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A COMPARATIVE STUDY ON EFFECT OF FOLIAR APPLICATION OF UREA AND SOME ORGANIC MANURE EXTRACTS ON WHEAT YIELD AND ITS COMPONENTS

BY

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ABSTRACT

The present study was carried out at Shibeen El-Qanater, Kalubia governorate, Egypt during two successive growing seasons of 2001/2002 and 2002/2003 to identify the effect of urea solution 2% N and some organic manure extracts (pigeon manure, chicken manure and biogas manure) with a ratio 1:12 manure : water as a foliar application on wheat yield (Gemmeza 5, *Triticum aestivum* L.) and its components. Manure extracts were applied in 4 equal doses (600 L fed^{-1}) at 20, 40, 60 and 80 days after cultivation, while urea solution (600 L fed^{-1}) was applied in equal two doses at 25 and 50 days after cultivation. A basal dose of urea fertilizer at rates of 25 and 75 kg fed^{-1} in the form of urea 46.5% N was also added as soil application.

Results revealed that the plant height, grain & straw yields and 1000 grain weight exhibited significant increases as a result of application studied treatments, in addition to a significant difference between wheat yield and its components at a basal dose of N (25 or 75 kg urea fed-1). Also, the results showed that the positive effect of pigeon manure on wheat yield and its components surpassed the other organic manures.

The NPK uptake by wheat plants were more pronounced at the applied treatment of pigeon manure, while the least one was urea spray at 2% N. As for the micronutrients (Fe, Mn and Zn) uptake by wheat plants, data indicated that the biogas manure extract surpassed the other organic manure extracts.

INTRODUCTION

Increasing wheat production by improving means of productivity is becoming a must in Egypt to overcome the gap between consumption and production. Previous recorded results on wheat production indicated that nitrogen is the most limiting element for wheat production in Egypt (Hamissa and Moustafa, 1998 and El-Aggory *et al.*, 2000 & 2001).

Response of wheat crop to nitrogen fertilization was studied by many workers who found significant increases in plant height (Gab Alla *et al.*, 1986; El-

Nagar *et al.*, 1989 and Shams El-Din and El-Habbak, 1992), seed index, grain and straw yield (Gab Alla *et al.*, 1986; Sharaan *et al.*, 1986; Khalil, 1989 and Shams El-Din and El-Habbak, 1992). Mandal *et al.* (1991) applied up to 200 kg N ha^{-1} as 100% soil application, 50% soil plus 25% foliar. They revealed that the plant height, straw yield and grain yield were greatest when 75% of N was applied to soil and the rest through foliage. Also, Taha *et al.* (1992) found that the foliar nutrition by urea significantly increased rice grain and straw yield as well as their attributes as compared with the control.

Rejpal *et al.* (2001) found that the N and Zn content in leaves increased with increasing concentration of urea (1, 2 and 3% urea). Foliar application of nitrogen is needed to increase the nitrogen use efficiency and to save fertilizer nitrogen. Ishag (1985) proved that the foliar fertilizers greatly increased the uptake of N, P and K. The organic manures play an important role in nutrients solubility as they activate physiological and biochemical processes in plant and improve both physical and chemical properties of soils leading to increase plant growth and nutrients uptake (Florensa *et al.*, 1985 and Hegab, 1997). More (1994), Panda *et al.* (1999) and El-Aggory *et al.* (2000) declared that balanced fertilization system including micronutrients can optimize the use of N fertilizer.

The present work aims at investigating the effect of spraying some organic manure extracts as well as urea fertilizer as (soil and foliar) application on yield and chemical composition of wheat plants grown on a clayey soil.

MATERIALS AND METHODS

The present study was carried out at Shibeen El-Qanater, Kalubia governorate, Egypt during two successive growing seasons of 2001/2002 & 2002/2003 to identify the effect of foliar application of some organic manure extracts (1manure : 12 water) or urea solution (2% N) together with a basal dose of urea fertilizer at a rate of 25 or 75 kg N fed^{-1} on wheat yield and its components as well as elemental composition of wheat plants grown on a clayey soil. Some characteristics of the experimental soil and used organic manures were determined according to Black (1965) and Page (1982) and tabulated in Tables (1 and 2). Also, the chemical composition of the organic manure extracts was presented in Table (3).

Table (1): Particle size distribution and some chemical properties of the soil at the experimental site:

pH (1:2.5)	EC (dS m^{-1})	Soluble cations (meq/L)				Soluble anions (meq/L)			
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{-}
7.9	1.3	4.90	1.60	6.50	0.50	-	2.35	6.85	4.30
Coarse sand %		Fine sand %		Silt %	Clay %	O.M. %	$CaCO_3$ %	Soil texture	
6.30		27.83		13.70	52.17	2.65	3.15	Clay soil	
Available N (mg kg^{-1})		Available P (mg kg^{-1})				Available K (mg kg^{-1})			
45.00		10.00				780.0			

Table (2): Chemical composition of the used organic manures

Manure	pH (1:5)	EC dSm^{-1} (1:5)	O.M. (%)	N (%)	P (%)	K (%)	C (%)
Pigeon	6.12	7.65	69.85	4.10	0.95	0.93	31.50
Chicken	6.42	8.50	62.70	2.85	0.68	0.79	29.30
Biogas	7.31	8.15	47.70	1.30	0.64	0.74	25.24

Table (3): Chemical composition of the organic manure extracts with a ratio of (1:12).

Manure	pH 1:12	EC dSm^{-1} 1:12	Macronutrients (%)			Micronutrients (ppm)		
			N	P	K	Fe	Mn	Zn
Pigeon	8.23	3.85	2.44	0.50	0.47	18.6	8.2	6.1
Chicken	6.48	3.85	1.37	0.38	0.41	17.1	7.6	6.8
Biogas	8.31	2.50	0.83	0.36	0.34	21.7	14.3	13.7

Experimental treatments:

Wheat (Gemmeza 5, *Triticum aestivum* L.) was used and N at the rate of 25 kg fed^{-1} as well as the phosphatic and potash fertilizers were applied just before cultivation. N at the rate of 75 kg fed^{-1} was applied at three doses the first one (20%) just before cultivation, the second one (40%) before life irrigation and the third one just before the next irrigation.

The detailed experimental treatments were as follows:

- Foliar application of urea solution (2% N) at a rate of 600 L fed^{-1} was added after 25 and 50 days from planting.
- Foliar application of organic manure extracts at a rate of 600 L fed^{-1} was applied in 4 equal doses at 20, 40, 60 and 80 days after cultivation.

The field trails have been established in a complete randomized block design (3x4 m) involving 5 treatments. All the plots received basal applications of N in the form of urea at a rate of 25 or 75 kg fed^{-1}, P and K in the forms of calcium superphosphate and potassium sulfate (15 kg P_2O_5 and 24 kg K_2O fed^{-1}) at the recommended doses.

RESULTS AND DISCUSSION

Effect of the tested variables i.e., two nitrogen levels (25 and 75 kg N fed^{-1}) as soil application, urea solution spray (2% N) and the organic manure extracts (pigeon, chicken and biogas) as foliar application on plant height, both straw and grain yields and 1000 grain weight of wheat are illustrated in Table (4).

It is obvious from the obtained data that a significant effect could be noticed between the two nitrogen levels as applied basically to the soil. Taking into consideration the differences appeared for plant yield and its components, it could be concluded that all these differences, except for in case of plant height, seemed to be significant as compared with the control treatment. In this concern,

Table (4): Effect of the nitrogenous treatments and organic manure extracts on wheat yield and its components.

Treatments	Plant height (cm)			Grain yield (ton fed^{-1})			Straw yield (ton fed^{-1})			1000 grain weight (g)		
	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I
1	86.66	104.83	95.75	2.34	2.71	2.52	3.74	3.61	4.18	39.01	41.89	40.45
2	105.93	120.87	113.40	2.79	2.94	2.86	3.82	5.53	4.70	41.17	42.89	42.03
3	118.90	129.80	124.40	3.59	3.91	3.75	4.72	6.68	5.70	44.50	44.51	44.50
4	109.70	127.60	118.65	3.51	3.55	3.53	4.70	6.58	5.63	43.07	43.76	43.41
5	83.17	128.80	105.98	3.28	3.46	3.37	4.37	6.31	5.34	42.18	43.23	42.71
Mean II	100.87	122.40	-	3.10	3.31	-	3.74	4.61	-	41.99	43.25	-
L.S.D. at 0.05	I = NS II = 13.706 I x II = NS			I = 0.118 II = 0.071 I x II = 0.160			I = 0.276 II = 0.175 I x II = 0.389			I = 0.801 II = 0.504 I x II = 1.131		

1. Control (25 kg N fed^{-1} or 75 kg N fed^{-1}).
2. 2% N urea as foliar application
3. Pigeon manure extract (1 : 12 ratio) foliar application.
4. Chicken manure extract (1 : 12 ratio) foliar application.
5. Biogas manure extract (1 : 12 ratio) foliar application.

it can be said that the pigeon extract was of the most pronounced effect on wheat yield and its components, where it resulted in the highest values of plant height (124.4 cm), grains yield (3.75 ton fed^{-1}) straw yield (5.7 ton fed^{-1}) and 1000 grain weight (44.5 g). Chicken manure extract came in the second order as its effects on the above mentioned parameters though were lower than the corresponding ones of the pigeon manure extract yet that were obviously higher than the other treatments.

The elemental composition of the organic manure extracts especially their content of N, P and K and the micronutrient may account for such a finding. These results stand in well agreement with those of More (1994) who stated that organic materials applied to the soil enhanced significantly the grain and straw yields of wheat grown thereon. Also, Abo-Elenin *et al.* (1984) and Hamissa and Moustafa (1998) went almost to similar findings. On the other hand, Panda *et al.* (1999) attributed such enhancing effects of the applied organic manures to their beneficial effects on soil bulk density, nitrogen and organic carbon contents as well as the C/N ratio. Moreover, Narvaez *et al.* (2000) decleared that application of organic manures and compost to soil increased soil available P by 20 mg kg^{-1} soil. Abd El-Rahman (1997), Awad *et al.* (1999) and Oko *et al.* (2003) reported that application of nitrogenous source increases the population of micro-organisms on rhizosphere, thus increases the root exudates, growth hormones and consequently growth and yield of wheat plants.

The lower values of all the studied parameters attained from foliar application of urea, may be due to the grown plants are no in need for N only but their requirements of the other nutritive elements should be also fulfilled.

Regarding the values of N, P and K uptake by both grains and straw, data presented in Table (5) reveal that the pigeon manure extract was of the most superior effect on N, P and K uptake by wheat followed by chicken manure extract which occupied the second order whereas the foliar application of urea was of the least effect on all the studied nutrients. Such effects are expected since they reflect the chemical composition and elemental contents of the used treating materials (see Table, 3). These results agree to some extent, with those of El-Sirafy *et al.* (1989) and Faiyad *et al.* (1991) who decleared that organic matter acts as a sustained release source of N, P and K.

The interaction effect between soil application of N with foliar application of organic manure or urea seemed to be significant for N, P and K uptake by grain as well as P and K uptake by straw. Insignificant for the interaction could be observed only on N uptake by straw.

Considering the plant uptake of the nutritive elements Fe, Mn and Zn, data indicate that the effect of the biogas manure extract was the most pronounced. This is likely to be a final product of its relatively higher contents of Fe, Mn and Zn. On the other hand, foliar application of urea was associated with the lowest uptake values of Fe, Mn and Zn whereas the other organic manure extracts were associated with relatively higher Fe, Mn and Zn uptake values proportional to their content of these elements (Table 6).

Table (5): Effect of the nitrogenous treatments and organic manure extracts on N, P and K uptake by grain and straw yields.

Treatments	Grain									Straw								
	N-uptake (kg fed^{-1})			P-uptake (kg fed^{-1})			K-uptake (kg fed^{-1})			N-uptake (kg fed^{-1})			P-uptake (kg fed^{-1})			K-uptake (kg fed^{-1})		
	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I
1	37.91	52.99	45.45	9.87	18.17	14.02	6.58	7.20	6.90	13.90	25.52	19.71	6.53	14.33	10.43	4.09	5.49	4.79
2	47.85	61.53	54.70	11.58	18.90	15.24	6.67	7.23	6.95	19.16	29.78	24.47	6.60	14.00	10.29	4.17	5.39	4.78
3	56.94	64.29	60.61	18.87	23.11	20.99	8.24	10.27	9.26	28.18	37.62	32.90	14.16	20.43	17.30	5.80	6.38	6.09
4	53.27	62.22	57.74	18.45	21.62	20.04	8.04	9.18	8.61	27.51	37.38	32.44	13.87	18.41	16.14	5.77	6.24	5.99
5	52.74	62.32	57.53	16.33	22.69	19.50	7.40	9.65	8.53	27.29	36.50	31.90	12.81	19.30	16.05	5.66	6.30	5.98
Mean II	49.74	60.67	-	15.02	20.90	-	7.39	8.71	-	23.21	33.36	-	10.79	17.29	-	5.10	5.95	-
L.S.D. at 0.05	I = 2.316 II = 1.455 I x II = 3.267			I = 1.366 II = 0.861 I x II = 1.900			I = 0.415 II = 0.267 I x II = 0.594			I = 1.464 II = 0.923 I x II = NS			I = 0.686 II = 0.433 I x II = 0.980			I = 0.169 II = 0.107 I x II = 0.240		

1. Control (25 kg N fed^{-1} or 75 kg N fed^{-1}).
2. 2% N urea as foliar application
3. Pigeon manure extract (1 : 12 ratio) foliar application.
4. Chicken manure extract (1 : 12 ratio) foliar application.
5. Biogas manure extract (1 : 12 ratio) foliar application.

Table (6): Effect of the nitrogenous treatments and organic manure extracts on Fe, Mn and Zn uptake by grain and straw yields.

Treatments	Grain									Straw								
	Fe-uptake (kg fed^{-1})			Mn-uptake (kg fed^{-1})			Zn-uptake (kg fed^{-1})			Fe-uptake (kg fed^{-1})			Mn-uptake (kg fed^{-1})			Zn-uptake (kg fed^{-1})		
	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I	25 kg N	75 kg N	Mean I
1	142.40	217.40	179.90	94.59	107.20	100.90	72.70	89.20	80.95	116.23	168.23	142.47	65.84	84.53	75.19	53.84	74.11	63.97
2	144.63	206.93	175.80	98.99	106.17	102.60	70.81	89.80	80.29	126.83	170.90	148.87	67.70	84.72	76.21	56.33	78.50	67.42
3	282.97	291.53	287.25	131.63	135.03	133.33	110.23	107.00	108.62	211.77	222.00	216.88	111.13	114.80	112.97	94.07	96.87	95.50
4	276.53	283.40	279.95	130.73	132.53	131.63	105.73	107.10	106.42	206.70	214.03	210.37	102.75	110.40	106.60	89.71	92.05	90.88
5	292.40	297.37	294.90	132.13	137.37	134.75	108.73	115.33	112.03	218.40	230.60	224.50	115.60	124.43	120.02	95.80	99.03	97.41
Mean II	227.40	259.31	-	117.62	123.66	-	93.64	101.68	-	175.99	201.25	-	92.61	103.78	-	77.95	88.11	-
L.S.D. at 0.05	I = 5.360 II = 3.388 I x II = 7.579			I = 2.673 II = 1.692 I x II = 3.774			I = 4.276 II = 2.711 I x II = 6.058			I = 5.019 II = 3.177 I x II = 0.128			I = 3.979 II = 2.494 I x II = 5.613			I = 1.841 II = 1.161 I x II = 2.598		

1. Control (25 kg N fed^{-1} or 75 kg N fed^{-1}).
2. 2% N urea as foliar application
3. Pigeon manure extract (1 : 12 ratio) foliar application.
4. Chicken manure extract (1 : 12 ratio) foliar application.
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دراسة مقارنة عن تأثير التسميد الورقى باليوريا ومستخلصات بعض الأسمدة العضوية على محصول القمح ومكوناته

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أجريت هذه الدراسة خلال موسمين متتالين(٢٠٠١/٢٠٠٢، ٢٠٠٢/٢٠٠٣) بمنطقة شبين القناطر – محافظة القليوبية لاستبيان تأثير التسميد الورقى باليوريا (٢% نيتروجين)، ومستخلصات بعض الأسمدة العضوية بالماء (بنسبة ١ سماد : ١٢ ماء) والتى أضيفت رشا على محصول القمح ومكوناته (صنف جميزة ٥). ولقد تم إضافة اليوريا رشا على دفعتين متساويتين بمعدل ٦٠٠ لتر/فدان بعد ٢٥، ٥٠ يوم من الزراعة، بينما تم الرش بمستخلصات الأسمدة العضوية على ٤ دفعات متساوية بمعدل ٦٠٠ لتر/فدان بعد ٢٠، ٤٠، ٦٠، ٨٠ يوم من الزراعة، بالإضافة إلى مستوين من النيتروجين المضاف للأرض (٢٥، ٧٥ كجم نيتروجين /فدان) على صورة يوريا ٤٦,٥% نيتروجين.

وتشير النتائج المتحصل عليها إلى:

- أوضحت النتائج المتحصل عليها أن قيم كل من طول نباتات القمح، ومحصول الحبوب والقش، وزن الـ ١٠٠٠ حبة قد زادت بدرجة معنوية باستخدام المعاملات السابق الإشارة إليها، وخاصة عند الإضافات الأساسية من النيتروجين بالمعدلين موضع الدراسة (٢٥، ٧٥ كجم نيتروجين/فدان).
- أظهرت النتائج أن الرش بمستخلص سماد الحمام كان ذات أفضلية مقارنة بالمعاملات السمادية الأخرى المستخدمة وذلك فيما يتعلق بالمحصول ومكوناته.
- وفيما يختص بمحتوى النباتات من عناصر النيتروجين، والفوسفور، والبوتاسيوم تشير النتائج إلى أن مستخلص سماد الحمام كان أفضلها، بينما الرش باليوريا كان أقلها تأثيرا.

أظهر مستخلص سماد البيوجاز تأثيرا أكثر وضوحا على محتوى النباتات من العناصر الصغرى بدرجة تفوق تأثير المعاملات السمادية الأخرى تحت الدراسة.