

## **EFFECT OF N-FERTILIZER WITH FOLIAR APPLICATION OF FYM EXTRACT ON YIELD AND MINERAL COMPOSITION OF WHEAT PLANTS.**

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### **ABSTRACT**

Two field experiments were conducted at Tag El-Ezz, Dakhalia governorate Research Station, Egypt, (17m altitude, 31° 36' latitude and 30° 57' longitude), during two successive winter seasons of 2007/2008 and 2008/2009. The work aimed to study the effect of N-fertilizer rates (45, 60 and 75 kg N/fed<sup>1</sup>) with foliar application of FYM extract rates (0.0 only distilled water, 5, 10, 15 and 20 %) on yield and mineral composition of wheat plants.

The data show :-

- 1- Adding 75 kg N/fed gave the highest mean values for all plant growth characteristics under study (plant height, leaf area, spike length, grain & straw yield and protein %) also increasing N, P and K concentration and uptake by wheat grains, while using 60 Kg N/fed gave the highest mean values for micronutrients concentration and uptake (Fe-Mn and Zn).
- 2- Foliar application of FYM extract (20%) gave the best results for most characteristics under study. While foliar application of FYM extract (15%) gave the best mean values for Fe concentrations & uptake and Zn concentration.
- 3- The interaction effect between treatments of 60 kg N/fed with foliar application of FYM extract (15%) gave the highest mean values at all studied characteristics under study.
- 4- From this trial, it can be recommended that, using 60 kg N/fed, with foliar application of FYM extract (15%), will improve wheat yield, (straw and seeds / fed) as well as mineral content of grains.

### **INTRODUCTION**

- Wheat is considered a very important crop for many countries in the world, which is regarded as the most important cereal crop in Egypt. The amount needed of such crop is greater than locally produced.
- Nitrogen is the most important element of wheat production in many cereal crops, Sultan *et al.*, (1993) indicated that nitrogen levels markedly increased plant height and crude protein percentage in grains up to 90 kg N/fed in both seasons. Moreover, application of N-fertilizer up to 75 kg N/fed markedly increased number of spike/m<sup>2</sup>. Zaher (1996) pointed out that increasing nitrogen fertilizer levels from 30 to 60, 90 and 120 kg N/fed significantly increased plant height, spike length, grain yield & straw yield and grain protein percentage.
- The literature suggest that certain liquid extraction of manure or composts can supply plants with at least four major benefits: a source of inorganic nutrients and beneficial organic compounds (Hadas and Resenberg, 1992); an ability to suppress certain plant disease (Brintone *et al.*, 1996); as a way to build soil structure when applied as a drench and optimizes the soil.

pH ( Ingham, 2000 a & b ) . In this respect Ingham (2001) mentioned that compost extract is rich in nutrients and microorganisms and can stimulate growth, protect plants from diseases and help suppress soil borne pathogens.

- The present work aimed to study the effect of N-fertilizer rates with foliar application of FYM extract on growth, yield & its components and nutrients uptake by wheat plant.

## MATERIALS AND METHODS

- Two field experiments were carried out at agriculture research station , Tag El-Ezz , Dakhalia governorate,(17m altitude, 31° 36' latitude and 30° 57' longitude), in the two growth seasons of 2007/2008 & 2008/2009 , respectively .

Soil : Representative surface soil samples (0-30cm) of the experiment were taken to analysis and also FYM and its aqueous extract . All characteristics were determined according to Piper (1950), Black (1965) and Page *et al.*, (1982) as indicated in Table 1.

**Table 1: Some mechanical and chemical properties of the soil, FYM and its aqueous extract for the experimentation.**

Soil			FYM				
pH (1:2.5 soil: water susp.)		8.2	pH (1:10 soil: water susp.)		7.10		
Ec (dsm <sup>-1</sup> , (1:5 soil: water ext.)		4.2	Ec (dsm <sup>-1</sup> , (1:10 soil: water ext.)		4.40		
O.M %		1.53	O.M %		38.38		
Total carbonate %		2.29	Total - N %		0.65		
Available mg/kg	N	26.00	C %		22.26		
	P	9.00	C / N ratio		34.25		
	K	268.14					
<b>Partial size distribution</b>							
Clay %		Silt %		Sand %		Texture	
64.86		24.89		10.25		clayey	
<b>Total contents of some nutrients in the FYM extract (1:10 w/v)</b>							
pH	Ec	Macronutrient (mgL <sup>-1</sup> )			Micronutrient (mgL <sup>-1</sup> )		
		N	P	K	Fe	Mn	Zn
7.10	3.10	35.00	10.10	266.00	6.2	4.13	3.80

**Studied crop:** Wheat (*Triticum aestivum* L.) Sakha 93 was obtained from Agric. Res. Center. The planting date were 20<sup>th</sup> and 25<sup>th</sup> of November in the two respective seasons. The two experiments were performed in a split plot design with four replicates. Each experiment included 60 plots, As a result the combination of the following factors :

- Nitrogen fertilizer levels (main plots): Three N-levels were 45, 60 and 75 kg N/fed. Nitrogen fertilizer in the form urea (46.6% N) was applied at the above mentioned levels in two equal portions before the first and second irrigation.

- The mineral fertilizers P and K (as single super phosphate, 15.5% P<sub>2</sub>O<sub>5</sub> and potassium sulphate, 48% K<sub>2</sub>O) were added at recommended rates (100 and 50 Kg/fed; respectively)
- Soaking 25 kg compost used was prepared from FYM with water, for 25 days. The aqueous extract from this compost was prepared, in dilution ratio of 1:10 (w/v) in plastic bottle (Brinton *et al.*, 1996).
- Extraction FYM: five ratios of FYM extract levels were (0.0 only water as control), 5, 10, 15 and 20 % for foliar application at after 45 days from sowing and the three times with intervals 15 days. The sub plot size was 3.5 length and 3.0 m in width i.e. (1/400 fed).
- Wheat plants were harvested after 6 months from sowing. Samples were collected from one m<sup>2</sup> in a plot and calculated per 1 feddan for grain and straw yield. Plant samples were collected for drying at 70°C till a constant weight and dry weight was recorded. The recorded data were as following:-  
Growth parameters; plant height (cm), leaf area (cm<sup>2</sup>), spike length (cm), grain yield (ardab. fed<sup>-1</sup>) and straw yield (ton. fed<sup>-1</sup>)
- Crude protein percentage in wheat grains was determined using the improved kjhldahl method according to A.O.A.C. (1980) by multiplying the nitrogen percentage by 5.75.
- Chemical parameters; N, P, K, Fe, Mn and Zn content were determined according to Jackson (1973).
- The analysis of variance for a split plot design was carried out for both years and the treatments means were compared by using the least significant differences (L.S.D) as mentioned by Gomez and Gomez (1984).

## RESULTS AND DISCUSSION

### 1- Growth characters :

The effect of nitrogen fertilizer rates on some plant growth characteristics are shown in Table 2. Where the increase in N-rates give highly significant increase effect and adding 75 kg N/fed have heighest mean values for all plant growth characteristics under study which are :plant height , Leaf area , spike length ,(grain& straw )yield and protein % their values are : 107.87 cm , 22.31 cm<sup>2</sup> , 11.86 cm , 13.75ardab fed<sup>-1</sup> , 2.68 ton fed<sup>-1</sup> and 12.85 % , respectively .

The effect of FYM extract rates on studied factors are illustrated in the same Table 2. Using 20% of FYM extract gave the favorite effect for most parameters under study except leaf area and grain yield (23.28 cm<sup>2</sup> and 14.78 ardab fed<sup>-1</sup>) were less than the value of 15% of FYM extraction gave the heighest mean values for leaf area and grain yield ( 23.55 cm<sup>2</sup> and 14.87 ardab fed<sup>-1</sup>). And It was noticed that the increasing rates of extract which percent the increasing mean values of all parameters under study.

Table (2) indicated the interaction effect of nitrogen rates with extraction of FYM on some wheat plant growth characteristics and protein %.The data refer to there is a highly significant effect of all treatments and their interactions on the studied factors such as: plant height, leaf area, spike length, grain, straw yield and protein %.

Data in Table 2, show the increasing N rates from 45 to 75 kg N/fed gave a significant positive effect on all studied factors with using extraction of FYM extract from 0.00 to 20 % . The data show the combination effect of using 45 kg N/fed with 20% of FYM extraction gave the highest mean values for all plant growth characteristics (plant height, leaf area, spike length, grain, straw yield and protein %) while using 60 kg N/fed with 15% of FYM extraction gave the highest mean values for all studied treatments But using 75 kg N/ fed gave the highest mean values for studied factors with 10% of FYM extraction. It is clear that , using 60 kg N/fed with 15% of FYM extraction gave the best results in this trail compared with other treatment and the data were , 121.26 , 25.95 , 12.96 , 15.86 , 3.10 and 14.56 % for plant height, leaf area ,spike length , grain , straw yield and protein % respectively.

**Table (2): Interaction effect between N-fertilizer rates and foliar application of FYM extract on some growth and yield components of wheat plants.**

Treatment	Plant height (cm)	Leaf area (cm <sup>2</sup> )	Spike length (cm)	Grain yield ardeb fed <sup>-1</sup>	Straw yield ton fed <sup>-1</sup>	Protein %	
<b>A- N- fertilizer rates</b>							
45 kg N/fed	95.02	20.022	10.51	12.12	2.394	12.00	
60 kg N/fed	104.06	21.976	11.29	13.31	2.678	12.748	
75 kg N/fed	107.87	22.31	11.86	13.75	2.68	12.85	
LSD 5 %	0.0713	0.0078	0.0131	0.0183	0.0052	0.0607	
<b>B- FYM extraction rates</b>							
Control	78.86	17.26	9.54	9.79	1.493	10.19	
5	96.85	20.45	10.1966	12.41	2.56	12.04	
10	106.69	22.68	11.45	13.44	2.889	13.05	
15	114.19	23.55	12.27	14.87	2.98	13.41	
20	114.99	23.28	12.64	14.78	3.00	13.516	
LSD 5 %	0.0616	0.0100	0.01888	0.0180	0.00973	0.0692	
<b>AB- interaction</b>							
45 kg N/fed	Control	73.06	15.89	8.87	9.01	1.26	10.00
	5	92.90	19.45	9.14	11.88	2.08	11.50
	10	96.32	20.41	10.63	12.51	2.70	13.00
	15	102.40	21.29	11.05	13.05	2.94	12.19
	20	110.40	23.07	12.88	14.16	3.00	13.31
60 kg N/fed	Control	80.91	17.12	9.68	10.10	1.56	10.19
	5	96.15	20.15	10.12	12.32	2.81	12.19
	10	103.70	22.02	11.53	13.50	2.91	13.31
	15	121.26	25.95	12.96	15.86	3.10	14.56
	20	118.30	24.64	12.16	14.78	3.01	13.63
75 kg N/fed	Control	82.62	18.78	10.10	10.30	1.66	10.38
	5	101.51	21.75	11.33	13.03	2.80	12.44
	10	120.05	25.61	12.89	15.30	3.06	14.19
	15	118.90	23.28	12.81	15.01	2.91	13.50
	20	116.26	22.13	12.80	15.00	3.00	13.75
LSD 5 %	0.1848	0.03014	0.0566	0.0541	0.02918	0.2077	

It can be concluded, foliar application of FYM extract either in a single form or in combination with mineral fertilizer led to a positive effect on the growth characters of wheat plants, this can be attributed to the role played by this substance for hastening the performance of nutrients availability in the presence of mineral fertilizer, beside high biological benefits of the used of spraying of extraction of FYM. These results confirmed with the work of Abd EL-Hameed *et al.*, (2003)

**2- Nutrients content :**

**2-a- Macronutrients:**

Data respected in Table 3, illustrate the effect of N-fertilizer and FYM extract rates on N, P and K percentage and uptake by wheat plant under study. It can noticed that, the N rate of 75 kg/fed have a highly significant effect on all studied parameters.

**Table (3): Interaction effect between N-fertilizer rates and foliar application of FYM extract on macronutrients concentration and uptake by grains of wheat.**

Treatment	N %	N-uptake kg/fed	P %	P-uptake kg/fed	K %	K- uptake kg/fed	
<b>A- N- fertilizer rates</b>							
45 kg N/fed	1.92	32.48	0.33	4.87	0.35	6.91	
60 kg N/fed	2.04	34.6	0.36	5.35	0.35	7.05	
75 kg N/fed	2.06	34.80	0.37	5.50	0.36	7.07	
LSD 5 %	0.0041	0.00453	0.00453	0.01570	0.00523	0.00261	
<b>B- FYM extract rates</b>							
Control	1.63	27.59	0.27	4.08	0.29	5.96	
5	1.93	32.62	0.31	4.68	0.34	6.81	
10	2.16	36.52	0.37	5.58	0.37	7.27	
15	2.15	36.34	0.40	5.93	0.38	7.41	
20	2.17	36.73	0.40	5.92	0.38	7.55	
LSD 5 %	0.01035	0.00939	0.00939	0.0087	0.01004	0.010357	
<b>AB- interaction</b>							
45 kg N/fed	Control	1.60	27.09	0.25	3.73	0.28	5.78
	5	1.84	31.15	0.30	4.48	0.34	6.81
	10	2.08	35.09	0.32	4.78	0.35	6.98
	15	1.95	33.01	0.35	5.23	0.37	7.33
	20	2.13	36.06	0.41	6.12	0.39	7.87
60 kg N/fed	Control	1.63	27.59	0.28	4.18	0.29	5.96
	5	1.95	33.01	0.31	4.63	0.33	6.64
	10	2.13	36.05	0.35	5.23	0.35	6.99
	15	2.33	39.45	0.47	7.02	0.42	8.18
	20	2.18	36.90	0.38	5.67	0.38	7.49
75 kg N/fed	Control	1.66	28.10	0.29	4.33	0.30	6.13
	5	1.99	33.69	0.33	4.93	0.35	6.98
	10	2.27	38.42	0.45	6.72	0.40	7.84
	15	2.16	36.56	0.37	5.53	0.36	7.15
	20	2.20	37.24	0.40	5.97	0.37	7.33
LSD 5 %	0.03107	0.02819	NS	0.02610	0.030145	0.03107	

\* These number expressed on average values during both seasons

Also increasing rates of FYM extract gave increases mean values of all parameters. It obvious that extraction 20% of FYM has the highest mean values for N, P and K % and uptake.

The interaction effect between treatments on macronutrients were reported in table 3, which refer to a highly significant effect on studied parameters except for P% which was insignificant, where adding 45 kg N/fed with 20% of FYM extract gave the highest mean values compared by other extraction of FYM concentration. While the highest mean values for 60 kg N/fed treatments, was obtained by interaction with 15% foliar application of FYM extract for all studied treatments. Also 75 application kg N/fed with 10% foliar application of FYM extract gave the highest mean values for all studied factors. In respect of comparing by N-levels and their effect on the trial. It was clear that the best results were obtained from using 60 kg N/fed with 15% foliar of FYM extraction, which the results were 2.33%, 39.45kg fed<sup>-1</sup>, 0.47%, 7.02 kg fed<sup>-1</sup>, 0.42% and 8.18 kg fed<sup>-1</sup> for N%, N-uptake, P%, P-uptake, K% and K-uptake, respectively. It can be concluded that, foliar application of FYM extract in single form or a combination with mineral fertilization led to a positive effect on N, P and K concentration and uptake. This results confirmed the prominent role of FYM extract which develop the root system of plant and improved water nutrient uptake. Also the role played by foliar application of FYM extract which contain enough values of macro nutrients which absorbed by leaves of wheat plants. These results confirmed with the work of Sarhan *et al.*, (2007).

### **2-b-Micronutrients:**

Data respected in Table 4 show the effect of N-fertilizer rates and foliar application rates of FYM extract rates on Fe, Mn and Zn concentration and uptake by wheat grains of under study. It can be noticed that adding 60 kg N/fed gave the highest mean values for Fe, Mn and Zn for concentration and uptake, which are: 100.01mg kg<sup>-1</sup>, 227.39 gm fed<sup>-1</sup>, 51.19mg kg<sup>-1</sup>, 117.96 gm fed<sup>-1</sup>, 46.28 mg kg<sup>-1</sup> and 108.24 gm fed<sup>-1</sup>, respectively.

From the same table, it can be noticed that foliar application at ratio of 15% FYM extract gave the heighest mean values for Fe concentration, uptake and Zn concentration only (103.71 mg kg<sup>-1</sup>, 235.81 gm fed<sup>-1</sup> and 47.09 mg kg<sup>-1</sup>, respectively. And using 20% of FYM extract gave the heighest mean values for Mn concentration, uptake and Zn uptake (51.97 mg kg<sup>-1</sup>, 119.75 gm fed<sup>-1</sup> and 116.76 gm fed<sup>-1</sup>) respectively.

From Table (4), it is clear that highly significant effect was obtained from the interaction between N-fertilizer rates and FYM extract rates for micronutrients by grains of wheat (*Triticum a sativum* L.). The data show, using 45 kg N/fed with 20% of FYM extraction gave the best effect as micronutrients concentration and uptake by wheat plant, while adding 60 kg N/fed with 15% FYM extraction gave the best results for all studied factors, and 75 kg N/fed with 10% of FYM extract gave the heighest mean values for all factors under study.

From data in table 4. It can noticed that using 60 kg N/fed with 15 % of FYM extract gave the best results for concentration and uptake of micronutrients in this trial. The values were: 120.13 mg kg<sup>-1</sup>, 273.14 gm fed<sup>-1</sup>, 54.18 mg kg<sup>-1</sup>, 124.84 gm fed<sup>-1</sup>, 49.88 mg kg<sup>-1</sup> and 116.67 gm fed<sup>-1</sup> for for Mn and Zn concentration and uptake, respectively.

This results imply that the role of foliar application of FYM extraction which contain a lot of micronutrients which are absorbed by leaves, beside mineral fertilizer (NPK) give availability for Fe, Zn and Mn in the soil and improved water nutrient uptake. These results confirmed with the work of Gamal and Ragab, (2003) and Sarhan, *et al.*, (2007) who concluded that foliar application of mineral fertilizers was increased Fe, Zn and Mn content compared with the control. From this study we can concluded that, using 60 kg of N/fed with 15% of FYM extract give the best results under the circumstances of this trial.

**Table (4): Interaction effect between N-fertilizer rates and foliar application rates of FYM extract on micronutrients concentration and uptake by grains of wheat.**

Treatment	Fe mg kg <sup>-1</sup>	Fe- uptake gm fed <sup>-1</sup>	Mn mg kg <sup>-1</sup>	Mn- uptake gm fed <sup>-1</sup>	Zn mg kg <sup>-1</sup>	Zn- uptake gm fed <sup>-1</sup>	
<b>A- N- fertilizer rates</b>							
45 kg N/fed	94.62	215.01	49.27	113.53	44.36	103.76	
60 kg N/fed	100.01	227.39	51.19	117.96	46.28	108.24	
75 kg N/fed	99.18	225.51	50.42	116.20	46.27	108.22	
LSD 5 %	0.24526	0.2743	0.0146	0.0269	0.04762	0.0277	
<b>B- FYM extract rates</b>							
Control	91.63	208.29	47.87	110.22	43.46	101.64	
5	94.30	214.20	49.23	113.43	45.31	105.97	
10	102.64	233.36	51.03	117.586	46.68	109.19	
15	103.71	235.81	51.43	118.51	47.09	110.14	
20	97.43	221.53	51.97	119.75	45.64	116.76	
LSD 5 %	0.25389	0.2521	0.00870	0.02737	0.03999	0.0366	
<b>AB- interaction</b>							
45 kg N/fed	Control	91.02	206.95	47.16	108.66	42.16	98.61
	5	93.16	211.18	48.19	111.04	43.70	102.22
	10	94.86	215.68	49.12	113.18	44.31	103.64
	15	96.01	218.30	49.98	115.16	45.50	106.43
	20	98.06	222.96	51.92	119.63	46.13	107.90
60 kg N/fed	Control	92.73	210.84	48.13	110.90	43.19	101.02
	5	95.07	216.16	49.62	114.33	45.11	105.51
	10	95.02	216.05	51.82	119.40	47.41	110.89
	15	120.13	273.14	54.18	124.84	49.88	116.67
	20	97.10	220.77	52.22	120.32	45.80	107.13
75 kg N/fed	Control	91.08	207.09	48.16	111.09	45.02	105.30
	5	94.67	215.25	49.88	114.93	47.11	110.19
	10	118.03	268.36	52.16	120.18	48.33	113.05
	15	95.00	216.00	50.14	115.53	45.88	107.31
	20	97.14	220.87	51.77	119.29	45.00	105.26
LSD 5 %	0.76168	0.75639	0.02610	0.08212	0.11999	0.10998	

\* These number expressed on average values during both seasons

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## تأثير التسميد النتروجيني مع الرش بمستخلص السماد البلدي على المحصول والتركيب المعدني للقمح.

عادل محمد عبد الحميد

قسم بحوث تغذية النبات - معهد بحوث الأراضي والمياه والبيئة - مركز البحوث الزراعية - الجيزة - مصر.

أجريت تجربتان خلال موسم ٢٠٠٧/٢٠٠٨ - ٢٠٠٨/٢٠٠٩ في محطة البحوث الزراعية بتاج العز - محافظة الدقهلية لدراسة تأثير التسميد النتروجيني ٤٥-٦٠ & ٧٠ كجم ن/فدان مع الرش بمستخلص السماد البلدي صفر كونترول - ٥ - ١٠ - ١٥ & ٢٠ % على المحصول والتركيب المعدني للقمح وأهم النتائج المتحصل عليها كما يلي :-

- ١- أعطت معاملة الإضافة ٧٥ كيلو جرام ن/ فدان أعلى متوسطات القيم لجميع صفات النمو تحت الدراسة ( طول النبات- مساحة الورقة- طول السنبل - محصول الحبوب والقش - نسبة البروتين) . كما أدت أيضا نفس المعاملة إلى زيادة تركيز وامتصاص النيتروجين - الفوسفور والبوتاسيوم في الحبوب- بينما أعطت معاملة ٦٠ كيلو جرام ن/ فدان أعلى متوسطات القيم لتركيز وامتصاص العناصر الصغرى ( الحديد - الماغنيزيوم والزنك ) .
  - ٢- أعطت الإضافة بالرش لمستخلص السماد البلدي بالمعاملة ( ٢٠% ) أفضل النتائج لجميع الصفات تحت الدراسة ، بينما أعطيت الإضافة للمعاملة بالرش لمستخلص السماد البلدي ( ١٥% ) أفضل النتائج لتركيز وامتصاص الحديد وتركيز الزنك .
  - ٣- أعطى التفاعل للمعاملة ٦٠ كيلو جرام ن / فدان مع المعاملة بالرش لمستخلص السماد البلدي ( ١٥% ) أعلى زيادة في جميع القيم تحت الدراسة لجميع الصفات المدروسة .
- من خلال التجربة يمكن أن نوصي بأن استخدام معاملة ٦٠ كيلو جرام ن/ فدان مع معاملة الإضافة بالرش بمستخلص السماد البلدي ( ١٥% ) أدت إلى تحسين محصول الحبوب والقش / فدان بالإضافة إلى زيادة المحتوى المعدني للحبوب .

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة

مركز البحوث الزراعية

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