ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 44(3): 1363-1373, (2006).

A COMPARATIVE STUDY BETWEEN BIOGAS MANURE AND TOWN REFUSE ON SOME CHEMICAL PROPERTIES AND PRODUCTIVITY OF SOIL

BY

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ABSTRACT

A Field experiment was conducted during the winter season of 2004 – 2005 using wheat (Seds) as plant indicator to evaluate the effect of two natural soil conditioners, i.e. biogas manure (BM) and town refuse (TR), on dry weight production, concentration and uptake of N, P, K, Fe, Zn and Mn by wheat plants as well as availability of the previous nutrients in soil. both biogas manure and town refuse were added at rates of 0, 5, 10, and 20 ton fed $^{-1}$. The obtained results could be summarized as follows :

- The dry weight of wheat plants was significantly and positively affected with increasing the application rate of both biogas manure and town refuse The positive effect of biogas manure was higher than that of town refuse on the dry weight of wheat plants.
- Both concentration and uptake of N,P,K,Fe,Zn and Mn gradually and consistently increased with increasing the addition rates of biogas manure and town refuse.
- Wheat grain yield and straw yield as well as the weight of 100 grains significantly stately increased as the rates of biogas manure and town refuse increased. The biogas manure was more effective on grain yield, straw yield and weight of 100 grains than town refuse.
- The availability of N,P,K,Fe,Zn and Mn after in soil 70 and 150 days from cultivation were gradually and consistently increased as the rates of biogas manure and town refuse increased at both sampled growth periods

Key words: Biogas manure, Town refuse, Wheat plants, concentration and uptake of N, P, K, Fe, Zn and Mn, soil available of N, P, K,Fe,Zn and Mn, dray weight (D.W), treatment (T), rate (R)

INTRODUCTION

Organic sources are undoubtedly an important source of nutrients in soil but their amounts and available nutrient content and the release rate is woefully inadequate for meeting the demands of intensive and high yielding crop production, Sanjay, Arora (1988). Kapur and Kanwar (1989) indicated that the successive application of organic wastes significantly increased Fe and Zn availability in post-harvest soils as compared to control. Antoun *et al.* (1990) showed that addition of town refuse compost dropping to soil increased its initial content of total nitrogen by 174 mg.kg^{-1} after 60 days. The treatment showed a 40

ppm increased over the initial, while the control did not show any increase. Ahmed, (1994) and El-Ghazoli (1998) found that the application of different organic wastes increased the availability of soil macronutrients. El-Ghazoli (1998) added that the combined effect between poudrette with mineral fertilization increased micronutrients uptake (Fe, Zn and Mn) in plant growth (in sandy and clay loam soils). Also, any practice could result in an increase in soil organic matter content, had been directed by Taha (2000).

Modern cities and towns produce a lot of waste. And in most cases, very little of the waste produced is recovered or recycled. In the United States, Europe and Japan, landfills are still the final destination for vast majority of municipal waste. Even in countries that consider themselves to be aggressive in developing recycling initiatives, the vast majority of waste still ends up in landfills Fujita Corporation (2005)

The world has won the important battle in the area of food security, but the war is still on. A total of 800 million people, that is one out of every six persons, in the developing world do not have access to food. One-third of all pre-school children in the developing countries are food insecure We, thus, have a big challenge ahead of us as we enter the next millennium Mashelker,(2006).

MATERIALS AND METHODS

During winter season of 2004 – 2005, a field experiment using wheat (Seds) was conducted at a Ghiada EL-Sharqia, Beni-Sufe Governorate to evaluate the influence of two natural conditioner, biogas manure (BM) and town refuse (TR), on dry weight (D.W.), concentration and uptake of N,P,K,Fe,Zn and Mn and by wheat plants as well as availability of the same nutrients under experimental conditions, both soil of the trial and conditioners were analyses before sowing according to Piper (1950) and Page *et al.* (1982) results are shown in Table (1).The plot area was 1/400 fed (10.5 $cm^{2)}$ and treated with biogas manure and town refuse at rates of 0, 5, 10 and 20 ton fed^{-1}. The treatments were arranged in a completely randomized block design with three replicates.

After 70 days from cultivation, the plant samples were taken to determine the dry weight, concentration and uptake of N,P,K,Fe,Zn and Mn by wheat plants. At harvesting (after 150 days from cultivation) grain and straw yield as well as the weight of 100 grains were determined for each treatment. The plant samples were dried at 70 C^{o} and ground for chemical analysis. A 1.0 g of the ground materials were digested using two mixture acids of H_2So_4 and $HClO_4$ for determination of nutrients under status, according *to* Chapman and Pratt, (1961).

During growth season, the soil samples were taken from agriculture area at periods of 70 and 150 days from cultivation to identify the status of nutrients under experimental conditions. The samples were air dried, crushed and sieved through a 2 mm sieve and extracted by DTPA- Ammonium bicarbonate according to Soltanpour (1985). The N,P,K,Zn and Mn were determined in soil and plant according to Page *et al.* (1982). The statistical analysis was carried out according to Snedecor and Cochran (1989).

Table (1): Soil and organic matter analysis:

Properties	Soil	Applied organic source	
	Ghiada EL-Sharkia	Biogas manure	Town refuse
pH	7.9	5.02	7.2
EC (dS/m-1)	3.8	5.60	2.4
O.M (%)	0.4	80.24	21.5
N (mg.kg-1)	112	2.50	1.3
P (mg.kg-1)	2.7	0.03	0.01
K (mg.kg-1)	216	0.95	0.6
Fe (mg.kg-1)	1.4	11450	2180
Zn (mg.kg-1)	0.6	2842	825
Mn (mg.kg-1)	1.4	268	160
C.S. and (%)	30.70	-	-
F.S. and (%)	38.60	-	-
Silt (%)	17.84	-	-
Clay (%)	12.86	-	-
Texture	S.L.	-	-

RESULTS AND DISCUSSION

Available nutrients in soil :

Data in table (2) show, the effect of biogas manure and town refuse on availability of N, P, K, Fe, Zn and Mn after 70 and 150 days from cultivation. Available nutrients soil were gradually and consistently increased as the rates of biogas manure and town refuse increased at either of 70 and 150 days.

As, for the effect of biogas manure on available soil nutrients, the N,P, and Mn decreased with increasing the growth period from 70 to 150 days, while K, Fe, and Zn increased. The corresponding mean values of N, P, K, Fe, Zn and Mn at 70 days from cultivation were 507, 4.3, 245, 3.5, 1.6 and 2.7 $\mu g\ g^{-1}$, respectively. While they were 384, 3.7, 255, 3.8, 1.7 and 3.0$\mu g\ g^{-1}$ at 150 days from cultivation, respectively.

Concerning influence of town refuse on availability of soil nutrients under study, were decreased when the growth period increased from 70 to 150 days except Fe, Zn and Mn increased. These results are in accordance with those obtained by EL-Ghzoli (1998); Badran *et al.* (2000); EL-Emam (2002) and Mahmoud (2004).

2 - Dry weight of wheat plants :

Data presented in table (3) and Fig (1) showed that the dry weight of wheat plants was significantly and positively affected with increasing the application rates both of biogas manure and town refuse. The percentage increases in dry weight corresponding to rates of biogas manure of 0,5,10 and 20 ton fed^{-1} were 100 %, 189.7 %, 231.2 % and 278.8 %,respectively. While in case of town refuse at the same addition rates, they were 100 %, 101.3 %, 152.2 % and 174.2 %, respectively.

Table (2): Effect of organic matter types and their rates on available soil nutrients (µg/g) in Sandy Loam soil.

Organic source	Rate Ton/ Fed	After 70 days					
		µg/g			µg/g		
		N	*P*	K	Fe	Zn	Mn
Biogas manure	0	210	2.3	200	1.6	0.5	1.8
	5	548	4.3	251	3.1	1.7	2.5
	10	642	5.1	261	4.1	1.9	3.0
	20	627	5.5	269	5.1	2.3	3.4
	Mean	507	4.3	245	3.5	1.6	2.7
Town refuse	0	210	2.3	200	1.6	0.5	1.8
	5	467	3.7	235	3.2	1.1	2.2
	10	548	4.2	255	3.1	1.7	2.8
	20	607	5.1	267	4.1	2.3	3.1
	Mean	458	3.8	239	3.0	1.4	2.5
General mean	0	210	2.30	200	1.60	0.5	1.8
	5	507	4.00	243	3.15	1.4	2.4
	10	595	4.56	258	3.60	1.8	2.9
	20	617	5.30	268	4.60	2.3	3.3
LSD. 0.05%	(T) type	27.2	0.15	5.8	0.13	0.2	0.2
	(R) rate	38.4	0.22	8.2	0.18	0.3	0.3
	T.R	54.3	0.30	Ns	0.26	ns	ns
After 150 days							
Biogas manure	0	152	1.8	174	1.5	0.4	1.5
	5	315	3.7	272	3.8	1.9	2.9
	10	525	4.2	278	4.3	2.1	3.6
	20	548	5.0	295	5.5	2.4	4.1
	Mean	384	3.7	255	3.8	1.7	3.0
Town refuse	0	152	1.8	174	1.5	0.4	1.5
	5	268	3.3	254	3.3	1.5	2.6
	10	268	3.6	277	3.8	1.9	2.9
	20	250	4.6	277	4.7	2.6	3.7
	Mean	235	3.3	245	3.3	1.6	2.7
General mean	0	152	1.8	174	1.5	0.4	1.5
	5	292	3.5	263	3.6	1.7	2.8
	10	397	3.9	278	4.1	2.0	3.3
	20	399	4.8	286	5.1	2.5	3.9
L.S.D. 0.05%	(T) type	24.6	0.32	17.02	0.16	ns	0.2
	(R) rate	34.7	0.45	24.06	0.22	0.3	0.3
	T.R	49.1	ns	34.03	0.31	ns	Ns

It is worthy to refer that, the positive effect of biogas manure was more effective than town refuse for increasing the dry weight of wheat plants. The average values of dry weight for biogas manure and town refuse were 9.54 and 6.29 g/plant, respectively. This an increase in dry weight of plants caused by addition of biogas manure may be because to that the biogas manure contain N % greater than town refuse. The effect of biogas manure and town refuse on dry weight. Plants could be illustrated by the regression equations as follows :

D.W.(g) after 70 days = 6.03 + 0.40 biogas manure.(ton/fed.) r = 0.94 **

D.W.(g) after 70 days = 4.59 + 0.19 town refuse (ton/fed) r = 0.90 **

These results were agreement with those obtained by Khalil, *et al.* (2000) and Mahmoud, (2004).

3 - Elemental composition of wheat plants :

3 – 1 Concentration of N, P, K :

Results in Table (3) reveal that the concentration of N,P and K, in wheat plants were gradually and consistently increased with increasing the addition rates of both biogas manure and town refuse. The mean values of N,P and K, in case of biogas manure were 4.25 %, 0.30 % and 3.36 %, respectively. While they were 4.04 %, 0.24 % and 3.05 %, respectively in case of town refuse.

Table (3):Effect of organic matter and their rates on plant dry weight, concentration of wheat Plant nutrients after 70 days.

Organic source	Rate Ton/ Fed	DW g/ Plant	Concentration					
			%			µg/g		
			N	P	K	Fe	Zn	Mn
Biogas manure	0	4.77	3.03	0.12	2.50	133	37	33
	5	9.05	4.11	0.33	3.39	233	73	50
	10	11.03	4.76	0.36	3.56	333	77	77
	20	13.30	5.08	0.37	3.97	433	80	80
	Mean	9.54	4.25	0.30	3.36	283	67	60
Town refuse	0	4.77	3.03	0.12	2.50	133	37	33
	5	4.83	3.83	0.21	3.05	133	50	40
	10	7.26	4.57	0.31	3.25	233	57	60
	20	8.31	4.74	0.33	3.41	267	60	60
	Mean	6.29	4.04	0.24	3.05	192	51	48
General mean	0	4.77	3.03	0.12	2.50	133	37.0	33.0
	5	6.94	3.97	0.27	3.22	183	61.5	45.0
	10	8.65	4.67	0.34	3.41	283	67.0	68.5
	20	10.81	4.91	0.35	3.70	350	70.0	70.0
L.S.D.at 0.05 %	Type	0.431	Ns	0.017	0.144	66.53	7.97	7.73
	Rate	0.609	0.48	0.023	0.204	94.09	11.26	10.93
	T x R	0.862	Ns	0.033	ns	ns	ns	ns

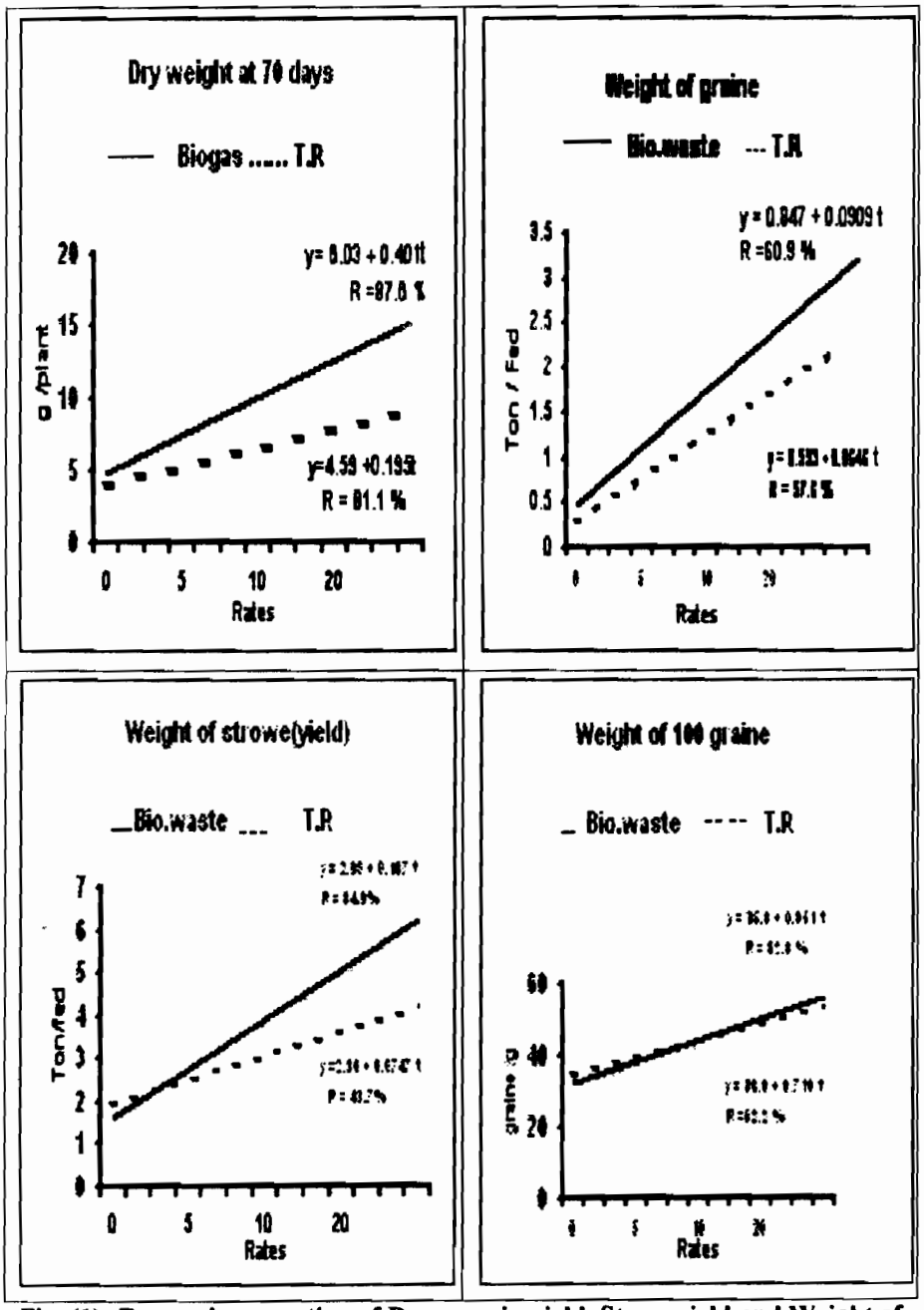


Fig. (1): Regression equation of D. w., grain yield, Straw yield and Weight of 100, grain with organic rate.

The analysis of variance show that there were no significant effect due to neither the type of organic manure nor the interaction between them on N concentration but the addition rates significant affecting. The P and K concentration in wheat plants were significantly effected with all parameters but K concentration did not respond significant' up to the interaction between biogas manure and town refuse. These results are in agreement with those obtained by EL-Ghozoli, (1998) and Mahmoud, (2004).

3 –2 Concentration of Fe, Zn and Mn :

Data in table (3) indicate that the concentration of Fe, Zn and Mn in wheat plants grown in sandy loam soil were pronounced increased with increasing the biogas manure and town refuse addition. The mean values of Fe, Zn and Mn concentration as affected by biogas manure were 283, 67 and 60 μg g^{-1}, while in case of town refuse, the corresponding mean values were 192, 51, and 48 μg g^{-1}, respectively.

It is clear that, the concentration of Fe, Zn and Mn in wheat plants were higher with biogas manure addition compared with town refuse. This result may be because the biogas manure contain wishes Fe, Zn and Mn values than town refuse

The analysis of variance show that, the concentration of Fe, Zn and Mn in wheat plants were significantly affected by the parameters under study except the interaction between biogas manure and town refuse. These results are in harmony with those obtained by Khlil *et al.* (2000), Narvaez *et al* (2000) and Mohmoud (2004)

3 – 3 Uptake of Macro and micronutrients by wheat plants :

Data illustrated in Fig. (2) show, the effect of biogas manure and town refuse on N,P,K,Fe,Zn and Mn uptake by wheat plants. The uptake of these nutrients was positively affected with increasing the application rates in either case of biogas manure or town refuse. Also, the results reveal that the biogas manure was superior in uptake of macro and micronutrients by wheat plants. These superiority can be attributed to higher content of elements biogas. These findings a greet with those achieved by EL- Ghazoli (1998) and EL-Emam, (2002). Who found that both concentration and uptake of macro and micronutrients by wheat plants were significantly increased as a result of organic sources application.

4 – Yield components :

Data presented in Table (4) and illustrated in Fig. (2) illustrate the relation ships between organic sources and grain yield of both, straw yield as well as weight of 100 grains of wheat plants.

Generally, both grain and straw yield of wheat as well as the weight of 100 grains were significantly and positively effected as the rates of biogas manure and town refuse increased. The relative increases in grain yield, and weight of 100 grains corresponding to the rates of biogas manure of 0, 5,10 and 20 ton fed^{-1}

were 100 %, 935 %, 1100 % and 1150 %; 100 %, 220.86 %, 247.24 % and 347.85 % and 100 %, 124.18 % 148.63 % and 159.02, respectively. While they are in case of town refuse were 100 %,635 %, 750 % and 835 %; 100 %, 138.04 %, 214.42 % and 209.82 % and 100 %, 135.85 %, 139.90 % and 149.08 %, respectively. It is worthy to refer that, the biogas manure was more effective on grain yield, straw yield and weight of 100 grains of wheat plants than town refuse.

The regression equations were describing these relations are :
Grain yield ton fed^{-1} = 0.847 + 0.0909 biogas R^2 = 60.9 % r = 0.78**
Grain yield ton fed^{-1} = 0.599 + 0.0646 town R^2 = 57.6 % r = 0 76**
Straw yield ton fed^{-1} =2.09 +0.187 biogas. R^2 = 84.9 % r = 0.92**
Straw yield ton fed^{-1} = 2.30 + 0.075 town. R^2 = 43.7 % r = 0.66**
Weight of 100 grain(g) = 85.3 + 0.85 biogas (ton/fed). r = 0.91**
Weight of 100 grain (g) = 86.9 + 0.71 town (ton/fed). r = 0.51**

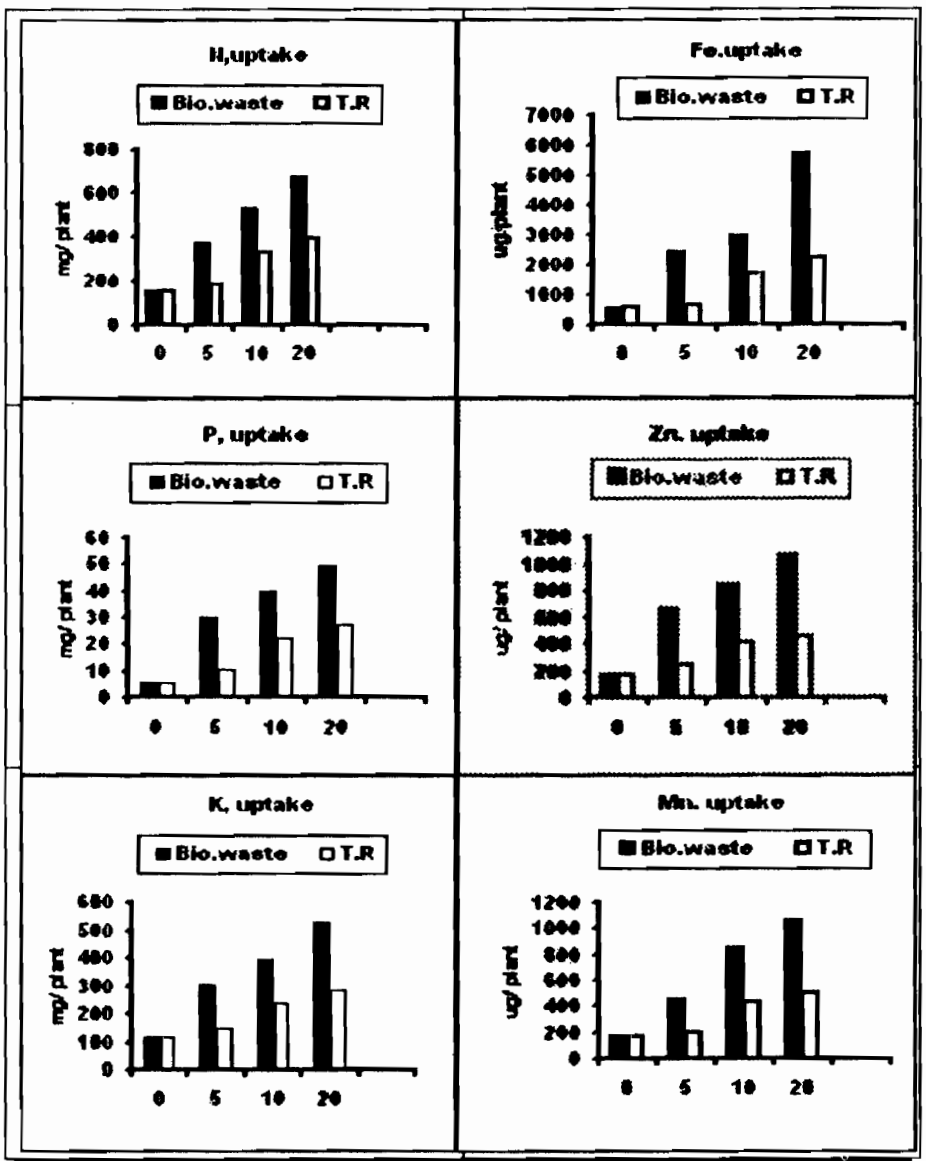
These results are in agreement with those obtained by El-Ghazoli,(1998) Awad, *et al.* (2000) and Basyouny, (2001).

Finally, it can be concluded that application of Biogas waste and town waste increased generally concentration and uptake by plant as well as the dry matter yield of wheat plants grown on the tested soil.

Table (4): Effect of organic sources types and their rates on some productivity and relative increment, after wheat harvesting.

Organic sources	Rate Ton/ fed	Productivity and relative increment ®					
		we. 100 grains /g	R %	grain Ton/ fed	R %	Straw Ton /fed	R %
Biogas manure	0	32.80	100	0.20	100	1.63	100
	5	40.73	124.18	1.87	935	3.60	220.86
	10	48.75	148.63	2.20	1100	4.03	247.24
	20	52.16	159.02	2.30	1150	5.67	347.85
	Mean	43.61		1.64		3.73	
Town refuse	0	32.80	100	0.20	100	1.63	100
	5	44.56	135.85	1.27	635	2.25	138.04
	10	45.88	139.90	1.50	750	3.50	214.72
	20	49.08	149.63	1.67	835	3.42	209.82
	Mean	43.08		1.16		2.70	
Grand mean	0	32.80		0.20		1.63	
	5	42.65		1.57		2.93	
	10	47.32		1.85		3.77	
	20	50.62		1.99		4.55	
L.S.D at 0.05 %	Type	ns		0.198		0.44	
	Rate	3.46		0.780		0.62	
	TXR	ns		ns		0.88	

T (treatment) R (rate) T. X R. (treatment x rate)



L.SD. at 0.05%	N	P	K	Fe	Zn	Mn
(T) type	35.39	1.80	13.73	364	62.54	226.4
(R) rate	50.04	2.55	19.41	515	88.45	320.2
TXR	70.77	3.60	27.45	728	125.1	452.8

Fig. (2): Effect of organic sources and their rates on plant, uptake of Wheat plant nutrients after 70 days.

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دراسه مقارنه بين سماد البيوجاز ومخلفات المدن على بعض الخواص الكيميائية والإنتاجية للتربة

صلاح الدين محمد عويس السيسى

معهد بحوث الأراضى والمياه والبيئة ــ مركز البحوث الزراعية ــ الجيزه.

أقيمت تجربة حقلية على أرض رمليه طميه في محافظة بني سويف خلال الموسم الزراعي ٢٠٠٤/٢٠٠٥ أستخدم نوعين من الأسمدة العضوية) سماد البيوجاز ومخلفات المدن (بمستويات(صفر، ٥ ، ١٠، ٢٠) طن /للفدان (كما أستخدم نبات القمح صنف سدس كنبات دليل، وأوضحت الدراسة مابلى :

- ازداد تيسر كلا من النيتروجين ,الفوسفور ,البوتاسيوم، الحديد، الزنك والمنجنيز فى التربة تزايدا تدريجيا ومتوافقة مع زيادة معدلات إضافة سماد البيوجاز ومخلفات المدن عند فترتا الدراسة (٧٠، ١٥٠) يوم من الزراعة.
- إزداد التركيز والمحتوى الغذائى لنبات القمح من النيتروجين،الفوسفور ,البوتاسيوم الحديد ,الزنك والمنجنيز تدريجيا وتوافقيا مع زيادة معدلات أضافه كلا من سماد البيوجاز ومخلفات المدن.
- تأثر الوزن الجاف لنبات القمح ايجابيا ومعنويا بزيادة أضافه معدلات سماد البيوجاز ومخلفات المدن وكان التأثير الإيجابى لسماد البيوجاز على إنتاجية المادة الجافة أعلى من مخلفات المدن.
- إنتاج الحبوب ,القش ووزن ١٠٠ حبه زاد زيادة مطردة مع زيادة معدلات أضافة كلا من سماد البيوجاز ومخلفات المدن وكانت هذه الزيادات معنوية .