

Effect of Mineral and Organic Manure Fertilizer on Maize Productivity in Reclaimed Land

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ABSTRACT

Two field experiments were conducted at Nubaria Agric. Res. Station during 2000 and 2001 seasons to study the effect of three levels of nitrogen (40, 80 and 120 kg N/fed.) and three levels of organic manure (5, 10 and 15 tons/fed.) on growth and grain yield and its components of maize single-cross hybrid 10. Results showed that the increase of nitrogen level significantly increased plant height, ear height, ear length, ear diameter, 100-grain weight, grain weight per ear, grain yield/fed., oil grain and crude protein percentage. Organic manure levels significantly increased plant height, ear height, ear length, 100-grain weight, grain weight per ear and grain yield/fed. Nitrogen and organic manure interactions had a significant effect on plant height, ear height, ear length, 100-grain weight, grain weight/ear and grain yield/fed. The highest grain yield (ardab/fed.) could be obtained under the application of 120 kg N + 15 tons organic manure per feddan.

INTRODUCTION

Maize is one of the most important cereal crops grown in Egypt. There is an over increasing need to increase the production in Egypt in order to meet the continuous demand of the growing population. An extension of maize area in the valley is limited, adding new areas in sandy and calcareous soils is an approach. This horizontal direction should go parallel to the vertical one.

Organic substances are the main source of nutrients and energy for the most soil microorganisms. Such substrate is responsible for dynamic adsorption of the soil fraction as well as the improvement of physical properties.

Nitrogen is an essential element for plant growth and maintenance. The trend now is to introduce nitrogen-fixing gene to the plant technique, which has not been yet reached, so no way but to use seed and seedling inoculation with associative fixing bacteria.

Nitrogen fertilizer is an important factor in increasing yield of maize. Many investigators reported that growth characters and grain yield were positively correlated with increasing nitrogen fertilizer (Baza, 1981; Moursi et al., 1983; Khedr, 1986; Ashoub et al., 1987; Bedeer et al., 1992; Younis et al., 1995; Abdel-Hameed, 1997; Faisal et al., 1997; Hassan, 1999 and Nofal, fatma, 1999). As well as, maize grain yield was increased by increasing the organic manure rate (Abdel-Aziz et al., 1982; Mahmoud et al., 1984 and El-Shimi et al., 1987).

The present work was conducted to study the effect of mineral and organic manure fertilizers on grain yield and its components of maize plants under reclaimed land conditions.

MATERIALS AND METHODS

Two field experiments were conducted at Nubaria Agric. Res. Station during 2000 and 2001 seasons to study the effect of three levels of nitrogen fertilizer and three levels of organic manure on growth and grain yield and its components of maize single-cross hybrid 10. The soil type of the experimental site was calcareous sandy clay loam with a fairly deep water table. Mechanical and chemical analyses of the experimental site are presented in Table (1). The preceding crop was faba bean in both growing seasons.

Table 1. Mechanical and chemical analyses of the experimental soil in 2000 and 2001 seasons.

Soil properties	Season	
	2000	2001
Soil particles (%)		
Sand	52.9	53.3
Silt	21.8	20.8
Clay	25.3	25.9
Soil texture	sandy clay loam	sandy clay loam
Chemical properties		
Total N (%)	0.046	0.051
Available N (ppm)	26.30	28.60
Available P (ppm)	9.68	8.40
Available K (ppm)	425.0	403.0
pH	8.2	8.1
E.C. (mmhos/cm)	2.21	1.95
O.M. (%)	0.95	0.98
CaCO ₃ (%)	22.9	22.5

Nitrogen fertilizer levels were 40, 80 and 120 kg/fed. The nitrogen fertilizer used was ammonium nitrate (33.5%). Each level was splitted into two equal doses and was applied before the first and second irrigation in both seasons.

Organic manure was inoculated into the soil at the rate of 5, 10 and 15 tons/fed. The fertilizer was applied during soil preparation before planting.

Maize (single cross 10) was grown on May 20th and 22nd during 2000 and 2001, respectively. The experimental design was a split-plot with four replicates. The main plots were devoted to the three nitrogen levels 40, 80 and 120 kg N/fed whereas the three organic manure levels (5, 10 and 15 tons/fed.)

were arranged at random with the sub-plots. The sub-plot area was 12 m², consisted of five ridges each 4 m in length and 60 cm apart. The plots were hand hoeing twice for controlling weeds before the first and the second irrigation. Recommended pest control was applied when necessary.

At harvesting time, the following data were recorded: plant height (cm), ear height (cm), ear length and diameter (cm), ear weight (g), 100-grain weight (g) and grain yield (ardab/fed). Ear characters were estimated at the average of ten ear samples. Grain yield and 100-grain weight were adjusted to 15.5% moisture.

Oil content in maize grains was determined by Soxhlet apparatus on dry weight basis as described by Sorenson (1947). Protein was determined as total nitrogen by micro-Kjeldahl method according to A.O.A.C (1970), then N was multiplied by 6.25 (Tripathi et al., 1971) to obtain protein content in maize grains.

The collected data were statistically analyzed according to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

1. Vegetative growth

Data presented in Table (2) show that plant height, ear height, ear length, ear diameter and grain weight/ear were significantly increased with increasing nitrogen levels from 40, 80 and up to 120 kg N/fed. These results indicate clearly the vital role of nitrogen in plant growth and ear characters, as it is necessary for protoplasm formation and photosynthesis in all plants, it is also necessary for cell division and merestimatic activity in plant organs. Similar results were obtained by Khedr (1986), Younis *et al.*(1995), Abdel-Hameed (1997), Hassan (1999) and Nofal, Fatma (1999).

Data in the same table showed that increasing organic manure levels from 5, 10 to 15 tons/fed. Increased significantly maize plant height, ear height, ear length and grain weight/ear during both seasons of the study. It could be concluded that the effect of organic manure in building maize ear may be attributed to its effect on photosynthesis activity in maize plants. These results are in agreement with those obtained by Mahmoud et al.(1984) and El-Shimi et al.(1987).

In addition, the data in Table (4) showed clearly that nitrogen and organic manure interaction had a significant effect on plant height, ear height, ear length and grain weight/ear. The highest values of these traits were recorded by growing maize under the application of 120 kg N + 15 tons organic manure per feddan.

Table 2. Plant height, ear height, ear length, ear diameter and grain weight/ear as affected by nitrogen and organic manure fertilizers in 2000 and 2001 seasons.

Treatments	Plant height (cm)		Ear height (cm)		Ear length (cm)		Ear diameter (cm)		Grain weight/ear (g)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Nitrogen levels (N) (kg/fed.)										
40	200.03	197.71	132.20	134.90	19.98	19.13	4.15	4.06	195.06	193.11
80	211.75	200.31	138.70	137.00	20.81	20.35	4.93	4.94	204.48	203.13
120	316.61	215.81	145.40	144.60	21.78	21.61	5.18	5.25	209.86	210.16
L.S.D _{0.05}	4.20	3.71	3.61	2.40	0.72	0.61	0.42	0.56	2.31	3.70
Organic manure (O) (ton/fed.)										
5	203.55	200.91	135.07	134.70	20.11	19.42	4.61	4.57	199.31	197.63
10	209.50	205.95	138.60	138.83	20.71	20.39	4.74	4.79	201.15	202.81
15	214.85	209.76	142.63	142.93	21.50	21.29	4.92	4.89	208.96	206.97
L.S.D _{0.05}	5.31	4.90	3.95	3.72	0.72	0.75	NS	NS	4.90	4.5
N x O	7.49	6.70	7.42	8.13	1.11	1.34	NS	NS	8.65	10.40

2. 100-grain weight and grain yield/feddan

Results in Table (3) showed that the increase in nitrogen fertilizer levels caused significant increases in 100-grain weight and grain yield per feddan. Applying N rates of 40, 80 and 120 kg N/fed. significantly increased grain yield/fed. During both seasons. The obtained results showed the vital role of nitrogen on maize grain yield. The effect of nitrogen fertilization on maize grain yield is the outcome of its effect on ear length, ear diameter, 100-grain weight and ear weight. Similar results were obtained by Ashoub et al.(1987), Bedeer et al.(1992), Faisal et al.(1997) and Nofal, Fatma (1999).

Results in Table (3) showed that organic manure significantly increased 100-grain weight and grain yield/fed. The highest value of grain yield/fed. was obtained by adding 15 ton of organic manure. Similar results were obtained by Abdel-Aziz (1982) and El-Shimi et al.(1987).

Data in Table (4) showed that nitrogen levels and organic manure interaction recorded significant effect on 100-grain weight and grain yield/fed. The highest grain yield/fed. could be obtained by adding 120 kg N + 15 ton organic manure per feddan.

3. Oil and crude protein percentages

Results in Table (3) show that oil percentage and crude protein percentages were significantly increased by increasing nitrogen levels from 40, 80 and 120 kg N/fed. Similar results were obtained by El-Kalla *et al.* (1981) and Assey *et al.*(1986).

Data in Table (4) showed that organic manure and interaction between the nitrogen levels and organic manure had no significant effect on oil and crude protein percentages. These showed that nitrogen fertilizer and organic manure act independently on those characters.

Table 3. 100-grain weight, grain yield/fed., oil percentage and crude protein percentage as affected by nitrogen and organic manure fertilizers in 2000 and 2001 seasons.

Treatments	100-grain weight (g)		Grain yield (ardab/fed.)		Oil (%)		Crude protein (%)	
	200	2001	2000	2001	2000	2001	2000	2001
Nitrogen levels (N) (kg/fed.)								
40	34.62	33.35	14.98	14.80	4.80	4.59	12.73	12.98
80	35.93	35.84	16.01	16.35	4.95	4.75	13.11	13.09
120	38.02	38.90	18.18	17.48	5.42	5.21	13.56	13.64
L.S.D _{0.05}	0.73	1.21	0.61	0.50	0.22	0.33	0.51	0.40
Organic manure (O) (ton/fed.)								
5	34.17	33.80	15.75	15.60	4.84	4.52	12.78	12.78
10	35.85	36.20	16.49	16.33	5.03	4.96	12.96	13.33
15	38.56	38.10	16.94	16.71	5.32	5.06	13.67	13.60
L.S.D _{0.05}	0.97	1.30	0.73	0.81	NS	NS	NS	NS
N x O	2.31	2.69	0.95	1.01	NS	NS	NS	NS

Table 4. Plant height, ear height, ear length, ear diameter and grain weight/ear as affected by interaction between nitrogen levels and organic manure fertilizers in 2000 and 2001 seasons.

Nitrogen fertilizer (N) (kg/fed.)	Organic manure (O) (tons/fed.)	Plant height (cm)		Ear height (cm)		Ear length (cm)		100-grain weight (g)		Grain yield (ardab/fed.)		Grain weight/ear (g)	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
40	5	195.13	193.36	131.5	132.9	19.12	18.12	33.17	30.14	14.21	14.63	191.21	186.36
	10	199.23	198.41	131.9	133.8	19.31	19.33	33.29	33.21	14.93	14.81	193.93	194.76
	15	205.03	201.36	133.3	138.0	20.73	19.94	37.41	36.71	15.82	14.96	200.04	198.21
	Mean	200.03	197.71	132.2	134.9	19.98	19.13	34.62	33.35	14.98	14.80	195.06	193.11
80	5	201.76	198.01	132.0	134.0	20.20	19.63	33.18	34.11	15.71	15.81	201.36	200.76
	10	213.51	203.74	139.3	136.3	20.92	20.46	35.49	36.17	15.97	16.31	201.76	201.31
	15	219.17	207.56	144.8	140.7	21.33	20.97	39.14	37.25	16.34	16.95	210.34	207.34
	Mean	211.75	203.10	138.7	137.0	20.81	20.35	35.93	35.84	16.01	16.35	204.48	203.13
120	5	213.75	211.36	141.7	137.2	21.00	20.51	36.17	37.14	17.33	16.37	205.36	205.76
	10	215.75	215.71	144.6	146.4	21.91	21.37	38.76	39.21	18.56	17.86	207.76	209.37
	15	220.34	220.37	149.8	150.1	22.43	22.96	39.14	40.35	18.66	18.21	216.51	215.36
	Mean	316.61	215.81	145.4	144.6	21.78	21.61	38.02	38.90	18.18	17.48	209.86	210.16
L.S.D _{0.05} Interaction (N x O)		7.49	6.70	7.42	8.13	1.11	1.34	2.31	2.69	0.95	1.01	8.65	10.4

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الملخص العربي

تأثير التسميد المعنى والعضوى على إنتاجية الذرة فى الأراضى الجديدة

سيد عبدالعزيز صالح ، فتحى رجب رمضان نوار

معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية - الجيزة

نفنت هذه الدراسة في محطة البحوث الزراعية بالنوبارية في موسمي ٢٠٠٠، ٢٠٠١ لدراسة تأثير ثلاث مستويات من التسميد المعدني (٤٠، ٨٠، ١٢٠ كجم نتروجين/فدان) وثلاث مستويات من التسميد العضوي (٥، ١٠، ١٥ طن/فدان) على نمو ومحصول الذرة الشامية هجين فردي ١٠. وتتلخص النتائج فيمايلي:

- أدت زيادة معدلات التسميد الأروتي إلى زيادة معنوية في كل من ارتفاع النبات، ارتفاع الكوز، طول الكوز، قطر الكوز، وزن الكوز، وزن مائة حبة، محصول الحبوب بالأردب/فدان، نسبة الزيت ومحتوى الحبوب من البروتين.
- أدت إضافة السماد العضوي إلى زيادة معنوية في كل من ارتفاع النبات، ارتفاع الكوز، طول الكوز، وزن مائة حبة ومحصول الحبوب بالأردب/فدان.
- أدى التفاعل بين التسميد النتروجيني المعدني والسماد العضوي إلى زيادة معنوية في كل من ارتفاع النبات، ارتفاع الكوز، طول الكوز، وزن الكوز، وزن مائة حبة ومحصول الحبوب بالأردب/فدان.
- وتم الحصول على أعلى محصول وذلك بإضافة ١٢٠ كجم نتروجين/ فدان + ١٥ طن سماد عضوي/فدان وأقل القيم بإضافة ٤٠ كجم نتروجين معدني ، ٥ طن سماد عضوي تحت ظروف تلك الدراسة.