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NITROGEN CONTENT AND YIELD OF WHEAT PLANT GROWN ON SANDY SOIL UNDER THE EFFECT OF ORGANIC AND BIO FERTILIZERS ADDITION

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ABSTRACT: **In Egypt, there is a great gap between consumption and production of wheat. Many efforts have been made to cross this gap within adequate and balanced nutrition in newly reclaimed soils.**

Organic fertilizers: farmyard manure "FYM", chicken manure "ChM" and plant residues "PR" were applied. Organic fertilizers were applied at the levels of 30 and 60 kg N fed^{-1}. Bio-fertilizers: Azotien, Phosphatine and Effective Microorganisms (EM) were applied. Mineral fertilizers: the recommended dose of phosphorus and potassium was added hence, the phosphorus was added as ordinary super phosphate (6.5 % P) at the rate of 15 kg P fed^{-1}, while potassium was added as potassium sulphate (41 % K) at the rate of 30 kg K fed^{-1} in tow equal doses. Nitrogen was added as ammonium sulphate ("AS" 20.6 % N) at the rate of 60, 90 and 120 kg N fed^{-1} respectively, in three equal doses.

A field experiment was conducted at Abou-Hammad town, Sharkia governorate, Egypt using wheat (*Triticum aestivum* c.v., Sakha 94) during the winter season of 2006 – 2007. This investigation aims to study the effect of organic and bio fertilization on plant growth, N uptake, grain yield and its quality. All treatments of mineral, organic and bio fertilizers in the current study were arranged in a split – plots design with three replicates.

Plant samples were collected at three different growth stages, i.e., 60, 90 and 150 days from sowing, corresponding to shooting stage, flowering stage, and harvest stage respectively. Plant samples were dried at 70 °C till constant weight and wet digested using a mixture of $HClO_4$ and H_2SO_4 for determining N uptake. Plant growth, grains yield, N uptake and its quality were measured.

The obtained results can be summarized as following:

1. **The addition of organic fertilizers significantly increased the dry matter content and grains yield; while the straw yield was decreased. The differences between the different sources of organic fertilizers were significant.**
2. **The addition of organic fertilizers significantly increased N uptake.**
3. **The addition of bio-fertilizers significantly increased the dry matter content and both of grains and straw yields. The differences between the different sources of bio fertilizers were significant.**
4. **The addition of bio fertilizers significantly increased N uptake at all stages; while the differences between the different sources of bio fertilizers were significant.**
5. **Interaction effect between organic and bio fertilization showed positive effect on dry matter content and yield of wheat.**
6. **Regarding to the interaction effect between the organic and biofertilizers on N uptake, the data showed that the interaction was significant.**

Key words: Bio-fertilizers, mineral fertilizers, organic manures, nutrients uptake, interaction effect

INTRODUCTION

The productivity of newly reclaimed sandy soils of Egypt is far less from their capacity to produce most of cultivars due to many factors, among them, poor soil fertility, low content of organic matter, low water holding capacity, high infiltration rate and low fertilizers use efficiency which in turn create many nutritional problems.

Low sandy soils fertility and productivity need to increase the use of mineral fertilizers. However, the mineral fertilizers have many problems such as speed losses, conversion into insoluble forms. Also manufacture of mineral fertilizer requires too high cost of energy; hence the organic fertilizers are known to have favorable effect on improving chemical and physical properties of the soil, as well as on nitrogen status, which in turn influence the potentiality of soil fertility.

Recently, great efforts are made on a large scale in the world to get informations about the biological activities in soil including the free living bacteria species which are able to fix atmospheric nitrogen as well as phosphate dissolving bacteria.etc.

The present work was conducted to investigate the possibility of using organic or biofertilizers in sandy soil as an alternative or complementary treatment in combination with mineral fertilization and investigating their effects on plant growth, grains yield, N uptake and quality of wheat grain.

MATERIALS AND METHODS

A field experiment was conducted at Abou-Hammad town, Sharkia governorate, Egypt using wheat (*Triticum aestivum* c.v., Sakha 94) during the winter season of 2006 – 2007. This investigation aims to study the effect of organic and bio fertilization on growth and N uptake as well as yield and quality of wheat grain.

Physical and chemical properties of the investigated soil are shown in Table1.

Mineral Fertilizers

The recommended doses of phosphorus and potassium were added, phosphorus used for all treatments was added as ordinary super phosphate (6.5 % P) at the rate of 15 kg P fed^{-1} before sowing. Potassium used for all treatments was added as potassium sulphate (41 % K) at the rate of 30 kg K fed^{-1} in two equal doses, before sowing and before booting stage. Nitrogen used for all treatments was added as ammonium sulphate (AS); 20.6 % N at the rate of 60, 90 and 120 kg N fed^{-1}, respectively in three equal doses.

Organic Fertilizers

Farmyard manure "FYM" (1.16 % N), chicken manure "ChM" (3.48 % N) and plant residues "PR" (1.39 % N) were applied as N sources. The main chemical properties of these organic fertilizers are shown in Table 2.

Bio-fertilizers

Azotien a commercial fertilizer contain non symbiotic N_2–fixing bacteria (*Azotobacter, Achromobacter*, 10^6 cell g^{-1}beat); it has an effective role of increasing the nitrogen availability in the soil, and saving nitrogen fertilizers for plants. Phosphatine a commercial fertilizer contain free living bacteria (*Bacillus megatherium* 10^6 cell g^{-1}beat) which dissolves the unavailable forms of phosphorus such as (Ca $_3(PO_4)_2$) to available forms such as (Ca $(H_2PO_4)_2$) "P-dissolving bacteria" (PDB). A commercial

Table 1a. Some physical properties of the investigated soil

CEC (me/100g)	O.M (%)	$CaCO_3$ (%)	S.P (%)	F.C (%)	Mechanical analysis				
					Fine Sand (%)	Coarse sand (%)	Silt (%)	Clay (%)	Textural Class
17.49	1.60	6.20	18.20	8.90	70.38	20.62	5.90	3.10	Sand

Table 1b. Some chemical properties of the investigated soil

EC*	pH**	SAR	Soluble ions (meL^{-1})*							
			Cations				Anions			
			Na^+	K^+	Ca^{++}	Mg^{++}	Cl^-	$CO3^-$	$HCO3^-$	$SO4^-$
0.71	7.41	3.86	4.17	0.54	1.33	1.03	1.41	nil	4.80	0.86

*Water extract of 1: 2.5 soil : water; **suspension of 1: 2.5 soil : water.

Table 1c. Some nutrients content of the investigated soil

Macro nutrients						Total micro nutrients (mg kg $soil^{-1}$)			
Nitrogen		Phosphorus		Potassium		Fe	Mn	Zn	Cu
Total (%)	Available* (mg kg $soil^{-1}$)	Total (%)	Available* (mg kg $soil^{-1}$)	Total (%)	Available* (mg kg $soil^{-1}$)				
0.14	93.30	0.04	13.80	0.13	298.35	671.05	180.10	55.26	59.20

* Extract for nutrients as follow: N (2 M **KCl** extract; mineral N); P: 0.5 M **NaHCO3** extractant **at** pH **8.5**; K: 1 M **NH4OAc at adjusted** pH **7.**

Table 2. Some chemical characteristics of the used organic fertilizers used

Characters / Organic fertilizers	EC*	pH**	C:N ratio	O.M (%)	Macro nutrients				Total Micro nutrients (%)			
					Nitrogen		Phosphorus	Potassium	(mg kg-1 soil)			
					Total (%)	Available (mg kg^{-1} soil)	Available (mg kg^{-1} soil)	Available (mg kg^{-1} soil)	Fe	Mn	Zn	Cu
Farmyard manure	3.00	7.25	12 : 1	24.82	1.16	279.9	95.0	4065	2.31	551	187	117
Chicken manure	4.21	7.84	9 : 1	56.03	3.48	4804.7	250.0	9016	0.22	391	316	123
Plant residues	3.22	8.72	15 : 1	35.34	1.39	350.0	132.0	10295	1.32	426	144	110

* Water extract of 1: 10 organic fertilizers: water ; ** suspension of 1: 10 organic fertilizers: water.

suspension named EM (Effective Microorganisms) containing photosynthic bacteria, lactic acid bacteria, yeast and fungi.

Experimental Design

The design of the experiment was a randomized complete block "factorial", involving 3 factors as follows:

FactorA: organic-mineral-N using farmyard manure (FYM); chicken manure (ChM), and plant residues (PR).

Factor B: bio-fertilization using: non-symbiotic N2–fixing bacteria "*Azotobacter*, *Achromobacter*, 10^6 cell g^{-1}beat" (in form of a commercial biofertilizer Azotien) ; P-dissolving bacteria (PDB)" *Bacillus megatherium* 10^6 cell g^{-1}beat" (in form of a commercial biofertilizer Phosphatine), and a mixture of microorganisms including photosynthic bacteria, lactic acid bacteria, yeast and fungi(in form of a commercial biofertilizer EM), a mixture of PDB + N2–fixing bacteria ; and a no-biofertilization treatment.

Factor C: N-type rates: using 3 rates of all mineral N, 1/3 organic N + 2/3 mineral N, 1/2 organic N + 1/2 mineral N.

Thus, total number of treatments is 45 (3 organic-mineral-N ×5 biofertilization × 3 N-type rates)

Organic N fertilizers combined with mineral N fertilizer were applied in the following rates:

(1) 120 kg N fed^{-1} (AS).
(2) 30 kg N fed^{-1} (FYM) + 90 kg N fed^{-1} (AS).
(3) 60 kg N fed^{-1} (FYM) + 60 kg N fed^{-1} (AS).
(4) 30 kg N fed^{-1} (ChM) + 90 kg N fed^{-1} (AS).
(5) 60 kg N fed^{-1} (ChM) + 60 kg N fed^{-1} (AS).
(6) 30 kg N fed^{-1} (PR) + 90 kg N fed^{-1} (AS).
(7) 60 kg N fed^{-1} (PR) + 60 kg N fed^{-1} (AS).

Bio-fertilization was achieved through the addition of bio fertilizers as follows

(1) No addition, control.
(2) Azotien: 10 g $plot^{-1}$(10.5 m^2); mixed thoroughly with the soil before sowing.
(3) Phosphatine: 10 g $plot^{-1}$(10.5 m^2); mixed thoroughly with the soil before sowing.
(4) Azotien + Phosphatine: (5g Azotien + 5g Phosphatine) $plot^{-1}$; mixed thoroughly with the soil before sowing.
(5) Effective Microorganisms (EM): 3 L fed^{-1} with irrigation water three times, once every month starting from sowing.

The bio-fertilizer treatments were applied under the above combined treatments of organic and mineral N fertilizers.

All treatments of organic, mineral and bio fertilizers in the current study were arranged in a split – plots design with three replicates.

Plant samples were collected at three different growth stages i.e. 60, 90 and 150 days from sowing, corresponding to shooting, flowering, and harvest stage, respectively. Plant samples were dried at 70 °C till constant weight and wet digested using a mixture of $HClO_4$ and H_2SO_4 (Piper, 1950) for determining total-N. Plant growth, N uptake, grain yield and yield quality were measured.

Methods of Analysis

Soil analysis

The following soil analyses were conducted:

Particle size distribution, by the pipette methods (Piper, 1950).

Calcium carbonate ($CaCO_3$) content, gasometrically using Collin 's Calcimeter (Piper, 1950).

Soil reaction (pH), using a glass electrode pH meter in (1:2.5) soil: water suspension (Jackson, 1973).

Electrical conductivity (EC) and soluble ions in (1:2.5) soil: water extracts as described by Jackson (1973).

Organic matter, the methods described by Black (1982).

Cation exchange capacity (CEC), according to Jackson (1973).

Available nitrogen was determined by steam - distillation procedure using MgO - Devarda alloy according to Bremner and Keency methods as described by Black (1982).

Available phosphorus in soil solution extracted by 0.5 N $NaHCO_3$ of pH adjusted at 8.5 (Olsen *et al.*1954); determined colourimetrically using the ascorbic acid methods (Watanabe and Olsen, 1965).

Available potassium, using 1 N ammonium acetate at pH 7.0 and determined flamephotometrically according to Jackson (1973).

Total nitrogen content was measured using the micro - Kjeldahl method according to Jackson (1973).

Total micro nutrients (Fe, Mn, Zn and Cu) in conc. H_2SO_4 acid using an atomic absorption spectrophotometer as described by Black (1982).

Fertilizers analysis

pH was measured using a glass electrode pH meter in (1: 10) organic fertilizer : water suspension according to Jackson (1973).

EC was measured in (1:10) organic fertilizer: water extracts as described by Jackson (1973).

Organic matter and total (N, P, K, Fe, Mn, Zn and Cu) and available (N, P and K) were determined as well as soil analysis.

Total bacterial count was determined using soil extract a jar medium according to Allen (1953).

Plant analysis

Total nitrogen content was determined using the micro - Kjeldahl method according to Jackson (1973).

Protein percent "yield quality" was calculated by N x 5.7 for wheat grains (Bishni and Hughes, 1979).

Statistical analysis

Statistical analysis of obtained results was carried out according to MSTAT-C (1988) program for ANOVA and L.S.D analysis.

RESULTS AND DISCUSSION

Effect of Organic and Bio fertilizers on Plant Growth

Effect of organic fertilizers

Data in Tables 3 and 4 reveal that, generally the farmyard manure addition gave the highest dry matter weight of wheat plant (0.721 kg plot^{-1}) at the shooting stage. The highest value (3.400 kg plot^{-1}) of wheat dry weight at the flowering stage was observed under the addition of plant residues. In this respect, Saks *et al.* (1992) found that the dry matter weight of wheat showed a pronounced increase by addition of FYM especially in combination with 60kg N/fed. Basyouny (2001) found that application of organic manures (FYM or chicken manure) had marked effect on the shoot dry weigh of wheat at tillering stage.

Statistical analysis of the obtained data shows that the addition of organic fertilizers significantly increased the dry matter weight. The differences between the different sources of organic fertilizers were significant.

Effect of bio-fertilizers

Data show that the highest values of dry matter weight at shooting and flowering stages

Table 3. Dry matter weight of wheat plant (kg plot^{-1}) at the shooting stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	0.649	0.977	0.889	0.937	0.708	0.832
	90 AS / 30 Org.	0.715	1.158	0.865	0.972	0.832	0.908
	60 AS / 60 Org.	0.798	0.991	0.899	0.972	0.884	0.909
	Mean	0.721	1.042	0.884	0.960	0.808	0.883
(ChM)	120 AS	0.649	0.977	0.889	0.937	0.708	0.832
	90 AS / 30 Org.	0.737	1.078	1.013	0.854	0.744	0.885
	60 AS / 60 Org.	0.742	1.164	0.884	0.890	0.879	0.912
	Mean	0.709	1.073	0.929	0.894	0.777	0.876
(PR)	120 AS	0.649	0.977	0.889	0.937	0.708	0.832
	90 AS / 30 Org.	0.681	1.166	1.000	0.872	0.736	0.891
	60 AS / 60 Org.	0.716	0.959	0.804	0.834	0.745	0.812
	Mean	0.682	1.034	0.898	0.881	0.730	0.845
Grand mean		0.704	1.050	0.903	0.912	0.772	0.868
Means of N-type rates (AS -N/org.)							
120 AS		0.649	0.977	0.889	0.937	0.708	0.832
90 AS / 30 org.		0.711	1.134	0.959	0.899	0.771	0.895
60 AS / 60 org.		0.725	1.038	0.862	0.899	0.836	0.877
LSD at 0.05	O	B	R	BO	BR	OR	BOR
	0.022	0.028	0.022	0.048	0.048	0.038	0.084

Notes:

A.S = Ammonium sulfate
FYM = Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

Table 4. Dry matter weight of wheat plant (kg plot^{-1}) at the flowering stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	3.412	4.917	4.502	3.649	3.470	3.990
	90 AS / 30 Org.	3.150	4.825	3.617	3.998	3.594	3.837
	60 AS / 60 Org.	3.401	4.050	3.765	3.793	3.574	3.717
	Mean	0.721	3.321	4.597	3.961	3.813	3.546
(ChM)	120 AS	3.412	4.917	4.502	3.649	3.470	3.990
	90 AS / 30 Org.	3.546	4.660	5.114	4.638	3.661	4.324
	60 AS / 60 Org.	2.882	4.661	5.617	4.258	4.077	4.299
	Mean	0.709	3.280	4.746	5.078	4.182	3.736
(PR)	120 AS	3.412	4.917	4.502	3.649	3.470	3.990
	90 AS / 30 Org.	3.352	4.415	4.014	4.943	3.907	4.126
	60 AS / 60 Org.	3.436	4.929	4.028	4.113	3.795	4.060
	Mean	0.682	3.400	4.754	4.181	4.235	3.724
Grand mean		0.704	3.334	4.699	4.407	4.077	3.669
Means of N-type rates (AS-N/org.)							
120 AS		3.412	4.917	4.502	3.649	3.470	3.990
90 AS / 30 org.		3.349	4.633	4.249	4.526	3.720	4.096
60 AS / 60 org.		3.240	4.547	4.470	4.055	3.815	4.025
LSD at 0.05	O	B	R	BO	BR	OR	BOR
	0.111	0.143	N.S	0.247	0.247	0.192	0.428

Notes:

A.S = Ammonium sulfate
FYM = Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

(0.977 and 4.917 kg plot^{-1}, respectively) were observed under the addition of Azotien. In this respect, Indu-Bala et al. (1988) found that wheat inoculation with *Azospirillum braslense* and *Azospirillum lipoferum* increased dry matter content by 2.9-8.4% and 0.0-10.0%, respectively.

(El- Maddah et al. 2005) found that seed inoculation with *Azotobacter chroococcum* increased plant growth.

Statistical analysis of the obtained data shows that the addition of bio-fertilizers increased significantly the dry matter weight.

The differences between the different sources of bio-fertilizers were significant.

Interaction effect between organic and bio fertilization

Concerning the interaction effect between organic and bio fertilization, presented data in Table 3 show that the addition of Azotien combined with chicken manure gave the highest value (1.073 kg plot^{-1}) of dry matter content at shooting stage. Regarding to the flowering stage, the addition of Phosphatine combined with chicken manure gave the highest value (5.078 kg plot^{-1}, Table 4) of dry matter content.

Concerning the interaction effect between the organic and bio fertilizers under study, the statistical analysis in Tables 3 and 4 show that the interaction effect between the organic and bio fertilizers under study was positive. In this respect, Desoki (2000) found that enriched compostused by using some microbial activators such as *Azotobacter chroococcum* (an active N_2 fixer), *Bacillus megatherium* (an active P-dissolver) and *Trichoderma viride* (a cellulose decomposer) with some organic amendments increased plant growth than those obtained by using town refuse compost as organic manure.

Effect of Organic and Bio fertilizers on Yield of Wheat

Effect of organic fertilizers

Data in Tables 5 and 6 reveal that, at the harvest stage, the highest values of grains and straw yields of wheat (5.591 and 5.725 kg plot^{-1}, respectively) were recorded under the addition of chicken manure and plant residues, respectively. In this respect, Abou-Bakr and Omar (1996) revealed that the addition of organic manure i.e. plant residues, farm wastes, mature compost or green manure to newly reclaimed sandy soil increased both yield and yield components of wheat; where increases were more pronounced

Table 5. Dry matter weight of wheat grains (kg plot^{-1}) at the harvest stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C) Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	5.154	5.556	5.570	5.418	5.362	5.412
	90 AS / 30 Org.	3.637	6.896	5.766	6.143	5.556	5.600
	60 AS / 60 Org.	5.415	6.507	6.181	6.349	5.418	5.974
	Mean	4.735	6.320	5.839	5.970	5.445	5.662
(ChM)	120 AS	5.154	5.556	5.570	5.418	5.362	5.412
	90 AS / 30 Org.	6.279	7.515	7.179	8.657	6.463	7.219
	60 AS / 60 Org.	5.339	6.925	6.452	7.905	5.481	6.421
	Mean	5.591	6.666	6.401	7.327	5.769	6.350
(PR)	120 AS	5.154	5.556	5.570	5.418	5.362	5.412
	90 AS / 30 Org.	5.305	8.155	8.132	7.191	6.699	7.097
	60 AS / 60 Org.	5.757	7.143	6.232	6.802	5.919	6.371
	Mean	5.405	6.952	6.645	6.470	5.993	6.299
Grand mean		5.224	6.646	6.295	6.589	5.746	6.104
Means of N-type rates (AS-N/org.)							
	120 AS	5.154	5.556	5.570	5.418	5.362	5.412
	90 AS / 30 org.	5.074	7.522	7.026	7.330	6.240	6.638
	60 AS / 60 org.	5.504	6.858	6.288	7.019	5.636	6.261
LSD at 0.05	**O**	**B**	**R**	**BO**	**BR**	**OR**	**BOR**
	0.036	0.047	0.036	0.081	0.081	0.063	0.140

Notes:

A.S = Ammonium sulfate
FYM = Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

Table 6. Dry matter weight of wheat straw (kg plot^{-1}) at the harvest stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	6.177	6.836	6.398	6.468	6.292	6.434
	90 AS/ 30 Org.	5.299	7.382	5.598	5.878	5.560	5.944
	60 AS/ 60 Org.	5.051	6.236	5.885	6.304	5.719	5.839
	Mean	5.509	6.818	5.961	6.217	5.857	6.049
(ChM)	120 AS	6.177	6.836	6.398	6.468	6.292	6.434
	90 AS/ 30 Org.	4.783	7.565	7.534	8.075	5.681	6.728
	60 AS/ 60 Org.	5.360	6.874	6.137	7.492	5.415	6.256
	Mean	5.440	7.092	6.690	7.345	5.796	6.473
(PR)	120 AS	6.177	6.836	6.398	6.468	6.292	6.434
	90 AS/ 30 Org.	5.358	6.993	6.585	6.907	6.108	6.390
	60 AS / 60 Org.	5.639	7.130	6.078	6.579	5.846	6.254
	Mean	5.725	6.986	6.354	6.651	6.082	6.335
Grand mean		5.558	6.891	6.334	7.38	5.908	6.286
Means of N-type rates (AS-N/org.)							
	120 AS	6.177	6.614	6.398	6.468	6.292	6.390
	90 AS / 30 org.	5.147	7.313	6.573	6.954	5.773	6.352
	60 AS / 60 org.	5.350	6.747	6.030	6.791	5.660	6.116
LSD at 0.05	O	B	R	BO	BR	OR	BOR
	0.202	0.261	0.202	0.452	0.452	N.S	0.783

Notes:

A.S = Ammonium sulfate
FYM =Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

with increasing the rate of applying of these soil conditioners. El-Beshbeshy (2000) reported that wheat plants responded significantly to compost application, when it was applied alone or in combination with mineral fertilizers, compared with mineral fertilizers alone.

Statistical analysis of the obtained data showed that the addition of organic fertilizers significantly increased the grains yield; while the straw yield was decreased. The differences between the different sources of organic fertilizers were highly significant.

Effect of bio-fertilizers

At harvest stage, the highest values of grains and straw yield of wheat (5.570 and 6.836 kg $plot^{-1}$, respectively) were obtained by the addition of Phosphatine and Azotien, respectively. In this respect, Fares (1997) noticed that inoculation of wheat seeds by *Azotobacter* showed a significant increase in grains and straw yields of wheat. Abdel-Hamid (1995) found that significant increases in the yield of different corps were possible when seeds inoculated with P-dissolvers in the presence of rock-phosphate.

Statistical analysis of obtained data, Tables 5 and 6 showed that, the addition of bio-fertilizers significantly increased the grains and straw yields. The differences between the different sources of bio-fertilizers were significant.

Interaction effect between organic and bio fertilization

At the harvest stage, the addition of (Azotien + Phosphatine) gave the highest values (7.327 and 7.345 kg $plot^{-1}$, Table 5 and 6 respectively) of grains and straw yield respectively were observed when combined with chicken manure. In this respect, Khamis and Metwally (1998) found that grains yield of wheat increased by the incorporation of organic material inoculated with microbial decomposers and *Azotobacter* in the soil compared to mineral fertilizer.

The statistical analysis shows that, the interaction effect between organic and biofertilizers under study was positive.

Effect of Organic and Bio fertilizers on N Uptake by Wheat Plant

Effect of organic fertilizers

Data in Tables 7, 8, 9 and 10 reveal that, generally the chicken manure addition gave the highest

Table 7. N-uptake by wheat plant (g plot^{-1}) at shooting stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	26.11	40.04	32.34	34.83	26.18	31.90
	90 AS / 30 Org.	28.26	47.53	33.43	37.15	28.94	35.06
	60 AS / 60 Org.	27.13	38.37	33.43	35.30	31.65	33.18
	Mean	27.17	41.98	33.06	35.76	28.93	33.38
(ChM)	120 AS	26.11	40.04	32.34	34.83	26.18	31.90
	90 AS / 30 Org.	30.63	45.88	37.64	33.05	30.85	35.61
	60 AS / 60 Org.	26.98	46.62	32.19	34.06	30.82	34.13
	Mean	27.91	44.18	34.05	33.98	29.28	33.88
(PR)	120 AS	26.11	40.04	32.34	34.83	26.18	31.90
	90 AS / 30 Org.	24.28	43.31	33.26	31.30	25.65	31.56
	60 AS / 60 Org.	22.74	33.65	25.57	27.13	25.16	26.85
	Mean	24.38	39.00	30.39	31.09	25.67	30.10
Grand mean		26.48	41.72	32.50	33.61	27.96	32.45
Means of N-type rates (AS-N/org.)							
	120 AS	26.11	40.04	32.34	34.83	26.18	31.90
	90 AS / 30 org.	27.72	45.57	34.77	33.83	28.48	34.08
	60 AS / 60 org.	25.62	39.55	30.39	32.17	29.21	31.39
		O	B	R	BO	BR	OR	BOR
LSD at 0.05		0.356	0.459	0.356	0.795	0.795	0.616	2.638

Notes:

A.S = Ammonium sulfate
FYM =Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

Table 8. N-uptake by wheat plant (g plot^{-1}) at flowering stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	66.07	123.5	93.16	88.95	82.93	90.92
	90 AS / 30 Org.	58.79	86.73	64.04	86.37	61.70	71.52
	60 AS / 60 Org.	62.74	87.9	71.72	72.42	64.16	71.79
	Mean	62.53	99.37	76.30	82.58	69.59	78.08
(ChM)	120 AS	66.07	123.5	93.16	88.95	82.93	90.92
	90 AS / 30 Org.	64.86	89.12	102.7	86.21	73.49	83.27
	60 AS / 60 Org.	53.58	100.1	104.7	95.51	81.95	87.16
	Mean	61.5	104.2	100.2	90.22	79.46	87.19
(PR)	120 AS	66.07	123.5	93.16	88.95	82.93	90.92
	90 AS / 30 Org.	60.24	76.49	75.29	81.24	70.78	72.81
	60 AS / 60 Org.	45.74	103.7	70.11	71.76	67.56	71.78
	Mean	57.35	101.2	79.52	80.65	73.76	78.50
Grand mean		60.46	101.6	85.33	84.48	74.27	81.23
	Means of N-type rates (AS-N/org.)						
	120 AS	66.07	123.5	93.16	88.95	82.93	90.92
	90 AS / 30 org.	61.30	84.11	80.67	84.61	68.66	75.87
	60 AS / 60 org.	54.02	97.23	82.18	79.89	71.21	76.91
	O	B	R	BO	BR	OR	BOR
LSD at 0.05	0.377	0.487	0.377	0.843	0.843	0.653	1.461

Notes:

A.S = Ammonium sulfate
FYM = Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

Table 9. N-uptake in wheat grains (g plot^{-1}) at harvest stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	106.20	129.8	130.6	119.3	110.0	119.2
	90 AS / 30 Org.	71.27	123.4	98.97	104.7	80.52	95.78
	60 AS / 60 Org.	63.93	119.8	96.45	105.7	95.77	96.33
	Mean	80.47	124.3	108.7	109.9	95.43	103.8
(ChM)	120 AS	106.2	129.8	130.6	119.3	110.0	119.2
	90 AS / 30 Org.	91.89	151.9	110.5	160.0	96.29	122.1
	60 AS / 60 Org.	80.04	122.4	97.11	123.4	90.67	102.7
	Mean	92.71	134.7	112.7	134.2	98.99	114.7
(PR)	120 AS	106.2	129.8	130.6	119.3	110.0	119.2
	90 AS / 30 Org.	93.17	158.1	133.8	132.3	94.54	122.4
	60 AS / 60 Org.	64.60	115.8	111.0	111.1	97.89	100.1
	Mean	87.99	134.6	125.2	120.9	100.8	113.9
Grand mean		87.05	131.2	115.5	121.7	98.4	110.8
Means of N-type rates (AS-N/org.)							
	120 AS	106.2	129.8	130.6	119.3	110.0	119.2
	90 AS / 30 org.	85.44	144.5	114.4	132.3	90.44	113.4
	60 AS / 60 org.	69.53	119.3	101.5	113.4	94.78	99.7
LSD at 0.05	O	B	R	BO	BR	OR	BOR
	0.454	0.456	0.454	1.014	1.014	0.786	1.757

Notes:

A.S = Ammonium sulfate
FYM = Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

Table 10. N-uptake in wheat straw (g plot^{-1}) at harvest stage as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	39.79	72.96	52.95	54.03	42.94	52.53
	90 AS / 30 Org.	31.77	57.16	36.93	38.75	34.80	39.88
	60 AS / 60 Org.	33.71	41.32	39.86	48.43	38.60	40.38
	Mean	35.09	57.15	43.25	47.07	38.78	44.27
(ChM)	120 AS	39.79	72.96	52.95	54.03	42.94	52.53
	90 AS / 30 Org.	27.39	56.28	43.92	64.02	33.42	45.01
	60 AS / 60 Org.	31.75	41.99	41.15	48.14	40.17	40.64
	Mean	32.98	57.08	46.01	55.40	38.84	46.06
(PR)	120 AS	39.79	72.96	52.95	54.03	42.94	52.53
	90 AS / 30 Org.	58.91	79.40	61.24	63.85	60.74	64.83
	60 AS / 60 Org.	47.34	76.07	54.37	61.21	47.54	57.30
	Mean	48.68	76.14	56.19	59.70	50.41	58.22
Grand mean		38.92	63.45	48.48	54.05	42.67	49.52
Means of N-type rates (AS-N/org.)							
	120 AS	39.79	72.96	52.95	54.03	42.94	52.53
	90 AS / 30 rg.	39.36	64.28	47.37	55.54	42.99	49.91
	60 AS / 60org.	37.60	53.13	45.12	52.59	42.10	46.12
LSD at 0.05	O	B	R	BO	BR	OR	BOR
	0.258	0.862	0.258	1.181	1.181	0.915	2.046

Notes:

A.S = Ammonium sulfate
FYM = Farmyard manure,
Ch.M = Chicken manure
PR = Plant residues
Bio = No addition
Bio I = Azotien
BioII = Phosphatine
Bio III = Azotien + Phosphatine
Bio IV= EM
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

N uptake (27.91 g plot^{-1}) at the shooting stage. However the highest of N uptake value at the flowering stage (62.53 g plot^{-1}) was accrued under the addition of farmyard manure.Moharram (1997) and Abdel-Wahab (1999) reported that addition of organic materials with 50 kg N/fed gave the highest values of N uptake by wheat plants grown on sandy soils.

However, at the harvest stage the highest values of N uptake in grains and straw (92.71 and 48.68 g plot^{-1}, respectively) were recorded due to the addition of chicken manure and plant residues respectively. These results agree with these obtained by Amer *et al.*(1997) who found that the addition of organic manure to wheat plants grown on sandy soil at a rate of 2.0% markedly increased N uptake by wheat plants. Sarkar and Singh (1997) found that organic fertilizer alone or in combination with chemical fertilizers increased the total N content.

Statistical analysis of obtained data show that the addition of organic fertilizers significantly increased N uptake. The differences between the different sources of organic fertilizers were highly significant.

Effect of bio-fertilizers

Regarding the effect of bio-fertilizers addition on N uptake, data show that the highest values of N uptake at shooting and flowering stages (40.04 and 123.5 g plot^{-1}, Tables 7 and 8, respectively) were observed under the individual addition of Azotien. In this respect, Mutry and Ladha (1988) and Patel *et al.* (1996) and Rashid *et al.* (1996) stated that inoculation of wheat plants with *Azospirillum, Azotobacter* strains increased N uptake in plants.

However, at the harvest stage, the addition of Phosphatine and Azotien gave the highest values of N uptake in both grains and straw (130.6 and 72.96 g plot^{-1}, Tables 9 and 10, respectively). In this respect, Amare and Dahdoh (1997) stated that inoculation of wheat grains with a mixture of *Azotobacter* sp. plus *Azospirillum* sp. increased the uptake of N in the straw. Gopal *et al.* (2000) concluded that inoculation with *Azotobacter* increased N uptake of wheat plants over no plants inoculation.

Statistical analysis of the obtained data showed that the addition of bio-fertilizers increased significantly N uptake at all growth stages; while the differences between the different

sources of bio-fertilizers were significant.

Interaction effect between organic and bio fertilization

Concerning the interaction effect between organic and bio fertilization, presented data in Tables 7 and 8 show that the addition of Azotien, combined with chicken manure gave the highest values (44.18 and 104.2 g $plot^{-1}$, respectively) of N uptake of wheat plants at shooting and flowering stage, respectively. At the harvest stage, the addition of Azotien combined with chicken manure gave the highest value (134.7 g $plot^{-1}$, Table 9) of N uptake of grains. Concerning of N uptake of straw, data in Table 10 show that the addition of Azotien gave the highest value of N uptake (76.14g $plot^{-1}$) when combined with plant residues. In this respect, Abdalla *et al.* (2003) reported that the greatest N uptake was obtained by the addition of microbine (a mixture of N-fixing + P-dissolving bacteria) combined with organic manure.

Regarding to the interaction effect between the organic and biofertilizers, the statistical analysis in Tables 7, 8, 9 and 10 show that the interaction effect between the organic and biofertilizers under study was highly significant.

Effect of Organic and Bio fertilizers on Yield Quality

Effect of organic fertilizers

Data in Table 11 reveal that, the highest value of wheat grains protein percent (9.89 %) was recorded under the addition of farmyard manure.

Effect of bio fertilizers

Regarding to the effect of bio fertilizers addition on protein percent, data show that the highest value (13.37 %, Table 11) was recorded under the addition of Phosphatine. In this respect, Omar et al. (1996) suggested that inoculation with B. polymyxa and A. brasilense beside nitrogen fertilization have a positive effect on both yield and grains protein content of wheat.

Interaction effect between organic and bio fertilization

Concerning the interaction effect between organic and bio fertilization, presented data in Table 11 show that the highest value of protein percent (11.64 %) was observed under the addition of Azotien when combined with chicken manure.

Table 11. Protein content (%) of wheat grains as affected by organic and bio fertilization

Org. min. -N (A)	N-type rates (AS-N/Org.-N)(B)	Bio-fertilizer (C)					
		Bio 0	Bio I	Bio II	Bio III	Bio IV	Mean
(FYM)	120 AS	11.75	13.31	13.37	12.55	11.69	12.53
	90 AS / 30 Org.	11.20	10.20	9.783	9.715	8.261	9.832
	60 AS / 60 Org.	6.730	10.50	8.896	9.489	10.08	9.137
	Mean	9.890	11.34	10.68	10.58	10.01	10.50
(ChM)	120 AS	11.75	13.31	13.37	12.55	11.69	12.53
	90 AS / 30 Org.	8.342	11.52	8.775	10.54	8.493	9.533
	60 AS / 60 Org.	8.545	10.08	8.578	8.899	9.432	9.107
	Mean	9.544	11.64	10.24	10.66	9.873	10.39
(PR)	120 AS	11.75	13.31	13.37	12.55	11.69	12.53
	90 AS / 30 Org.	10.01	11.05	9.379	10.49	8.044	9.795
	60 AS / 60 Org.	6.396	9.244	10.16	9.312	9.435	8.909
	Mean	9.384	11.20	10.97	10.78	9.725	10.41
Grand mean		9.606	11.39	10.63	10.67	9.869	10.43
Means of N-type rates (AS-N/org.)							
	120 AS	11.75	13.31	13.37	12.55	11.69	12.53
	90 AS / 30 org.	9.851	10.92	9.312	10.25	8.266	9.720
	60 AS / 60 org.	7.224	9.941	9.211	9.233	9.649	9.051

Notes:

A.S = Ammonium sulfate
Ch.M = Chicken manure
Bio = No addition
BioII = Phosphatine
Bio IV= EM
FYM = Farmyard manure,
PR = Plant residues
Bio I = Azotien
Bio III = Azotien + Phosphatine
120 AS = 120 kg N fed-1 (as A.S)
90 AS / 30 org. = 90 kg N fed-1(as A.S) +30 kg N fed-1 (Org.)
60 AS / 60 org. = 60 kg N fed-1(as A.S) +60 kg N fed-1 (Org.)

In this respect, El-Sersawy *et al.* (1997) studied the effect of using composted garbage; alone or with either sludge or sheep dung; combined with biofertilizers on wheat plants grown under sand sandy soil conditions. They reported that under all treatments, the N uptake and protein content of straw and grains were enhanced.

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محتوى النيتروجين والمحصول لنبات القمح النامى فى أرض رملية تحت تأثير إضافة الأسمدة العضوية والحيوية

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أجريتْ تجربة حقلية في مدينة أبو حماد / محافظة الشرقية باستخدام القمح (سخا٩٤) وذلك خلال الموسم الزراعى ٢٠٠٦ / ٢٠٠٧ ،بهدف دراسة تأثير التسميد العضوي والحيوي على محتوى المادة الجافة، وامتصاص النيتروجين وكذلك إنتاجية المحصول. أخذت العينات النباتية عند ثلاث مراحل نمو مختلفة منْ الزراعة هى مرحلة الإستطالة، مرحلة التزهير، ومرحلة الحصاد (٦٠، ٩٠ ،١٥٠ يوماً منْ الزراعة على التوالى). وقد تم تقدير محتوى المادة الجافة وامتصاص النيتروجين وكذلك إنتاجية المحصول وجودتة.

النَتائج المتحصل عليها يُمكنُ أنْ تُلخّصَ كالتالي:

١. أوضح التحليلَ الإحصائيَ للبياناتِ المتحصل عليها أنّ إضافةَ الأسمدة العضوية أدت إلى زيادة محتوى المادة الجافة ومحصول الحبوب زيادة معنوية؛ بينما نقص محصول القش. وكانت الإختلافات بين المصادرِ المختلفة للأسمدة العضوية معنوية .
٢. أوضح التحليلَ الإحصائيَ للبياناتِ المتحصل عليها أنّ إضافةَ الأسمدة العضوية أدت إلى زيادة امتصاص النيتروجين زيادة معنوية.
٣. أظهرت النَتائج أنّ إضافةَ الأسمدة الحيوية أدت إلى زيادة محتوى المادة الجافة وكلا من محصول الحبوبَ والقشّ زيادة معنوية. وكَانتْ الإختلافات بين المصادرِ المختلفةِ للأسمدة الحيوية معنوية.
٤. أوضح التحليلَ الإحصائيَ للبياناتِ المتحصل عليها أنّ إضافةَ الأسمدة الحيوية أدت إلى زيادة امتصاص النيتروجين زيادة معنوية في كل مراحل النمو، وكانت الإختلافات بين المصادرِ المختلفة للأسمدة الحيوية معنوية .
٥. أوضحت النَتائج أنّ التداخل بين الأسمدة العضوية والحيوية تحت الدراسة على محتوى المادة الجافة ومحصول الحبوب والقشّ كَانَ إيجابياً.
٦. أظهر التحليلَ الإحصائيَ أنّ التداخل بين الأسمدة العضوية والحيوية على امتصاص النيتروجين كَانَ معنوياً.