 thousand plants fad^{-1}, respectively. The crop was hand weeded twice each season, $20m^3$ of manure was applied to all experimental units before planting. The first dose was applied one week after planting and the rest was added weekly as side dressing behind each hill. Calcium super phosphate (15.5% P_2O_2) and Potassium sulphate (48% K_2O) were added before planting at the rate of 30 Kg P_2O_2 48 Kg K_2O fad^{-1}, respectively. The crop was harvested on the 23^{rd} of September and 5 of October in 2005 and 2006 growing seasons, respectively. Characters studied were number of days from planting to 50% tasseling and silking, plant and ear height (cm), ear length and ear diameter(cm), rows ear^{-1}, grains row^{-1} and grain yield in ard fad^{-1}. Asample of 5 Kg of ear were taken for moisture determination. Grain yield was adjusted to 15.5% moisture. All obtained data were statistically analyzed according to Steel and Torrie (1980).

Table (1): Chemical analysis of the sandy soil at the experimental site in 2007 and 2008 seasons.

Chemical analysis	2007	2008
pH	7.80	8.10
Total soluble salt %	0.21	0.20
Total N %	0.10	0.09
Available N (ppm)	27.30	28.00
Available K (ppm)	177.90	155.00
Available P (ppm)	9.50	10.00

Table (2): Physical properties of the soil at the experimental site in 2007 and 2008 seasons.

Partial distribution	2007	2008
Clay %	13.70	14.30
Silt %	20.22	20.00
Fin sand %	53.78	51.21
Coarse sand %	12.31	13.20
Texture	Sandy loan	Sandy loan

Table (3): Some macro and micro nutrient contents of the added manure in 2007 and 2008 seasons.

Content	2007	2008
Organic carbon, %	23.20	22.90
Total nitrogen %	1.70	1.60
C/N ratio, %	13.30	14.10
Available N, %	0.14	0.13
Available P, %	0.39	0.44
Available K, %	5.47	5.16
Available Fe,ppm	3.70	3.80
Available Zn, ppm	47.00	43.00
Available Mn, ppm	97.00	99.00

RESULTS AND DISCUSSION

1. Flowering and growth characters:

Mean of number of days from planting to 50% tasseling and silking as well as plant and ear height of the inbred lines as affected by nitrogen fertilizer rates and plant population density is presented in Table 4. Maize inbred lines significantly differed in flowering dates. Concerning days to 50% tasseling, Sd-34 was the earliest in pollen shading in both growing seasons followed by Sd-7 and Sd-63 (63.8, 67.2 and 69.5, and 61.3, 63.7 and 64.5 days after planting in 2007 and 2008 growing seasons), respectively. In case of silking date, Sd-34 and Sd-7 were earlier than Sd-63 in 2007 season and, Sd-34 was earlier than Sd-63 in 2008 season (69.6, 70.0 and 72.6, and 65.4, 66.2 and 66.8 days after planting in 2007 and 2008 growing seasons), respectively. It is worth noting that the flowering dates of different inbred lines were earlier in 2008 season than that in 2007 season. This may be due to the late planting date in the second season compared with the first one.

Concerning plant and ear height, data in Table 1 show that inbred line Sd-63 exhibited the shortest plants with lowest ear placement in both growing seasons comparing to the other two studied inbred lines, i.e. Sd-7 and Sd-34(159.7 and 78.0 cm, 161.5 and 73.4 cm for plant and ear height in 2007 and 2008 growing seasons), respectively.

Table (4): Means of number of days from planting to 50% tasseling and silking, plant and ear height of maize inbred lines as affected by nitrogen fertilization and plant population density in 2007 and 2008 growing seasons.

Treat-ments	2007 growing season				2008 growing season			
	Days to 50% tasseling	Days to 50% silking	Plant height cm	Ear height cm	Days to 50% tasseling	Days to 50% silking	Plant height cm	Ear height cm
Inbred lines								
Sd 7	67.2	70.0	231.4	112.2	63.7	66.2	230.9	108.1
Sd 63	69.5	72.6	159.7	78.0	64.5	66.8	161.5	73.4
Sd 34	63.8	69.6	233.9	109.1	61.3	65.4	224.9	108.5
LSD 0.05	1.0	1.1	9.5	6.6	0.6	1.0	8.1	5.3
N-Fertilizer rates (Kg N fad^{-1})								
0	**68.0**	73.8	184.6	82.4	64.3	68.8	175.8	78.0
45	**66.5**	70.3	210.2	103.8	62.9	66.3	206.5	92.1
90	**66.7**	69.7	215.0	102.5	62.4	64.5	221.1	105.3
135	**66.2**	69.2	223.5	110.4	63.1	64.9	219.8	103.2
LSD 0.05	**1.1**	1.3	11.0	7.6	0.7	1.1	9.4	6.2
Plant density (1000 plants fad^{-1})								
25	66.9	70.5	208.1	98.3	63.2	66.1	204.8	94.7
30	66.7	71.0	208.5	101.2	62.9	66.2	206.8	94.6
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS

Effect of nitrogen fertilizer rates on flowering dates as well as plant and ear height is presented in Table 1. Results revealed that increasing N rates up to 45 kg N fad^{-1} significantly reduced number of days to 50% tasseling in both growing season. However, no significant effect in number of days to 50% tasseling by increasing nitrogen rates beyond 45 kg N fad^{-1}. For days to 50% silking, increasing nitrogen rates up to 45 kg N fad^{-1} (2007 season) and 90 kg N fad^{-1} (2008 season) was coupled with a significant decrease number of days from planting to 50% silking with no further reduction by increasing N rates beyond these two N rates. The reduction in number of days to 50% tasseling and silking could be attributed to the effect of nitrogen fertilization on accelerating vegetative growth, which led to reduction in number of days to 50% tasseling and silking. These results are in harmony with those of Younis *et al.* (1990), Mahgoub *et al.* (1991), Ibrahim *et al.* (1995), El-Moursy *et al.* (1998), Soliman *et al.* (2001), Nofal and Silem (2003), Hassan (2004), El-Mekser and Seiam (2008), and Hassan *et al.* (2008).

Data in Table 4 revealed that nitrogen fertilizer application had significant effect on plant and ear heights. Increasing nitrogen fertilizer rates from zero up to 45 Kg N fad^{-1} and 90 kg N fad^{-1} significantly increased both plant and ear height in 2007 and 2008 growing season, respectively. Increasing N rates over 90 Kg fed^{-1} was not associated with a significant increase in plant and ear heights, except for plant and ear height in the first growing season which increased as N increased up to 135 kg N fad^{-1}.These results are in agreement with those reported by Ismail and El-Sheikh (1994), Abdel-Gawad and El-Batal (1996), El-Moursy *et al.* (1998), Said and Gaber (1999) and Hassan (2004).

Effect of plant population density on number of days to 50% tasseling and silking as well as plant and ear heights is presented in Table 1. Increasing plant density from 25000 to 30000 plants fad^{-1} did not affect number of days to 50% tasseling and silking as well as plant and ear height in both growing seasons.

2. Ear characteristics:

Means of ear length, ear diameter, number of rows ear^{-1} and number of grains row^{-1} of some maize inbred lines as affected by nitrogen fertilizer rates and plant population density are presented in Table 5. Differences among inbred lines in terms of ear characteristics, *i.e.* ear length, ear diameter, number of rows ear^{-1}, and number of grains row^{-1} were significant in both growing seasons (Table 5). Results revealed that the inbred line Sd-34 had the highest values of ear characteristics in both growing seasons, except that for ear length and number of grains row^{-1} in 2008 season. On the other hand, the shortest ears with lower number of grains row^{-1} were produced by Sd 63 (11.9 and 11.6 cm and 25.4 and 25.1 grains row^{-1}) in both growing seasons, respectively.

The effect of nitrogen fertilizer rates on ear characteristics in 2007 and 2008 growing seasons is presented in Table 2. The obtained results indicated that nitrogen rates significantly influenced ear length, ear diameter, rows ear^{-1} and grains row^{-1} in both growing seasons. It worth noting that the average values of ear diameter and number of rows per ear were gradually increased as nitrogen fertilizer rates increased up to 135 kg N fad^{-1}.

Table (5): Means of ear characteristics as affected by nitrogen fertilization and plant population density in 2007 and 2008 growing seasons.

Treatments	2007 growing season				2008 growing season			
	Ear length cm	Ear diameter cm	Rows ear^{-1}	Grains row^{-1}	Ear length cm	Ear diameter cm	Rows ear^{-1}	Grains row^{-1}
Inbred lines								
Sd 7	14.2	3.4	11.3	28.5	15.4	3.6	10.3	30.9
Sd 63	11.9	3.5	12.1	25.4	11.6	3.5	11.4	25.1
Sd 34	14.5	3.8	13.4	29.6	14.6	3.8	12.4	29.4
LSD 0.05	0.5	0.1	0.2	1.4	0.9	0.1	0.7	2.3
N-Fertilizer rates (Kg N fad^{-1})								
0	10.2	3.2	11.8	20.2	11.2	3.3	10.5	21.3
45	13.2	3.5	12.2	27.5	14.1	3.6	11.5	28.6
90	14.8	3.7	12.6	31.1	14.4	3.8	11.5	30.3
135	15.9	3.8	12.6	32.5	15.8	3.9	12.0	33.7
LSD 0.05	0.6	0.1	0.3	1.6	1.0	0.1	0.8	2.6
Plant density (1000 plants fad^{-1})								
25	13.7	3.5	12.4	28.1	14.1	3.7	11.6	28.8
30	13.4	3.5	12.2	27.5	13.6	3.6	11.2	28.1
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS

Ear length and number of grains per row increased N rate increased up to 135 kg N fad^{-1}. These results might be attributed to the role of nitrogen as an essential element on plant growth, which improves ear development, dry matter accumulation in grains, and ear size. These results were in agreement with those obtained by Shalaby *et al.* (1994), Shams El-Dein and El-Habbak (1996), Osman (1998), El-Far (2000), and Hassan (2004).

Data in Table 5 revealed that ear characteristics were not significantly affected by the two studied plant population densities. This might be attributed to the narrow range of the two studied population densties, which have been recommended for growing maize hybrids as well.

3. Grain yield:

Means of grain yield $plant^{-1}$ and grain yield per faddan of the maize inbred lines as affected by nitrogen fertilizer rates and plant population density is presented in Table 6. Results showed that differences among inbred lines in grain yield $plant^{-1}$ and $faddan^{-1}$ were significant in both growing seasons. Respecting grain yield per plant, Sd-34 as well as Sd-

7 produced the highest grain yield per plant in 2007 growing season, whereas Inbred line Sd-7 only had the highest grain yield plant^{-1} in 2008 However, Sd-63 produced the lowest grain yield per plant in both growing seasons (57.9 and 38.2 g plant^{-1}, respectively). Concerning grain yield as arddab per faddan, Sd-34 as well as Sd-7 produced the highest grain yield (14.4,and 13.7 ard fad^{-1}) in 2007 growing season, followed by Sd-63 (11.2 ard fad^{-1}), respectively. In 2008 growing season, however, Sd-7 produced the highest grain yield followed by Sd-34 and Sd-63 (10.8, 8.6, and 7.2 ard fad^{-1}, respectively). It is worth noting that the difference between the studied inbred lines was due mainly to the differences in their origin and environmental conditions. In this respect, Soliman and Barakat(2006), mentioned that the differences between maize inbred lines respecting their performance and productivity were due mainly to the difference in their origin and environmental effects.

Concerning the effect of nitrogen rates, data in Table 6 show that grain yield per plant and per faddan significantly affected by nitrogen fertilization in both growing seasons. The increase in nitrogen rates up to the highest rate of 135 kg N fad^{-1}was associated with a significant increase in grain yield plant^{-1} and faddan^{-1} in both growing seasons. Nitrogen rates of 45, 90 and 135 kg N fad^{-1} were linked to a significant increased in grain yield per plant in 2007and 2008 growing seasons. The same trend was observed with respect to grain yield in ard faddan^{-1}. Nitrogen rates of 45, 90 and 135 kg N fad^{-1}, were coupled with significant increase in grain yield faddan^{-1}. in 2007, and 2008 growing seasons. Comparing with the control treatment, the percentage of yield increase resulted from the application of 45, 90, and 135 kg N fad^{-1} were 95, 140, and 170%, respectively in the first growing season. The corresponding percentages in yield increase were 130, 224, and 315%, respectively in 2008 growing season. In other words, the average increase in grain yield per each kilogram of N fad^{-1} was 19.3, 9.0 and 6.2 kg, in 2007, and 13.4, 9.6 and 9.3 kg in 2008 growing seasons, respectively. Effect of nitrogen fertilization on maize grain yield was mainly attributed to its effect on vegetative growth of maize plants and ear characteristics. Similar results were reported by Gouda *et al.* (1992), Mouris *et al.* (1993), Chittapur and Pujari (1995), Faisal *et al.* (1997), El-Agamy *et al.* (1999), El-Hassanin *et al.* (2002), Nofal and Mobarak (2003), and El-Makser and Seiam (2008).

Table (6): Means of grain yield per plant (g) and per faddan (ard fad^{-1}) as nitrogen fertilization and plant population density in 2007 and 2008 growing seasons.

Treatments	2007 growing season		2008 growing season	
	Grain yield plant^{-1} (g)	Grain yield ard fad^{-1}	Grain yield plant^{-1} (g)	Grain yield ard fad^{-1}
Inbred lines				
Sd 7	70.2	13.7	58.2	10.8
Sd 63	57.9	11.2	38.2	7.2
Sd 34	73.4	14.4	45.3	8.6
LSD 0.05	5.2	1.0	3.9	0.7
N-Fertilizer rates (Kg N fad^{-1})				
0	33.4	6.5	17.9	3.3
45	65.0	12.7	40.1	7.6
90	79.7	15.6	57.0	10.7
135	90.5	17.6	73.8	13.7
LSD 0.05	6.0	1.2	4.5	0.8
Plant density (1000 plants fad^{-1})				
25	70.9	12.7	47.8	8.4
30	63.5	13.4	46.6	9.3
LSD 0.05	4.3	NS	NS	0.6

Effect of plant population density on grain yield plant^{-1} was significant in 2007 growing season. However, it was not significant in 2008 growing season. Generally, increasing number of plants faddan^{-1} from 25000 to 30000 plants fad^{-1} led to significant decrease in grain yield plant^{-1} in 2007 growing season. It is worth noting that the decrease in plant productivity due to increasing number of plants per unit area was due mainly to the competition and mutual shading between the adjacent plants. On the other hand, the effect of plant population density on grain yield in arddab faddan^{-1} was not significant in 2007 growing season, whereas it was significant in the second season. These results were in agreement with those obtained by Tollenaar (1988); Simeonov and Tsankova (1990); El-Zeir *et al.* (1998); and Said and Gaber (1999) they reported that increasing plant density significantly increased grain yield per unit area. In contrast, Abdel-Aziz (1987), and found that increasing plant population densities decreased grain yield per unit area. Nunez *et al.* (1996) demonstrated that grain yield of maize was not significantly affected by increasing plant population density.

4. Inbred lines x nitrogen Interaction:

Effect of inbred line x N interaction on ear characteristics and grain yield in 2007 and 2008 growing seasons is presented in Table 7. Results revealed that the effect of this interaction on ear characteristics, *i.e* ear length, ear diameter, rows ear^{-1}, grains row^{-1} and grain yield was significant in both growing seasons. The inbred line Sd-34 exhibited the highest values concerning ear length, ear diameter, rows ear^{1} and grains row^{-1} when fertilized by 135 kg N fad^{-1} in both growing seasons.

Table (7): Effect of nitrogen fertilization and inbred lines interaction on ear characteristics, grain yield per plant and per faddan in 2007 and 2008 growing seasons.

N rates kg fad^{-1}	Inbred lines	Ear length (cm)	Ear diameter (cm)	Rows ear^{-1}	Grains Row^{-1}	Grain yield plant^{-1} (g)	Grain yield ard fad^{-1}
			2007 growing season				
0	Sd 7	11.7	3.2	10.2	23.9	36.7	7.07
	Sd 63	8.9	3.1	12.1	18.6	33.1	6.30
	Sd 34	10.0	3.2	13.2	18.2	30.5	6.00
45	Sd 7	14.0	3.4	11.4	29.2	67.9	13.42
	Sd 63	12.0	3.5	11.9	25.8	57.3	10.88
	Sd 34	13.7	3.7	13.2	27.5	69.6	13.72
90	Sd 7	14.8	3.4	11.8	29.8	83.6	16.40
	Sd 63	13.2	3.6	12.3	28.4	70.6	13.88
	Sd 34	16.4	4.1	13.7	35.0	84.9	16.45
135	Sd 7	16.2	3.6	12.0	30.9	92.5	17.72
	Sd 63	13.7	3.6	12.3	28.9	70.7	13.67
	Sd 34	17.9	4.1	13.5	37.7	108.4	21.28
LSD 0.05		1.1	0.2	0.5	2.7	10.4	1.99
			2008 growing season				
0	Sd 7	12.1	3.3	9.8	24.4	22.2	4.11
	Sd 63	9.9	3.4	11.4	20.2	20.0	3.77
	Sd 34	11.7	3.3	10.5	19.4	11.4	2.12
45	Sd 7	16.1	3.7	10.5	32.8	53.8	10.23
	Sd 63	11.3	3.4	11.2	24.5	33.3	6.47
	Sd 34	14.8	3.8	13.0	28.3	33.3	6.18
90	Sd 7	16.7	3.7	10.3	31.8	68.4	12.77
	Sd 63	12.3	3.6	11.4	27.3	44.4	8.56
	Sd 34	14.2	4.0	12.9	31.7	58.3	10.85
135	Sd 7	16.6	3.8	10.8	34.6	88.2	15.91
	Sd 63	12.9	3.7	11.6	28.4	54.9	10.16
	Sd 34	17.9	4.2	13.5	38.2	78.4	15.05
LSD 0.05		1.8	0.2	1.3	4.5	7.9	1.39

CONCLUSIONS

Inbred line Sd 34 and Sd 7 were earlier than Sd 63 in terms of number of days to 50 % tasseling and silking. Inbred line Sd 63 had the shortest plants and lowest ear height. The two inbred lines Sd 7 and Sd 34 had the heighest grain yield in both growing seasons. Increasing nitrogen fertilizer rates up to 135 Kg N Fed^{-1} increased plant and ear height in the first season, ear length and its diameter,row ear^{-1}, no of grains row^{-1}, grain yield $plant^{-1}$ and, $feddan^{-1}$ in both seasons. Plant density had no significant effect on all studied traits, except for grain yield $plant^{-1}$ in the first season, and grain yield(ard $fed^{-1)}$ in the second season.

REFERENCES

Abdel-Aziz, A.A. (1987):Effect of some agricultural practices on yield and yield components of corn (*Zea mays* L.). M. Sc. Thesis, Fac Agric., Minia Univ.

Abdel-Gawad, M.H., and El-Batal, M.A. (1996): Response of maize productivity to the growth treatment "uniconazole" under high nitrogen fertilization and plant density. Annals Agric. Sci., Moshtohor, Egypt, 34(2): 429-440.

Abdrabou, R.Th., (1996): Response of maize yield to ethephon treatment and nitrogen fertilizer rates under two directions. Annals Agric. Sci., Ain. Shams Univ. Cairo, Egypt, 41(2): 683-695.

Badr, M.M.A., and Sanaa A. Osman (2006): Effect of plant density, organic manure, bio- and mineral nitrogen fertilizers on maize growth and yield and soil fertility, Annals Agric. Sci., Moshtohor, 44 (1): 75-88.

Chittapur, B.M., and Pujari, B.T. (1995): Response of maize to population and fertilizer levels in the north eastern transitional tract of Karnataka. Farming Systems, 11(3-4): 45-47 (CF Computer Search).

El-Agamy, A.I.; Morshed, G.A.; Soliman, F.H. and Osman, M.Kh. (1999): Performance of some yellow maize hybrids under different plant population densities and nitrogen fertilizer levels. J. Agric. Sci., Mansoura Univ., 24(3): 911-923.

El-Far, H.A.R. (2000): Agronomic studies on maize. Ph.D. Thesis, Fac. Agric., Mansoura Univ., Egypt.

El-Hassanin, A. S.; Mahmoud, M. I;. Amer, Samia, M., and El-Mekser, Hoda, Kh. A. (2002): Response of maize to mineral, organic and biofertilizer under calcareous soil conditions. Egypt. J. Apll. Sci., 17(1): 91-104.

El-Mekser, Hoda, Kh. A., and Mofeeda, A. Seiam 2008. Nitrogen use efficiency of some new white maize hybrids under sandy soil. Egypt. J. Appl. Sci., 23 (2B):514-526.

El-Moursy, S.A.; Kandil, A.A.; Attia, A.N. and Abdel-Naby, M.M. (1998): Evaluation of some foliar and soil fertilizers on growth and yield of maize. J. Agric. Sci., Mansoura Univ., 23(2): 711-721.

El-Zeir, F.A.; El-Shenawy, A.A.; Amer, E.A. and Galal, A.A. (1998): Influence of narrow row spacing (high plant density) and nitrogen fertilization on two maize hybrids. J. Agric. Sci., Mansoura Univ., 23(5): 1855-1864.

Faisal, R.I.I.; Khedr, E.A. and Sultan, M. A. (1997): Effect of nitrogen fertilization and weed management treatments on maize plants and weeds. Egypt. J. Appl. Sci., 11(10): 31-44.

Gardner, C.A.C.; Bax, P.L.; Bailey, D.J.; Cavelieri, A.J.; Clausen, C.R.; Luce, G.R.; Meece, J.M.; Murphy, P.A.; Piper, T.E.; Segebart, R.L.; Smith, O.S.; Tiffany, C.W.; Trimble, M.W. and Wilson, B.N. (1990): Response of corn hybrids to nitrogen fertilizer. Journal of Production Agriculture: 3:39-43.

Gouda, A.Sh.A.; Maha, M. A. and Faisal, R.I.I. (1992): Response of some maize varieties to nitrogen fertilization. Annals Agric. Sci., Moshtohor, 30(4): 1649-1661.

Gouda, A.Sh.A.; Ragheb, M.M. and Bedeer, A.A. (1993): Grain yield of some maize hybrids as affected by plant population density and nitrogen fertilizer rates under different environmental conditions. Bull., Fac. Agric., Cairo Univ., 44: 599-618.

Hassan, M.M.M. (2004): Response of yellow maize to nitrogen, potassium fertilization and plant density. Ph. D. Thesis, Fac. Agric., Al-Azhar Univ., Egypt.

Hassan, M.M.M.; El-Ghonemy, M.A.M. and Ally, R.S.H. (2008): Response of some maize single cross hybrids to plant density under different Egyptian environmental conditions. Menufiya J. Agric. Res., 33(2): 427-443.

Ibrahim, M.E.; El-Naggar, H. M. and El-Hosary, A.A. (1992): Effect of irrigation intervals and plant densities on some varieties of corn. Menoufiya J. Agric. Res., 23(2): 1083-1098.

Ibrahim, M.E.; Esmail, S.E. and Nawar, A.A. (1995): Varietal response to nitrogen levels and planting date and determination of the dependence structure in yellow maize yield by using factor analysis. Zagazig J. Agric. Res., 22(2): 329-347.

Ismail, S.E., and El-Sheikh. M. H. (1994): Relationship between the nitrogen fertilizer levels and the yield of some maize varieties supported by response curve. Menofiya J. Agric. Res., 19(1): 139-152.

Killorn, R. and, Zourarakis, D. (1992): Nitrogen fertilizer management effects on corn grain yield and nitrogen up take. Journal of Production Agriculture 5:142-148.

Mahgoub, G.A.M.; Badawi, H.; Essad, M.A. Younis and El-Sherbeiny, H.Y.Sh. (1991): Effect of bacteria inoculate and nitrogen fertilizer on maize plants. Annals Agric. Sci., Moshtohor, 29(2): 645-655.

Matta, S.E.G.; Khedr, E.A. and Younis, M.A. (1996): Effect of stand reduction on maize growth and grain yield. Egypt. J. Appl. Sci., 11(2): 322-335.

Mouris, T.F.; Blackmer, A.M. and El-Hout; N.M. (1993): Optimal rates of nitrogen fertilization for first year corn after alfalfa. J. Production Agric., 6(3): 344-355 (CF Computer Search).

Nafziger, E.D. (1994): Corn planting date and plant population. Journal of Production Agriculture 7:59-62.

Nawar, A.A.; Ibrahim, M.E. and Attia, M.B. (1992): Grain yield, yield components and infestation levels of corn borers and aphid of maize genotypes as influenced by nitrogen fertilization. Egypt. J. Agron., 17(1-2): 41-58.

Nielsen, D.C. and Halvorson, A.D (1991): Nitrogen fertility on water stress and yield of winter wheat. Agronomy Journal 83: 1065-1070.

Nofal, Fatma, A.E., and Mobarak, El.A. (2003): Influence of manure and nitrogen fertilization on grain yield and some physical properties of maize hybrids under sandy soil conditions. Egypt. J. Appl. Sci., 18(5B): 497-507.

Nofal, Fatma, A.E.,, and Hinar A. Silem (2003): Growth and chemical properties of some maize grains of some single crosses as affected by nitrogen and manure fertilization under sprinkler irrigation in sandy soil. Egypt. J. Appl. Sci., 18(5B): 583-596.

Nunez-Hernandez, G.; Gastaneda, F.G.; Martin del Campo; S. and Ortiz, J. J. (1996): Effect of plant density on forage and grain yield production in maize with spreading and erect leaves.

Osman, M.K.A. (1998): Evaluation of some hybrids of maize under different levels of nitrogen fertilization and plant population density. M. Sc. Thesis, Fac. Agric., Al-Azhar Univ., Egypt.

Said, E.M., and Gaber, E.M.E. (1999): Response of some maize varieties to nitrogen fertilization and plant density. J. Agric. Sci., Mansoura Univ., 24(4): 1665-1675.

Sallah, P.Y.K.; Ehlkeand., N.J. and Geadelmann. J.L (1998): Progress from selection in La Posta maize population evaluated under three nitrogen fertilizer levels. African Crop Science Journal 6:241-248.

Samira, M. A. Hussein.; Haikel,, M.A. and El-Masry, M.A. (1998): Effect of some preceding crops, hill space and nitrogen fertilization on yield attributes and grain yield of maize under reclaimed sandy soil conditions in East Delta. Egypt. Soc. Crop Sci. & Fac. Agric., Suez Canal Univ. The Eight Conference of Agronomy. Nov. 28-29, Abst., p:35.

Shalaby, A.A.; Gomaa, M.A.; Radwan, E.I. and Gaafar, R.A. (1994): Response of maize to increasing levels of nitrogen fertilization and plant population. J. Agric. Res., Tanta Univ., 20(1): 18-22.

Shams El-Din, G. M., and Habbak, K. E. (1996): Use of nitrogen and potassium fertilization levels by maize growth under three plant densities for grain yield. Annals Agric. Sci., Moshtohor, 34(2): 513-528.

Simeonov, N., and Tsankova, G. (1990): Effect of fertilizers and plant density on yield of maize hybrids with two ears. Resteneiv "dni-Nauki", 27(8): 4-18 (CF Computer Search).

Soliman, F.H.S.; Ahmed, A.A. and Abdel-Azeem, M.E. (2005): Maize productivity under different plant densities in Toshka region, South Valley of Egypt. Egypt. J. Appl. Sci., 20 (5B): 671-695.

Soliman,, M.S.M., Abdel-Aziz, A.A. and Derar, R.A. (2001): Effect of nitrogen levels, farmyard manuring and biofertilization on growth, yield and yield components of maize (*Zea mays* L.). Egypt. J. Appl. Sci., 16(7): 151-167.

Steel, R.G.D. and Torrie, J.H. (1980): Principles and procedures of Statistics: A biometrical approach. 2nd (ed). McGraw-Hill Book Co., New York, USA.

Tollenaar, M., and Brulsema, T. W. (1988): Efficiency of maize dry matter production during periods of complete leaf area expansion. Agric. J., 80: 580-585.

Younis, M.A.; Mahgoub, G.M.A.; Khedr, E.A.F. and El-Demerdash, F.M. (1990): Response of some maize hybrids to plant density and nitrogen fertilization. Egypt. J. Appl. Sci., 5(1): 125-135.

إستجابة بعض سلالات الذرة الشامية للتسميد النيتروجينى وكثافة النباتات

محمد محمود حسان، هدى خيرى عبد المنعم المقصر، علاء الدين محمود خليل الجلفى
قسم بحوث الذرة الشامية-معهد بحوث المحاصيل الحقلية-مركز البحوث الزراعية

أقيمت تجربة حقلية فى المزرعة البحثية لمحطة البحوث الزراعية بالإسماعيلية خلال موسمى النمو ٢٠٠٧ ، ٢٠٠٨ وذلك لدراسة استجابة ثلاث سلالات نقية من الذرة الشامية وهى سدس ٧ ، سدس ٦٣ ، سدس ٣٤ لأربعة مستويات من التسميد النيتروجينى هى صفر ، ٤٥ ، ٩٠ ، ١٣٥ كجم ن/فدان تحت مستويين من كثافة النباتات هما ٢٥٠٠٠ ، ٣٠٠٠٠ نبات/فدان. أوضحت النتائج أن لمستويات التسميد النيتروجينى تأثيرا معنويا على جميع الصفات موضع الدراسة فى الموسمين. وقد أدت زيادة معدلات التسميد النيتروجينى حتى ١٣٥ كجم نيتروجين /فدان الى التبكير فى انتثار حبوب اللقاح فى الموسمين والتبكير فى ظهور الحريرة والى زيادة كل من ارتفاع النبات والكوز فى الموسم الأول فقط ، بينما أدت زيادة معدلات التسميد النيتروجينى حتى ٩٠ كجم نيتروجين /فدان الى التبكير فى ظهور الحريرة وزيادة إرتفاع النبات والكوز فى الموسم الثانى ، كما أدت زيادة معدلات التسميد النيتروجينى حتى ١٣٥ كجم نيتروجين /فدان ، وطول وقطر الكوز وعدد صفوف الكوز وعدد حبوب الصف ومحصول الحبوب للنبات وللفدان وذلك فى الموسمين. لم يكن لكثافة النباتات تأثيرا معنويا على جميع الصفات موضع الدراسة فيما عدا محصول الحبوب للنبات فى الموسم الأول ، ومحصول الحبوب بالأردب/فدان فى الموسم الثانى ' حيث أدت زيادة عدد النباتات بالفدان من ٢٥٠٠٠ الى ٣٠٠٠٠ نبات الى حدوث نقص معنوى فى محصول حبوب النبات فى موسم ٢٠٠٧ ، وحدوث زيادة معنوية فى محصول الحبوب بالأردب للفدان فى موسم ٢٠٠٨. وقد إختلفت السلالات موضع الدراسة بالنسبة لمعظم الصفات فيما بينها ، حيث أعطت كلا من السلالة سدس ٣٤، السلاله ٧ أعلا محصول حبوب للفدان فى موسم ٢٠٠٧ ، بينما أعطت السلالة سدس ٧ أعلا محصول حبوب للفدان فى موسم ٢٠٠٨ ، ومن ناحية أخرى كانت السلالة سدس ٦٣ أقل السلالات محصولا فى كلا الموسمين.