J. Agric. Sci. Mansoura Univ., 29 (11): 6063 - 6070, 2004

RESPONSE OF SOME MAIZE HYBRIDS TO NTROGEN AND POTASSIUM FERTILIZATION LEVELS.

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ABSTRACT

Two field experiments were carried out during 2002 and 2003 growing seasons at the Experimental Farm of the Faculty of Agricultural, Al-Azhar University, Assuit Governorate, Egypt, to Study the effect of nitrogen fertilizers (90, 120 and 150 Kg N/fed.) and potassium fertilizer rates (zero, 24 and 48 Kg K_2O N/fed.) on yield and yield components of maize hybrids S.C.10 and T.W.C. 310.

The most important results could be summarized as follows:

1-Each increase in nitrogen level up to 150 kg N/fed. and potassium fertilizer up to 48 Kg K_2O /fed. resulted in significant increases in ear length, ear diameter, number of rows per ear, 100-grain weight, shelling percentage and grain yield per feddan in both seasons.

2-The interaction between maize hybrids, nitrogen fertilizer levels and potassium fertilizer levels had a significant effect on grain yield per feddan in both seasons.

3- In general, the highest grain yield/fed. (33.21 Ardab/fed) was obtained from S.C. 10 when received nitrogen and potassium at rates of 150 and 48 kg/fed, respectively.

INTRODUCTION

Maize (*Zea mays, L.*) is great important crop for both human and animal feeding. In Egypt, it is very important to increase production of maize to cover the gab between production and consumption. The highest maize yield production depend on many factors i.e cultivars, nitrogen and potassium fertilization.

Maize hybrids differed in its productivity as well as its response to nitrogen fertilization. Nitrogen is usually the most limiting factor for maize production for early growth, grain filling and protein (*Khalil 1994*). Each increase in level of nitrogen up to 120 Kg N/fed resulted in significant increases in stem diameter, ear leaf area, ear length, ear diameter, 100-grain weight, grain yield/plant and grain yield/fed. (*Said et al 1996*). Raising nitrogen levels from 30 to 150 Kg N/fed increased growth, yield and yield components of maize (*Zohry and Farghaly 2003*). *EL-Bana and Gomaa (2000)* found a significant increase in grain yield as a result of increasing nitrogen levels from 100 to 125 kg N/fed. *Faisal et al (1996)* reported that increasing nitrogen level from 90 to 125 kg N/fed significantly increased number of grains/row, 100-Kernel weight, yield per plant and per fed.

Increasing nitrogen fertilization rates led to a significant increase in plant height, ear leaf area, ear height, ear diameter, 100-grain weight, ear length, number of kernel/rows, ear weight and grain yield/fed, *(Atta Allah 1998, Salem 1999, EL Naggar and Amer 1999 and EL-Douby et al 2001).*

Also, in respect to potassium fertilizer, *EL-Bana and Gomaa (2000)* found a significant response to increasing the level of potassium fertilizer application from 25 to 50 kg K_2O/ fed. The increase was in grain number rather than in grain weight. *Said et al (1996)* reported that each increase in

level of potassium fertilizer up to 24 kg K_2O /fed, resulted in a significant increase in ear length, ear diameter, 100-grain weight, grain yield/plant and grain yield/feddan, the interaction between N, P and K levels had significant effect on grain yield per plant and per feddan.

The objective of the present study is to investigate the effect of N and K fertilization levels on yield and yield components of two maize hybrids i.e. S.C–10 and T.W.C–310 under Assuit Governorate conditions.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm, of the Faculty of Agricultural, Al-Azhar University, Assuit Governorate during 2002 and 2003 summer seasons, to study the effect of different rates of nitrogen and potassium fertilization on yield and its components of maize hybrids i.e. S.C. 10 and T.W.C. 310.

Soil characterization for the two experimental sites during both seasons i.e 2002 and 2003 are listed in Table (1).

Table (1): Soil chemical analysis of the experimental site before planting the experiment:

Analysis / Season	Texture	P.H	O.M %	N PK		
				Total N PPm	Available P and K (p.p.m)	
					P	K
2002	Clay loam	7.2	1.40	790	14.17	515
2003		7.4	1.41	785	15.41	528

The maize hybrids were sown in rows 70 cm. apart at spacing of 25cm between hills. After 3weeks from planting, plants were thinned to one plant per hill. Calcium superphosphate (15.5% P_2O_5) was added during grain bed preparation at the rate of 150 kg/fed. Nitrogen fertilizer at rates of 90, 120 and 150 kg N/fed. as Urea (46% N) was applied at two equal doses just before the first and second irrigations. Potassium fertilizer at rates of zero, 24 and 48 kg K_2O/fed. as potassium sulphate (48% K_2O) was added before the first irrigation. The preceding crop was wheat in both seasons. The other recommended cultural operations were carried as usual in both seasons. Sowing dates were on 15 June in both seasons.

The experimental were laid in split-split plot design with four replications, the area of each plot was 1/400 feddan, including 5rows, three meters long and 70 cm.wide.

I. Maize hybrids (main- plots): 1. S.C. 10 2. T.W.C. 310.
II. Nitrogen levels (sub-plots) as Urea 46%N.
1- 90 kgN/fed. 2-120 kgN/fed. 3-150 kgN/fed.
III. Potassium levels (sub-sub plots) as potassium sulphate 48% K_2O:
1- zero kg K_2O fed. 2- 24 kg K_2O fed. 3- 48 kg K_2O fed.

At harvest time in which was carried out after 110 days from planting, three medium rows taken from each sub-sub plot in which were harvested and grain yield was determined on the basis of 15.5% moistures and the following data were recorded:

1- Ear length/cm.
2- Ear diameter /cm.
3- Number of rows/ear.
4- 100-grain weight/gm.
5- Shelling percentage.
6- Grain yield (ardab/feddan).

All Collected data were statistically analyzed according to the procedure described by *Gomez and Gomez (1984)*. The L.S.D test at 0.05% level of significance was calculated in to indicate treatment differences.

RESULTS AND DISCUSSIONS

1- Effect of hybrids:

The results in Table (2) show that hybrids affected significantly, ear length, ear diameter, number of rows per ear, 100-grain weight, shelling percentage and grain yield in ard/fed in superior of S.C. 10 hybrid as compared with T.W.C. 310 hybrid. The differences between the two maize hybrids under studies could be due to the variation in the genetical make up and their interaction to the environmental conditions prevailing during their growth. These results are in agreement with those obtained by *Said et al (1996), Badawi and Moursy (1997), Hassanein et al (1997), Atta Allah (1998), EL-Zeir et al (1998), EL-Bana and Gomaa (2000) and Darwish (2003).*

Table (2): Effect of hybrids on yield and yield components of maize (combined data).

Hybrids	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard.)
S.C- 10	22.51	4.823	14.06	34.54	85.17	30.29
T.W.C- 310	21.52	4.434	13.09	33.39	84.07	26.22
F- test	**	**	**	**	**	**

2-Effect of nitrogen fertilizer levels:

The results presented in Table (3) indicated that nitrogen fertilization levels affected significantly ear length, ear diameter, number of rows/ ear, 100-grain weight, shelling percentage and grain yield per feddan in superior of increasing nitrogen fertilizer rates from 90 to 150 kg N/fed. The increase of the characters under studies could be due to the increase in the amount of metabolites synthesized by plants as a result of increasing nitrogen levels. This may be attributed to the favorable effect of nitrogen fertilizer levels on the metabolic processes and physiological activities of meristimatic tissues, which are responsible for cell division and elongation in addition to formation of plant organs this lead to more vigorous growth and consequently accumulation of more photosynthesis assimilates.

Similar results were reported by *Dawood et al (1992), Abusteit (1993), Khalil (1994), Faisaal et al (1996), Said et al (1996), Atta Allah (1998), Mohamed and El-Aref (1999), EL-Naggar and Amer (1999), Salem (1999), EL-Bana and Gomaa (2000), Badran (2000), Yakout and Greish (2002), Darwish (2003) and Zohry and Farghaly (2003).*

Table (3): Effect of nitrogen fertilizer levels on yield and yield components of maize (combined data).

Nitrogen levels N kg/fed	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard.)
90	20.58	4.373	12.97	32.73	83.68	25.25
120	22.46	4.708	13.72	34.28	84.85	29.13
150	23.00	4.805	14.04	34.87	85.34	30.39
F- test	**	**	**	**	**	**
L.S.D. 5%	0.24	0.066	0.25	0.27	0.37	0.44

3-Effect of potassium fertilizer levels:

The results reported in Table (4) revealed that potassium fertilizer levels affected significantly ear length, ear diameter, number of rows ear, 100-grain weight, shelling percentage and grain yield per feddan in superior of increasing potassium rates from zero to 24 and 48 kg K_2O /fed. Therefore, the studied characters under studies increased with raising potassium fertilizer levels could be attributed to the role of potassium in one or more of the physiological function: (1) carbohydrate metabolism or formation and translocation of carbohydrate, (2) control and regulation of activities of various essential elements and (3) activation of various enzymes. Similar observation were reported by *Ibrahimm (1987,) Khalil (1994), Said et al (1996) and EL-Bana and Gomaa (2000).*

Table (4): Effect of potassium fertilizer levels on yield and yield components of maize (combined data).

Potassium levels K_2O kg/fed	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard.)
0	21.34	4.458	13.39	33.61	84.21	27.51
24	22.19	4.686	13.66	34.12	84.77	28.49
48	22.50	4.743	13.68	34.16	84.88	28.76
F- test	**	**	*	**	**	**
L.S.D. 5%	0.22	0.083	0.25	0.22	0.33	0.39

4- Effect of interactions:

The results in Table (5) revealed that first order interaction of hybrids x nitrogen fertilizer levels proved to be significant, where S.C. 10 hybrid surpassed T.W.C. 310 hybrid, in the response to 150 kg N/fed in all characters under studies except number of rows per ear and shelling percentage.

The results in Table (6) indicated that the first order interaction of hybrids x potassium fertilizer levels was significant in only on ear length where S.C. 10 was superior than T.W.C. 310 under all K level.

Also, the results in Table (7) indicated that the interaction between nitrogen fertilizer x potassium fertilizer levels was significant only on ear length.

The results presented in Table (8) showed that the second order interaction was significant only on ear length and 100-grain weight. The addition 150 kg N/fed and 48 kg K_2O/ fed enhanced the response of S.C. 10 hybrid. In general, the highest grain yield (33.21 ard/fed. was obtained when S.C. 10 received nitrogen and potassium fertilizer at a rates of 150 kg N/fed and 48 kg K_2O fed respectively.

Table (5): Effect of the interaction between hybrids and nitrogen fertilizer levels on yield and yield components of maize (combined data).

Hybrids	Nitrogen Levels kg/fed.	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard)
S.C.-10	90	20.84	4.467	13.57	33.06	84.15	26.84
	120	23.27	4.960	14.12	35.02	85.46	31.25
	150	23.43	5.042	14.48	35.53	85.90	32.78
T.W.C-310	90	20.32	4.279	12.37	32.40	83.22	23.66
	120	21.65	4.457	13.32	33.55	84.23	27.01
	150	22.58	4.568	13.59	34.22	84.77	27.99
F- test		**	**	N.S	*	N.S	**
L.S.D. 5%		0.34	0.094	-	0.39	-	0.62

Table (6): Effect of the interaction between hybrids and potassium fertilizer levels on yield and yield components of maize (combined data).

Hybrids	Potassium Levels K_2Okg/fed.	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard)
S.C.-10	0	21.90	4.631	13.87	34.20	84.82	29.49
	24	22.42	4.899	14.10	34.64	85.26	30.66
	48	23.22	4.938	14.21	34.77	85.43	30.73
T.W.C-310	0	20.79	4.284	12.92	33.02	83.61	25.53
	24	21.79	4.472	13.11	33.49	84.28	26.33
	48	21.97	4.547	13.26	33.69	84.33	26.80
F- test		**	N.S	N.S	N.S	N.S	N.S
L.S.D. 5%		0.31	N.S	N.S	N.S	N.S	N.S

Table (7): Effect of the interaction between nitrogen and potassium fertilizer levels on yield and yield components of maize (combined data).

Nitrogen levels Nkg/fed.	Potassium Levels K_2Okg/fed.	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard)
90	0	20.23	4.269	12.62	32.20	83.17	24.40
	24	20.43	4.381	13.12	33.03	83.78	25.35
	48	21.06	4.468	13.17	32.97	84.10	25.99
120	0	21.54	4.565	13.61	34.01	84.21	28.13
	24	22.41	4.917	13.71	34.41	85.15	29.62
	48	23.42	4.933	13.83	34.42	85.18	29.65
150	0	22.26	4.539	13.95	34.62	85.26	30.00
	24	23.10	4.760	14.08	34.95	85.39	30.51
	48	23.65	7.862	14.08	35.04	85.36	30.66
F- test		**	N.S	N.S	N.S	N.S	N.S
L.S.D. 5%		0.37	-	-	-	-	-

Table (8): Effect of the interaction between hybrids, nitrogen, and potassium fertilizer levels on yield and yield components of maize (combined data).

Hybrids	Nitrogen levels Nkg/fed.	Potassium Levels K_2O kg/fed.	Ear length (cm)	Ear diameter (cm)	No. of rows/ear	100-grain weight (gm)	Shelling (%)	Grain yield (Fed./ard)
S.C. 10	90	0	20.58	4.302	13.20	32.67	83.58	25.78
		24	20.85	4.510	13.61	33.20	84.16	27.37
		48	21.08	4.588	13.90	33.32	84.70	27.37
	120	0	22.43	4.822	13.99	34.49	85.10	30.27
		24	22.86	5.140	14.17	35.09	85.62	31.61
		48	24.52	5.165	14.19	35.47	85.67	31.89
	150	0	22.69	4.770	14.23	35.45	85.78	32.41
		24	23.54	5.048	14.53	35.52	85.97	32.73
		48	24.06	5.062	14.69	35.62	85.97	33.21
T.W.C. 310	90	0	19.89	4.237	12.04	31.72	82.75	23.03
		24	20.28	4.252	12.45	32.63	83.40	23.34
		48	21.79	4.348	12.63	32.86	83.50	24.61
	120	0	20.65	4.308	1306	33.38	83.32	25.99
		24	21.97	4.693	13.24	33.53	84.63	27.36
		48	22.33	4.702	13.67	33.73	84.75	27.70
	150	0	21.83	4.308	13.48	33.80	84.75	27.58
		24	22.66	4.472	13.62	34.39	84.75	28.10
		48	23.25	4.590	13.67	34.47	84.82	28.28
F- test			*	N.S	N.S	*	N.S	N.S
L.S.D. 5%			0.53	-	-	0.53	-	-

REFERENCES

Abusteit, E.O.(1993): Influence of atrazine rates under different levels of nitrogen fertilization in maize *(Zea mays. L.)* Zagazig J. Agric. Res., 20(3): 1017-1029.

Atta Allah, S.A.A.(1998): Response of maize to nitrogen and biofertilizer. Assuit J. of Agric. Sci., 29(1): 59-73.

Badawi, M.A and S.A. EL-Maursy (1997): Nitrogen and phosphorus requirements for maize *(Zea mays. L.)* growth in a newly reclamined Sandy Soil. J. Agric. Sci. Mansoura Univ., 22(3): 659-671.

Badran, M.S.S. (2000): Response of some maize cultivars to biofertilizer (Halxex). Alex J. Agric. Res., 45(1): 129-141.

Darwish, A.A. (2003): The yield and yield components of maize as influenced by nitrogen, Zinc and Boron fertilization. J. Agric. Sci. Mansoura Univ., 28(2): 799-810.

Dawood, R.A., K.A. Kheiralla and M.A. Gomeh (1992): Effect of nitrogen and foliar application of some micronutrients on the yield, yield components and quality of maize. Assuit J. of Agric. Sci., 23(4): 3-17.

EL-Bana, A.Y.A and Gomaa, M.A. (2000): Effect of N and K fertilization on maize grown in different populations under newly reclaimed sandy soil Zagazig J. Agric. Res., 27(5): 1179-1190.

EL-Douby, K.A., E.A. Ali and S.E.A. Toaima (2001): Effect of nitrogen fertilizer defoliation and plant density on maize grain yield. Egypt J. Agric. Res., 79(3): 965-981.

EL-Naggar, M.A and E.A. Amer (1999): The Effect of nitrogen fertilizer on some maize cultivars in relation to the yield and the infestation by ostrinia nubilalis. Minufiya J. Agric. Res., 24(3): 937-943.

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

Faisal, R.I.I., M.H.M. Graish and M.A. Sultan (1996): Effect of plant populations density and nitrogen fertilization on yield and yield components of some yellow maize hybrids. J. Agric. Sci. Mansoura Univ., 21(12): 4299-4306.

Hassanein, M.S., D.M. EL-Hariri and M.A. Ahmed (1997): Effect of nitrogen fertilizer levels and bacterium inoculation on yield and its components on maize. J. Agric. Sci. Mansoura Univ., 22(1): 63-72.

Gomez, K.A and A.A. Gomez (1984): Statistical procedures for agricultural research. John Wiley and Sons, Inc, New york, U.S.A.

Ibrahim, S.A. (1987): Combined effect of K-fertilizer and foliar application with commercial compounds on corn plant. Egypt J. Agron., 7(2): 121-129.

Khalil, F.A. (1994): Studies on some macro and micronutrients fertilization of corn (*Zea mays. L.)* in Upper Egypt Ph. D. Thesis, Fac. Agric. Minia, Univ.Egypt .

Mohamed, E.I and K.A.O. EL-Aref (1999): Farm manure as a substitution of part or all chemical nitrogen fertilizer dose at planting for fertilizing maize (*Zea mays. L.).* Assuit J. of Agric. Sci., 30(5): 139-148.

Said, EL-M., M. S. Sultan, A. M. Salama and H.A. EL-Far (1996): Response of maize cv Single Crass 10 to NPK fertilizer levels. J. Agric. Sci. Mansoura Univ., 21(12): 4243-4251.

Salem, M. A. (1999): Response of maize plants to drought and nitrogen fertilization . Minia of Agric. Res. and Develop., 19: 187-206.

Yakout, G. M and M. H. Greish (2002): Yield and yield components of some maize hybrids as affected by some fertilization treatments under new reclaimed sandy soil conditions. Agric. Res. J., Suez Canal Univ., 1: 23-27.

Zohry, A. A. and B. S. Farghaly (2003): Maize and its relation to plant population and nitrogen fertilizer levels. J. Agric. Sci. Mansoura Univ., 28(7): 5173-5181.

استجابة بعض هجن الذرة الشامية لمستويات التسميد الازوتى والبوتاسى

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أقيمت تجربتان حقليتان بمزرعة كلية الزراعة جامعة الأزهر بأسيوط خلال موسمى ٢٠٠٢ و ٢٠٠٣ وذلك لدراسة تأثير مستويات مختلفة من التسميد الازوتى (٩٠، ١٢٠ ، ١٥٠ كيلوجرام نيتروجين/ للفدان) والتسميد البوتاسى (٠، ٢٤ ، ٤٨ كيلوجرام بوتاسيوم/ للفدان) على المحصول ومكوناته فى اثنين من هجن الذرة الشامية(هجين فردى ١٠ ، وهجين ثلاثي ٣١٠).

وكانت النتائج المتحصل عليها كما يلى :

١-أدت الزيادة المتوالية فى مستويات التسميد الازوتى (من ٩٠ إلى ١٥٠ كجم/فدان) وكذلك فى التسميد البوتاسى (من صفر إلى ٤٨ كجم/فدان إلى حدوث زيادة معنوية فى طول النيات وقطرة وعدد الصفوف بالكوز ووزن المائة حبة ونسبة التصافى ومحصول الحبوب للفدان فى كلا الموسمين.

٢- أدى التفاعل بين هجن الذرة الشامية ومستويات التسميد الازوتى والبوتاسى إلى وجود فروق معنوية فى محصول الحبوب للفدان .

٣-وجد بصفة عامة أن أعلى محصول من الحبوب للفدان هو ٣٣,٢١ أردب وتم الحصول عليه من الهجين الفردى ١٠ عندما سمد بالسماد الازوتى والبوتاسى بمعدل ١٥٠ و ٤٨ كجم للفدان على التوالى.