IMPROVEMENT OF CORN PRODUCTIVITY BY BACTERIAL INOCULATION, N MINERAL AND ORGANIC FERTILIZATION

Mehasen, S.A.S. * and M.A. Ahmed**
*Agron. Dept., Fac. of Agric., Moshtohor, Benha Univ., Egypt
** Agron. Dept., Fac. of Nasser Agric Science, Aden Univ., Yemen

ABSTRACT

The study was carried out at the Agricultural Research and Experimental Center of the Faculty of Agriculture, Moshtohor, Benha University, Egypt, in 2007 and 2008 seasons, to determine the effect of two bacterial inoculation (uninoculation and inoculation with a mixture of *Azot+Azos*) and seven N fertilizer rates (zero, 60 kg M, 120 kg M, 60 kg O, 120 kg O, 30 kg M+30 kg O and 60 kg M+ 60 kg O/fed) on yield and yield components of two maize hybrids (S.C30k8 and S.C30k9). The most important results which were obtained from this study were as follows:

The difference between two maize hybrids was significant on ear diameter, No. of rows ear^{-1}, weight of grains ear^{-1}, 100-grain weight, shelling %, grain yield plant^{-1} and feddan^{-1} in combined analysis. Maize hybrid S.C. 30k9 gave the highest means values of the above characters.

Bacterial inoculation with a mixture of *Azot+Azos* affected significantly ear length, No. of rows ear^{-1}, No of grains row^{-1}, ear weight, weight of grains ear^{-1} and grain yield plant^{-1} in combined analysis.

Ear length, ear diameter, No. of rows ear^{-1}, No of grains row^{-1}, ear weight, weight of grains ear^{-1}, 100-grain weight, shelling%, grain yield plant^{-1} and feddan^{-1} in combined analysis were significantly increased by increasing N fertilizer rates. Application of 120 kg M/fed or 60 kg M+60 kg O/fed gave the highest values of the above characters.

Effect of the interaction between maize hybrids and bacterial inoculation was significant on ear diameter and No. of rows ear^{-1} and the interaction between maize hybrids and N fertilizer rates was significant on ear length, ear diameter, No. of rows ear^{-1}, No of grains row^{-1}, shelling% and grain yield feddan^{-1}, as well as the interaction between bacterial inoculation and N fertilizer rates was significant on ear diameter, No. of rows ear^{-1} and No of grains row^{-1}, while the interaction between maize hybrids, bacterial inoculation and N fertilizer rates was significant on ear diameter, No. of rows ear^{-1} and 100-grain weight in combined analysis.

Key words: *Maize hybrids, Inoculation, N organic & inorganic, Yield and Yield components.*

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops in Egypt and the world. Maize is still a major traditional food and feed crop in many regions. Furthermore, the grain is a key industrial raw material for very diverse purposes. In Egypt great attention has been paid to increase its total production. This could be achieved by using high yielding cultivars, bacterial inoculation and fertilization. In this connection, maize cultivars differ in grain

yield and yield components as reported by **El-Bana (2001); El-Wakil (2002); Hamed (2003); El-Aref *et al* (2004); Nofal *et al* (2005); Moser *et al* (2006); Atta (2007) and Hassan *et al* (2008).**

Inoculated maize grains with *Azotobacter* or *Azospirillum* or mixture increased yield and yield components of maize as reported by **Metwally *et al* (2007); Aly *et al* (2008) and Gholami *et al* (2009).**

With regard to yield and yield components of maize were positively affected by increasing the rate of nitrogen (mineral and organic or mineral + organic) fertilizer as reported by **El-Banna and Gomaa (2000); Abd El–All (2002); Saleh and Nawar (2003); Suleiman (2004); Abdel-Hameed (2005); Bader and Othman (2006); El-Maihy (2007); Shisanya *et al* (2008) and Ayoola and Makinde (2009).**

The aim of this investigation was to study the effect of bacterial inoculation with a mixture of *Azot+Azos* and nitrogen fertilization (mineral and organic or mineral + organic) on yield and yield components of two maize hybrids.

MATERIALS AND METHODS

This investigation was conducted at the Agricultural Research and Experimental Center of the Faculty of Agriculture, Moshtohor, Kalubia Governorate, Benha University, Egypt, in 2007 and 2008 seasons, to study the effect of two bacterial inoculation [noninoculation (Nonin.), inoculation (Inoc.) with a mixture of *Azotobacter (Azot) +Azospirillum (Azos)*] and seven N fertilizer rates[zero, 60 kg N mineral (60 kg M), 120 kg N mineral (120 kg M), 60 kg N organic (60 kg O), 120 kg N organic (120 kg O), 30 kg N mineral (30 kg M) + 30 kg N organic (30 kg O) and 60 kg N mineral (60 kg M) + 60 kg N organic (60 kg O)/fed] on yield and yield components for two maize hybrids[Single cross 30k8(S.C30k8) and Single cross 30k9(S.C30k9)].

The soil type was clay with pH value of 8.06 and 8.02, organic mater was 1.91and 1.98%, total N was 0.14 and 0.12% in the first and second growing seasons, respectively. The experimental sites were preceded by wheat in the two seasons. Efficient strains of nitrogen fixers bacteria namely, *Azotobacter chroococcum* and *Azospirillum brasilense* supplied by the Microbiology Department, Soil, Water, and Environment Research Institute, ARC, Giza, Egypt. Maize hybrids namely S.C.30K8 and S.C.30K9 were developed by Pioneer Company. Organic fertilizer in the form of farmyard manure (FYM) whose chemical composition pH value of 7.80 and 7.98, organic mater was 26.89 and 28.28%, total N was 0.98 and 0.94% and C/N ratio was 16:1 and 17:1 in the first and second growing seasons, respectively. The manure was applied during soil preparation before sowing. While, the rates of the mineral N fertilizer in the form of urea 46% N were added at two equal doses, the first dose after thinning and before the first irrigation and the second dose at before the second irrigation in both seasons.

A spilt plot design with three replications was used in each trial. The four treatments of the combinations between two maize hybrids and two bacterial inoculations were allocated with main plots and seven treatments for nitrogen fertilizer rates were randomly in the sub plots. Each sub-sub plot was 10.5 m^2 (1/400 fed) consisting of 5 ridges, 3.5 m long and 70 cm width while, the distance between plants was 25 cm.

At planting, super phosphate (15.5%), at a rate of 30 kg P_2O_5/fad was applied. Maize grains were inoculated with a mixture of *Azot+Azos*

immediately at planting where the adhesive glue material was added to 500 ml mild hot water, splashed on grains and then bacterial were added, well mixed with grains and air dried for adhesion. Maize grains were planting on 28th and 18th May in the first and second seasons, respectively. All recommended cultural practices for the region were followed in both seasons.

At harvest ten plants were taken at random from each sub-plot to determine ear length (cm), ear diameter (cm), No. of rows ear^{-1}, No. of grains row^{-1}, ear weight (g), weight of grains ear^{-1}(g), 100-grain weight (g), shelling percentage and grain yield plant^{-1}(g). Grain yield feddan^{-1} (kg) was determined on the whole sub plot basis. The grain yield was adjusted to 15.5% moisture content.

Data of the experiments were statistically analyzed according to **Gomez and Gomez (1984)**. L.S.D test at 0.05 level of probability was used to compare between means.

RESULTS AND DISCUSSION

Analyses of variances for all traits in each season as well as the combined analysis are presented in **Table (1)**. Test of homogeneity revealed that the error variance for the two seasons were homogenous, therefore combined analysis was processed. Year's mean squares were not significant for all the studied traits except for ear length, 100-grains weight and grain yield feddan^{-1} were significant. The hybrids mean squares were significant for all traits in both seasons as well as the combined data except ear length, No. of grains row^{-1}, shelling% and grain yield feddan^{-1} in the first season and No. of rows ear^{-1}, No. of grains row^{-1}, ear weight and grain yield plant^{-1} in the second season as well as ear length, No. of grains row^{-1} and ear weight in the combined analysis. The bacterial inoculation mean squares were significant for all traits in both seasons as well as the combined data except ear length, ear diameter and grain yield feddan^{-1} in the first season and ear diameter, No. of rows ear^{-1}, ear weight, 100-grain weight, shelling%, grain yield plant^{-1} and grain yield feddan^{-1} in the second season as well as ear diameter, 100-grain weight, shelling% and grain yield feddan^{-1} in the combined analysis. N fertilizer rates mean squares were highly significant for all studied traits in both seasons and combined analysis except 100-grain weight was significant only in the second season, while 100-grain weight and shelling% were not significant in the first and second seasons, respectively. The interaction between years and hybrids mean squares was not significant for all of the studied characters except ear length. The interaction between years and inoculation mean squares was not significant for all of the studied characters except ear length and No. of rows ear^{-1}. The interaction between years and N rates mean squares were not significant for all of the studied characters except ear diameter and No. of rows ear^{-1}. The interaction between years, hybrids and inoculation mean squares were not significant for all of the studied characters except ear length. The interactions between years, hybrids and N rates mean squares were significant for ear weight and shelling%. The interactions between years, inoculation and N rates mean squares were significant for ear diameter. Also, the interactions between years, hybrids, inoculation and N rates mean squares were significant for ear diameter.

Table (1). Mean square values and significance for maize yield and yield components in 2007, 2008 seasons and their combined analysis.

S.O.V.	d.f	Ear length (cm)	Ear diameter (cm)	Number of rows ear^{-1}	Number of grains row^{-1}	Weight of ear (g)	Weight of grains ear^{-1}(g)	100-grain weight(g)	Shelling %	Grain yield plant^{-1} (g)	Grain yield fed^{-1}(kg)
2007 season											
Hybr.	1	0.634	0.107*	0.943**	52.804	1257.440**	2585.190**	241.673**	4.762	9324.107*	123280.048
Inoc.	1	1.363	0.004	1.743**	159.639*	1272.964**	720.429*	2.407	65.190*	16436.012**	116629.762
HxI	1	1.030	0.488**	0.114	47.852	7.440	68.762	11.678	55.048*	1336.012	382995.048**
Err.(a)	6	0.518	0.008	0.063	14.228	50.282	68.258	13.909	7.774	763.639	25114.679
Fert.	6	14.812**	1.900**	4.256**	157.373**	7835.889**	7658.881**	12.830	93.206**	70668.492**	6022976.77**
HxF	6	1.115**	0.039*	0.073	4.116	160.802*	208.857	4.995	98.929**	1000.024	319253.325**
IxF	6	0.299	0.089**	0.130*	11.734**	22.437	89.373	3.556	57.357*	1015.817	135605.429
HxIxF	6	0.051	0.029	0.040	3.318	7.746	140.317	11.330	27.270	250.651	66319.325
Err.(b)	48	0.277	0.015	0.048	2.612	69.212	110.440	6.406	24.030	786.300	60080.571
C.V.%		2.65	2.53	1.57	3.41	2.83	4.16	6.88	5.76	7.59	5.78
2008 season											
Hybr.	1	2.787**	0.190**	0.298	0.373	48.762	2130.107**	94.255**	198.10**	3627.429	383130.107*
Inoc.	1	11.514**	0.008	0.252	161.852**	804.762	680.012*	0.969	11.440	4032.429	84296.679
HxI	1	1.981**	0.488**	0.138	4.667	438.857	41.440	0.106	0.583	88.048	2618.583
Err.(a)	6	0.115	0.013	0.055	3.448	234.079	110.139	4.500	9.901	1347.052	53816.837
Fert.	6	14.213**	1.909**	3.410**	160.238**	5325.413**	7071.373**	18.037*	37.270	56120.762**	6301275.88**
HxF	6	0.205	0.038	0.107**	3.722	469.873*	34.802	5.692	37.270	615.929	105400.552
IxF	6	0.183	0.096**	0.192**	11.255**	137.484	47.651	12.564	8.524	752.762	31634.345
HxIxF	6	0.208	0.109**	0.098**	1.052	135.024	35.746	16.832*	13.944	674.325	65002.361
Err.(b)	48	0.186	0.020	0.023	2.101	159.526	109.351	5.959	16.482	1012.659	189474.387
C.V.%		2.19	2.95	1.10	3.10	4.2	4.08	6.34	4.75	8.69	10.26
Combined analysis											
Year	1	2.104*	0.077	0.251	12.269	504.054	463.339	119.956*	4.339	375.006	16.720**
Hybr.	1	0.381	0.292**	1.150**	31.029	405.482	4704.292**	318.891**	132.149*	12291.482*	470535.006*
YxH	1	3.040*	0.006	0.091	22.149	908.720	11.006	17.037	70.720	660.054	35875.149
Inoc.	1	10.400**	0.000	1.660**	321.487**	2051.006*	1400.149**	0.161	65.625	18375.292 **	199617.149
YxI	1	2.477*	0.012	0.335**	0.004	26.720	0.292	3.215	11.006	2093.149	1309.292
HxI	1	0.077	0.975**	0.251**	41.204	166.006	1.720	4.781	33.482	369.054	161138.149
YxHxI	1	2.934*	0.000	0.001	11.315	280.292	108.482	7.003	22.149	1055.006	224475.482
Err.(a)	12	0.366	0.012	0.019	16.942	199.565	71.054	10.045	14.863	1429.577	76829.452
Fert.	6	28.525**	3.712**	7.549**	316.968**	12929.29**	14532.456**	26.087**	99.540**	125240.623**	12142422.44**
YxF	6	0.500	0.097**	0.117*	0.642	232.012	197.798	4.780	30.937	1548.631	181830.220
HxF	6	0.972**	0.064**	0.093*	6.962**	230.996	161.083	6.464	43.190*	502.302	282885.062*
YxHxF	6	0.349	0.013	0.087	0.876	399.679**	82.575	6.464	76.095**	1113.651	141768.815
IxF	6	0.419	0.132**	0.273**	19.505**	95.048	85.746	4.444	28.750	439.000	81541.843
YxIxF	6	0.062	0.053**	0.049	3.484	64.873	51.278	11.676	37.131	1329.579	85697.931
HxIxF	6	0.167	0.086**	0.090*	2.437	89.714	94.595	22.374**	15.329	629.123	98516.954
Y.H.I.F	6	0.092	0.052*	0.047	1.933	62.056	81.468	5.787	25.885	295.853	32804.732
Err.(b)	96	0.231	0.017	0.040	1.967	110.891	110.520	6.236	19.317	875.775	118375.915
C.V.%		2.43	2.72	1.43	2.98	3.56	4.13	6.63	5.16	8.05	8.11

* and ** significant at 5% and 1% level of probability, respectively.

1- Effect of hybrids, inoculation and N fertilizer rates on yield and its components of maize:

1.1- Varietal differences.

Data in **Table (2)** show effect of the varietal differences on yield and yield components of maize in combined analysis. Ear diameter, No. of rows ear^{-1}, weight of grains ear^{-1}, 100-grain weight, shelling percentage, grain yield plant^{-1} and grain yield feddan^{-1} of maize were significantly affected by the two maize hybrids under study. Maize hybrid S.C. 30k9 gave higher mean values of the above mentioned parameters. On the other hand, the difference between two maize hybrids was not significant on ear length, No. of grains row^{-1} and ear weight. These differences may be due to the genetical differences between the two studied maize hybrids. Similar results were obtained by **El-Bana (2001); El-Wakil (2002); Hamed (2003); El-Aref *et al.* (2004); Nofal *et al* (2005); Moser *et al* (2006); Atta (2007) and Hassan *et al* (2008).**

1.2- Effect of the bacterial inoculation.

Maize ear length, No. of rows ear^{-1}, No. of grains row^{-1}, ear weight, weight of grains ear^{-1} and grain yield plant^{-1}of maize were significantly increased by bacterial inoculation in combined analysis as shown in **Table (2)**. Ear length, No. of rows ear^{-1}, No. of grains row^{-1}, ear weight, weight of grains ear^{-1} and grain yield plant^{-1} increased with the inoculation a mixture of *Azot+Azos* by 2.50, 1.44, 6.06, 2.38, 2.29 and 5.85% compared to noninoculated plants, respectively. On the other hand, ear diameter, 100-grain weight, shelling% and grain yield feddan^{-1} were not significantly affected by bacterial inoculation in combined analysis. These microorganisms may produce some biological activities substances which improve plant growth. Similar results were obtained by **Metwally *et al* (2007); Aly *et al* (2008) and Gholami *et al* (2009).**

1.3- Effect of N fertilizer rates.

Maize ear length, ear diameter, No. of rows ear^{-1}, No. of grains row^{-1}, ear weight, weight of grains ear^{-1}, 100-grain weight, shelling %, grain yield plant^{-1} and grain yield feddan^{-1} were significantly increased by increasing N fertilizer rate in the combined analysis as shown in **Table(2)**. Application of 120 kg M/fed in the mineral form or 60 kg M+ 60 kg O/fed gave higher values for the above mentioned parameters. Application of N rate 120 M/fed and 60 kg M+60 kg O/fed significantly increased ear length, ear diameter, No. of rows ear^{-1}, No. of grains row^{-1}, ear weight, weight of grains ear^{-1}, 100-grain weight, shelling %, grain yield plant^{-1} and grain yield feddan^{-1} by 18.22 and 14.95%, 27.71 and 23.61%, 12.18 and 10.12%, 27.83 and 23.22%, 24.35 and 17.90%, 35.10 and 26.94%, 8.38 and 5.48%, 6.80 and 5.99%, 85.00 and 62.61% and 57.13 and 53.36%, respectively compared with the zero N/fed. The increases in yield and components may be due to the increases in the growth characters and indirectly affected by N general functions in plant. Furthermore, the increase in grain yield/fed is attributed mainly to the increases in yield components. Similar results were obtained by **El-Bana and Gomaa (2000); Abd El–All (2002); Saleh and Nawar (2003); Suleiman (2004); Abdel-Hameed (2005); Bader and Othman (2006); El-Maihy (2007); Shisanya *et al* (2008) and Ayoola and Makinde (2009).**

Table (2). Yield and its components of maize as affected by variety, inoculation and rate of the applied N fertilizer (Combined analysis of 2007 and 2008 seasons)

Treatments	Ear length (cm)	Ear diameter (cm)	Number of rows ear^{-1}	Number of grains row^{-1}	Weight of ear (g)	Weight of grains ear^{-1}(g)	100-grain weight(g)	Shelling %	Grain yield plant^{-1} (g)	Grain yield fed^{-1}(kg)
Verities										
S.C.30K8	19.73	4.82	13.86	46.64	294.42	249.22	36.26	84.34	359.17	4189.7
S.C.30K9	19.82	4.90	14.03	47.50	297.53	259.81	39.02	86.11	376.28	4295.5
L.S.D at 5%	**N.S**	**0.04**	**0.05**	**N.S**	**N.S**	**2.83**	**1.06**	**1.29**	**12.71**	**93.1**
Inoculation										
Nonin.	19.53	4.86	13.85	45.68	292.48	251.63	37.61	84.60	357.27	4208.1
Inoc.	20.02	4.86	14.05	48.45	299.47	257.40	37.67	85.85	378.19	4277.1
L.S.D at 5%	**0.20**	**N.S**	**0.05**	**1.38**	**4.75**	**2.83**	**N.S**	**N.S**	**12.71**	**N.S**
N rates (kg/fed)										
Zero	18.05	4.15	13.13	40.34	270.00	217.12	36.49	81.37	263.75	3356.9
60 M	19.35	4.74	13.55	45.79	288.41	253.08	37.50	85.95	356.25	4073.0
120 M	21.34	5.30	14.73	51.57	335.75	293.33	39.55	86.91	487.95	5274.7
60 O	19.13	4.65	13.62	45.68	280.12	240.50	36.94	83.58	331.29	3737.0
120 O	19.66	4.89	13.93	47.61	296.20	256.41	37.14	85.66	367.20	4126.4
30 M+30 O	20.16	5.16	14.21	48.75	283.04	245.54	37.36	86.87	338.75	3982.0
60 M+60 O	20.75	5.13	14.46	49.71	318.33	275.62	38.49	86.25	428.91	5148.2
L.S.D at 5%	**0.27**	**0.07**	**0.11**	**0.80**	**6.02**	**6.00**	**1.42**	**2.51**	**16.91**	**196.6**

M=Mineral O=Organic N.S=Insignificant

3. Interactions effect:

Effect of the interaction between maize hybrids and bacterial inoculation was significant on ear diameter and No. of rows ear^{-1} **(Table 3a)**. S.C. 30k9 under inoculation with a mixture of *Azot+Azos* gave higher P value than the S.C. 30k8.

Table (3a): Effect of the interaction between maize hybrid and bacterial inoculation on ear diameter and number of row ear^{-1} of maize (over the combined analysis)

Maize hybrids	Bacterial inoculation	Ear diameter (cm)	Number of rows ear^{-1}
S.C. 30K8	Nonin.	4.74	13.80
	Inoc.	4.90	13.92
S.C. 30K9	Nonin.	4.831	13.89
	Inoc.	4.98	14.17
L.S.D at 5%		0.05	0.06

The effect of the interaction between maize hybrids and N fertilizer rates was significant on ear length, ear diameter, No. of rows ear^{-1}, No. of grains row^{-1}, shelling% and grain yield feddan^{-1} **(Table 3b)**. Maize hybrid S.C 30k9 under 120 kg M/fed gave the highest values of the above mentioned characters except No. of grains row^{-1} S.C 30k8 under the same N rate gave the highest value of this trait.

Table (3b): Effect of the interaction between maize hybrids and N fertilizer rates on ear length, ear diameter, No. of rows ear^{-1}, No. of grains row^{-1}, shelling % and grain yield fed^{-1} of maize (over the combined analysis)

Maize hybrids	N rates (kg/fed)	Ear length (cm)	Ear diameter (cm)	No. of rows ear^{-1}	No. of grains row^{-1}	Shelling %	Grain yield fed^{-1} (kg)
S.C. 30K8	Zero	17.73	4.13	13.03	39.31	79.75	3261.4
	60 M	19.65	4.71	13.48	46.10	84.66	3996.6
	120 M	21.25	5.20	14.55	51.70	84.75	5107.3
	60 O	19.14	4.53	13.59	45.16	84.91	3835.0
	120 O	19.74	4.85	13.93	47.46	85.41	4094.7
	30 M+30 O	20.08	5.19	14.15	48.01	87.00	4059.7
	60 M+60 O	20.52	5.12	14.33	48.70	83.91	4973.0
S.C. 30K9	Zero	18.36	4.16	13.23	41.37	83.00	3452.5
	60 M	19.05	4.76	13.61	45.47	87.25	4149.4
	120 M	21.43	5.40	14.91	51.45	89.08	5442.2
	60 O	19.12	4.78	13.65	46.20	82.25	3639.0
	120 O	19.59	4.93	13.93	47.75	85.91	4158.1
	30 M+30 O	20.24	5.14	14.28	49.50	86.75	3904.2
	60 M+60 O	20.97	5.15	14.60	50.72	88.58	5323.3
L.S.D at 5%		0.39	0.11	0.16	1.13	3.55	278.1

M=Mineral O=Organic

Effect of the interaction between bacterial inoculation and N fertilizer rates was significant on ear diameter, No. of rows ear^{-1} and No. of grains row^{-1} of maize **(Table 3c)**. Inoculation with a mixture of *Azot+Azos* under 120 kg M

/fed or 60 M+60 O kg/fed gave the highest values of the above mentioned characters.

Effect of the interaction between maize hybrids, bacterial inoculation and N fertilizer rates was significant on ear diameter, No. of rows ear^{-1} and 100-grain weight **(Table 3d).** Maize hybrid S.C. 30k9 and inoculation with mixture of *Azot+Azos* under 120 kg M/fed gave the highest values of above characters.

Table (3c): Effect of the interaction between bacterial inoculation and N fertilizer rates on ear diameter, No. of rows ear^{-1} and No. of grains row^{-1} of maize (over the combined analysis)

Bacterial inoculation	Nonin.	Inoc.	Nonin.	Inoc.	Nonin.	Inoc.
N rates (kg/fed)	Ear diameter(cm)		No. of rows ear^{-1}		No. of grains row^{-1}	
Zero	4.04	4.25	13.10	13.16	39.76	40.92
60 M	4.80	4.67	13.51	13.58	42.77	48.80
120 M	5.23	5.37	14.70	14.76	51.30	51.85
60 O	4.61	4.70	13.50	13.73	44.17	47.20
120 O	4.90	4.87	13.81	14.05	45.75	49.46
30 M+30 O	5.17	5.07	14.08	14.35	47.40	50.11
60 M+60 O	5.25	5.10	14.16	14.76	48.62	50.80
L.S.D at 5%	0.11		0.16		1.13	

M=Mineral O=Organic

Table (3d): Effect of the interaction between maize hybrids, bacterial inoculation and N fertilizer rates on ear diameter, No. of rows ear^{-1} and 100-grain weight of maize (over the combined analysis)

Maize hybrids		S.C 30K8	S.C 30K9	S.C 30K8	S.C30K9	S.C30K8	S.C30K9
Treatments		Ear diameter(cm)		No. of rows ear^{-1}		100-grain weight (g)	
Nonin.	Zero	3.96	4.11	13.00	13.20	32.87	39.56
	60 M	4.68	4.93	13.46	13.56	36.20	39.53
	120 M	5.08	5.38	14.73	14.80	37.57	41.08
	60 O	4.33	4.90	13.45	13.56	35.37	39.51
	120 O	4.73	5.08	13.86	13.76	36.31	38.49
	30 M+30 O	5.23	5.28	14.10	14.06	37.46	36.25
	60 M+60 O	5.18	5.16	14.03	14.30	36.65	39.16
Inoc.	Zero	4.30	4.21	13.06	13.26	35.45	37.13
	60 M	4.75	4.60	13.50	13.66	37.14	38.07
	120 M	5.33	5.41	14.36	15.03	37.98	41.58
	60 O	4.73	4.66	13.73	13.73	36.49	36.40
	120 O	4.96	4.78	14.00	14.10	35.56	38.21
	30 M+30 O	5.15	5.00	14.20	14.50	35.10	40.63
	60 M+60 O	5.06	5.13	14.63	14.90	37.49	40.64
L.S.D at 5%		0.15		0.23		2.01	

M=Mineral O=Organic

REFERENCES

Abd El–All, A.M. (2002): Effect of preceding crops, organic and mineral nitrogen and plant density on productivity of maize plant. J. Agric. Sci., Mansoura Univ., 27 (12):8093-8105.

Abdel–Hameed, I.M. (2005): Effect of sources and levels of nitrogen fertilization on productivity of maize. Proc. 11th Conf. of Agronomy, Agron. Dept., Fac. Agric., Assiut Univ., Nov., I: 171 – 187.

Aly, M.H.; Soudi, A.M. and Ashmaye, S.H. (2008): The usage of biofertilizer to minimize the mineral fertilizer for sweet sorghum. Egypt J. Appl. Sci., 23 (2B): 486-499.

Atta, Y.I. (2007): Improving growth, yield and water productivity of some maize cultivars by new planting method. Egypt J. Appl. Sci., 22(11): 1-16.

Ayoola O.T. and E.A. Makinde (2009): Maize growth, yield and soil nutrient changes with N-enriched organic fertilizers. African J. Food, Agric., Nutrition and Development 9(1) 580-592.

Bader, M.A. and Sanaa A. Othman (2006): Effect of plant density, organic manure, bio and mineral nitrogen fertilizers on maize growth and yield and soil fertility. Ann. of Agric. Sc., Moshtohor, Egypt, 44 (1): 75-88.

El-Aref, Kh. A.O.; Abo El-Hamed, A.S. and Abo El-Wafa, A.M. (2004): Response of some maize hybrids to nitrogen and potassium fertilization levels. J. Agric. Sci. Mansoura Univ., 29(11): 6063-6070.

El-Bana, A.Y.A. (2001): Effect of nitrogen fertilization and stripping leaves on yield and yield attributes of tow maize (*Zea mays L.*) hybrids. Zagazig J. Agric. Res., 28 (3): 579-596.

El–Bana, A.Y.A. and M.A. Gomaa (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-Maihy, Amira A.E. (2007): Evaluation of some crop successions of main crops under different fertilization levels. M. Sc. Thesis, Fac. Agric., Benha Univ., Egypt.

El-Wakil, N.M.H. (2002): Response of some cultivars of maize to plant density and nitrogen fertilization. M.Sc., Thesis, Fac., Agric., Moshtohor, Zagazig Univ., Egypt.

Gholami, A.; S. Shahsavani, and S. Nezarat (2009): The effect of plant growth promoting rhizobacteria (pgpr)on germination, seedling growth and yield of maize. Inter. J. Bio. and Life Sciences, 1(1):35-40.

Gomez, K.A. and A.A. Gomez (1984): Statistical procedures for agricultural research. 2nd, (ed.). John Wiley and Sons, NY, U.S.A.

Hamed, M.F (2003): Performance of two maize hybrids under irrigation intervals and ethryl treatments. Annals of Agric., Sc., Moshtohor, 41(2):669-678.

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

Metwally, A. A.; M. M. Shafik; M. Fayez and S. A. Safina. (2007): Effect of nitrogen fertilization and diazotroph inoculation on yield of solid intercropped maize with soybean. J. Agric. Sci. Mansoura Univ., 32(6): 4207-4215.

Moser, S.B.; B. Feil ; S. Jampatong and P. Stamp (2006): Effects of pre-anthesis drought, nitrogen fertilizer rate, and variety on grain yield, yield components, and harvest index of tropical maize. Agric. Water Manage., 81: 41–58.

Nofal, F.A.; G.M.A. Mahgoub and R.I. Faisal (2005): Nitrogen use efficiency of some maize hybrids under different rates of nitrogen fertilizer. Egypt. J. Appl. Sci. 20(4): 145-147.

Saleh, S.A. and F.R.R. Nawar (2003): Effect of mineral and organic manure fertilizers on maize productivity in reclaimed land. J. Adv. Agric. Res. (Fac. Agric. Saba Basha).,8 (1): 59- 68.

Shisanya, C.A.; Monica W. Mucheru; D.N. Mugendi; J.B. Kung'u (2008): Effect of organic and inorganic nutrient sources on soil mineral nitrogen and maize yields in central highlands of Kenya. Soil & Tillage Research, doi:10.1016/j.still.5-16

Suleiman, M.M. (2004): Effect of mineral and organic fertilization and plant density on growth and yield of corn in sandy soil. Ph. D. Thesis. Fac. Agric., Cairo. Univ., Egypt.

تحسين إنتاجية الذرة الشامية باستخدام التلقيح البكتيرى والتسميد الأزوتى المعدنى والعضوى

صديق عبد العزيز صديق محيسن* ، محسن على أحمد**

* قسم المحاصيل – كلية الزراعة بمشتهر – جامعة بنها– مصر.

** قسم المحاصيل - كلية ناصر للعلوم الزراعية – جامعة عدن– اليمن.

أجريت هذه الدراسة بمركز البحوث الزراعية بكلية الزراعة بمشتهر – جامعة بنها– مصر، خلال موسمي ٢٠٠٧، ٢٠٠٨ م بهدف دراسة تأثير التلقيح البكتيري (بدون تلقيح ،التلقيح بمخلوط من الأزوتوباكتر والآزوسبيريللم) وسبعة مستويات من التسميد النيتروجيني المعدني والعضوي (صفر، ٦٠، ١٢٠ كجم ن معدني في صورة يوريا ، ٦٠، ١٢٠ كجم ن عضوي في سماد بلدي، ٣٠ كجم ن معدني+٣٠ كجم ن عضوي و ٦٠ كجم ن معدني+٦٠ كجم ن عضوي للفدان) على صفات النمو والمحصول ومكوناته لهجيني من الذرة الشامية (هجين فردى ٣٠ ك٨ و هجين فردى ٣٠ ك٩). وتتلخص أهم النتائج على النحو التالي:

إختلفت الهجن معنويا في كل من سمك الكوز، عدد صفوف الكوز، عدد حبوب الصف، وزن الـ ١٠٠ حبة، النسبة المئوية للتصافي، محصول الحبوب للنبات ومحصول الحبوب لفدان الذرة الشامية في التحليل التجميعي لموسمي الزراعة حيث أعطي الهجين الفردي ٣٠ ك٩ أعلى القيم للصفات سابقة الذكر.

تأثر معنويا بالتلقيح البكتيري بخليط من "الأزوتوباكتر + الآزوسبيريللم" كل من طول الكوز، عدد صفوف الكوز، عدد حبوب الصف، وزن الكوز، وزن حبوب الكوز ومحصول الحبوب لنبات الذرة الشامية في التحليل التجميعي لموسمي الزراعة حيث أعطى التلقيح البكتيري أعلى القيم للصفات السابقة مقارنة بعدم التلقيح.

زاد كل من طول الكوز، سمك الكوز، عدد صفوف الكوز، عدد حبوب الصف، وزن الكوز، وزن حبوب الكوز، وزن الـ ١٠٠ حبة، النسبة المئوية للتصافي، محصول الحبوب للنبات ومحصول الحبوب لفدان الذرة الشامية في التحليل التجميعي لموسمي الزراعة زيادة معنوية بزيادة معدلات التسميد النيتروجيني حيث أعطى مستوى ١٢٠ كجم ن معدني/فدان أعلى قيم للصفات سابقة الذكر يشترك معه في بعض الصفات مستوي ٦٠ كجم ن معدني + ٦٠ كجم ن عضوي/فدان.

أثر التفاعل بين هجيني الذرة الشامية والتلقيح البكتيري تأثيرا معنويا على كل من سمك الكوز وعدد صفوف الكوز. كان للتفاعل بين هجيني الذرة الشامية ومستويات التسميد النيتروجيني تأثيرا معنويا على كل من طول الكوز ، سمك الكوز، عدد صفوف الكوز، عدد حبوب الصف، النسبة المئوية للتصافي ومحصول الحبوب لفدان الذرة الشامية. تأثر سمك الكوز، عدد صفوف الكوز وعدد حبوب الصف تأثيرا معنويا بالتفاعل بين التلقيح البكتيري ومستويات التسميد النيتروجيني.

أثر التفاعل بين كل من هجيني الذرة الشامية والتلقيح البكتيري والتسميد النيتروجيني تأثرا معنويا على كل من سمك الكوز، عدد صفوف الكوز ووزن الـ ١٠٠ حبة حيث أعطى الهجين الفردي ٣٠ ك٩ الملقح بخليط من "الأزوتوباكتر+ الأزوسبيريللم" تحت مستوى تسميد ١٢٠ كجم ن معدني/فدان أعلى القيم للصفات سالفة الذكر.