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INFLUENCE OF COMPOST, N-MINERAL AND HUMIC ACID ON YIELD AND CHMICAL COMPOSITION OF WHEAT PLANTS

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ABSTRACT

Two field experiments were carried out at the experimental farm of El-Ismailia Agric. Research station, during two successive winter seasons of 2007/2008-2008/2009 to study the effect of different levels of nitrogen fertilizers 0,25, 50, 75 and 100kg N/fed. from recommended dose (100kg/fed) with or without composted rice straw and ***/*** or humic acid on yield, yield components, chemical composition of wheat plant and its attributes as well as NPK uptake of wheat grain and straw, and protein content. A three way randomize complete block (Factorial) design with three replicates was used.

The obtained results could be summarized as follow;-

1- Raising mineral nitrogen fertilizer level from 25 to 50, 75 and 100 kg N/fed resulted in significant increases in plant height, spike length, grain and straw yields/fed and protein content of grain and straw. Also, NPK uptake of grain and straw were significantly increased.
2- The wheat grain and straw yields as well as their NPK contents and grain protein were significantly increased by application of compost and humic acid treatments.
3- Raising the nitrogen rate along with compost application increased the quantity and quality of wheat yield.
4- Addition of humic acid markedly increased plant height, spike length, 1000-grain weight, grain and straw yield/fed., protein content of grain, NPK uptake of both grain and straw.
5- The interaction between compost, mineral nitrogen level and humic acid had significant effects on grain yield/fed. and N,P and K uptake of straw and 1000-grain weight.
6- The highest values for yield and its components were obtained by humic acid, under the highest level of nitrogen fertilizer and compost treatment.

Therefore, it could be concluded that the application of compost+ 100 kg N/fed + humic acid was the most compatible and economical, since it has the highest wheat yield.

INTRODUCTION

Wheat is the main winter cereal crop in Egypt for grain and straw production. Wheat grains are the main source for human feed while the straw is a main source of fodder for animal feed to support the rapid developing animal production. Wheat responds to nitrogen much more than any single nutrient element. The need to apply optimal amounts of nitrogen to attain high grain and straw yields, yield components and some chemical compositions has long been emphasized. Omran *et al*. (1999), Salem *et al*. (2004), Madiha *et al*. (2004) and Abdel-Messih and Abdel-Nour (1999) found that grain and straw yields, yield components, protein and carbohydrate contents and N,P and K uptake were increased with raising nitrogen application rates.

Recently, intensive effort is being spent to minimize the amount of N fertilizers applied to wheat to decrease production cost and environmental pollution without grain yield reduction.

Organic matter application to soil is known to improve soil properties and consequently the plant growth. Among the types of organic matter, farmyard manure could be one of the most economic ways to increase organic matter content in soil. Several investigators indicated that application of FYM increased plant growth and dry matter production (Khalil *et al*., 2000). Organic fertilizers considered as an important source of humus, macro and microelements carrier and at the same time increase the activity of the useful microorganisms (El-Gizy, 1994). Dahdouh *et al*., (1999) and Laila (2004) who found that organic manure plays an important role in nutrients solubility as it activate physiological and biochemical processes in plant leading to increase the plant growth and nutrients uptake. Also, Mahmoud *et al.* (2006) found that grain and straw yields of sesame and wheat and N, P and K uptake in grain and straw yield as well as crud protein content in wheat were increased by application of 75% of N as ammonium sulfate with 25% composting rice straw.

Humic acid is very important on the biological activity in soils and this is attributed to its chemical structure and its function groups (El-Fakharani, 1999). Humic acid contains auxins which influences cell division and stem giving the cell walls the ability to stretch. So humic acid contributes on seed weight with increasing its contents of protein and oil (Singaroval *et al*., 1993).

The aim this work is to study the effect of compost of rice straw, nitrogen rates and humic acid on yield, yield components and some chemical compositions of wheat plant, (Sakha 93 cultivar) under sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were carried out at the experimental farm of El-Ismailia Agric. Research station, Agricultural Research Center (ARC), Egypt during two successive winter seasons of 2007/2008 and 2008/2009 to study the effect of different levels of nitrogen fertilizers (0,25,50,75and 100 kg N/fed.) with and without composted rice straw and /or humic acid on yield, yield components and some chemical compositions of wheat plant.

The chemical analysis of the used rice compost and some physical and chemical properties of the experimental soil were carried out as described by Black (1965), and the data obtained are presented in Tables (1 and 2). Wheat (*Triticum aestivum*, L.) "Sakha 93" was obtained from ARC. The planting date was 20^{th} and25^{th} of November in the season 2007/2008-2008/2009 respectively. A three way randomized complete block (Factorial) design with three replicates was used

Table (1): Some physical and chemical properties of the experimental soil

a- Particle size distribution

Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture class
45.2	39.5	9.34	5.96	sandy

b-Some chemical properties

pH (1:2.5, Soil : water)	EC dS/m (1:5. soil : water)	Anions (meq/L)				Cations (meq/L)				OM %	$CaCO_3$ %	Available nutrients (mg/kg soil)		
		CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+			N	P	K
7.62	0.56	-	1.92	1.61	2.18	1.62	1.45	2.10	0.54	0.38	1.12	26.5	6.90	86.7

Table (2): Some characteristics of composted rice straw

Characters	Values
pH (1:10 water suspension)	7.5
EC (dS/m, 1:10"soil : water extract)	5.26
Organic carbon (%)	20.64
C/N ratio	17.2:1
Total macronutrients (%):	
N	1.20
P	0.47
K	2.45

The experimental plot area was 10.5 m^2. The composted rice straw was added to the soil at rate 12.5kg/plot (5 ton/fed.) and thoroughly incorporated in the soil before wheat planting. Single Super phosphate (15% P_2O_5) was added as single dose at the rate of 30 kg P_2O_5 /fed. and mixed in the same times with soil surface layer. The nitrogen fertilizer(as ammonium sulphate 20.6%N) was added according to the treatment in two equal portions, i.e. after 30 and 60 days from sowing. Also, potassium fertilizer (as K-sulphate 48% K_2O) was added at the rate of 24 kg K_2O/fed., and divided into two equal portions applied with N fertilizer.

The used humic acid was of a good quality containing on dry weight basis, 53, 5, 40 and 2.5% total C, N, O, and ash, respectively and its C/N ratio was 10.6:1.

During soil preparing for planting, the half of plots received humic as potassium humat (10g air dried humic acid were shaken with one liter of distilled water at room temperature for 24h and dissolved with 20L of water and sprayed on the half plots on the soil). The other half of plots was not treated with humic acid.

The experiment included 20 treatments as follows:

Compost:

1- With compost

2- Without compost

Nitrogen levels:

1-N_0 (without nitrogen)
2-N_{25} (25 kg N/fed.).
3-N_{50} (50 kg N/fed.).
4-N_{75} (75 kg N/fed.).
5-N_{100} (recommended N) 100 kgN/fed.

Humic acid:

1-With humic acid 2- without humic acid.

The following were estimated at harvest

1- Plant height (cm).
2- Spike length (cm).
3- No. of spike /m^2.
4- Weight of 1000-grain (g).
5- Grain yield (kg/fed).
6- Straw yield (kg/fed).
7- N, P and K uptake (kg/fed).

Samples of grain and straw at harvest were taken, oven dried, weighed and ground. N, P and K contents in plant materials were determined according to the methods by Jackson (1973). Crud protein in grains was determined by multiplying the corresponding values of N- content by 5.7.used for protein cereal crops (Tel, 1984).

The results of the two seasons were subjected to the combined analysis according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

wheat yield and its components

Effect of nitrogen fertilizer levels:

Plant height, No. of spike/m^2, spike length, grain yield and straw significantly increased with increasing the rate of applied nitrogen fertilizer (Tables 3 and 4). This might be attributed to the fact that nitrogen fertilization promotes tillering in cereals and encourages the formation of more spikes/plant. These increments may be also due to that the nitrogen is one of the most important components of cytoplasm, nucleic acid and chlorophyll, so nitrogen has an important role in encouraging cell elongation, cell division and consequently increasing vegetative growth and activation of photosynthesis process which enhance the amount of metabolites necessary for building plant organs which reflect the increases in grain and straw yields. These results are in agreement with those obtained by El-Sebasy and Abd El-Maaboud (2003), Abbas *et al.* (2007) and Zaki *et al*. (2007).

Effect of compost:

Data in Tables (3 and 4) show the effect of rice compost on all growth characters and wheat yield/fed. (Grains and straw). All the studied characteristics were significantly affected by the application of compost. The positive effects of compost on wheat yield and its components are mainly due to improving the soil physical and chemical properties. Moreover, compost is considered as an important source of humus; macro and microelements carrier, and in the same time, increase the activity of the useful microorganisms. Similar results were gained by Abd El-Rasoul *et al*. (2003), Ali *et al*. (2005) and El-Shouny (2006).

Effect of Humic acid:

Application of humic acid had significant effects on increasing grain and straw yields as well as its components as compared to that without addition of humic acid, where the recorded relative increase of the grain and straw yields were 30.6 and 26.11%, respectively, over those un-treated. Theses results are in agreement with those obtained by Tawfik and Gomma (2005), El-Kouny (2007) and Ragab *et al.* (2010).

Effect of interaction between N-mineral and rice compost:

Data in Tables (3 and 4) show the interaction between N-mineral and compost treatments on all growth parameters and wheat yield/fed (grain and straw), which differed significantly. The higher growth values were obtained when nitrogen was applied at the rate of 100 kg N/fed., with compost. On the other hand, the lowest values were obtained by application of nitrogen at the rate of 25 kg N/fed without compost application.

Table (3): Effect of different nitrogen levels, compost and humic acid and their combinations on yield components of wheat plants (A mean of two seasons 2007/08 and 2008/09)

Treatment		Plant height (cm)			No. of spike/m^2			Spike length (cm)		
Compost	N-fertilizer	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean
Without compost	N_0	51.33	57.67	53.30	265.0	260.67	262.83	5.37	6.10	5.73
	N_{25}	61.00	66.33	63.66	328.62	335.00	331.81	6.60	7.03	6.81
	N_{50}	66.00	69.00	67.50	354.67	353.33	354.00	7.30	7.83	7.50
	N_{75}	69.00	71.67	70.33	363.67	380.67	372.17	7.77	8.13	7.65
	N_{100}	71.00	75.33	73.16	386.00	406.33	396.18	8.33	8.87	8.60
	Mean	63.67	68.00	65.83	339.60	347.20	343.40	7.08	7.59	7.33
With compost	N_0	61.00	64.67	62.83	274.67	281.67	278.17	5.67	6.83	6.25
	N_{25}	62.67	67.00	64.82	359.00	379.00	369.00	6.57	7.27	6.92
	N_{50}	67.33	71.00	69.16	375.67	376.67	376.17	7.07	7.97	7.52
	N_{75}	72.67	76.33	74.50	381.67	420.00	400.83	7.63	8.70	8.16
	N_{100}	79.00	82.33	80.66	402.67	443.33	423.00	8.10	8.97	8.53
	Mean	68.53	72.27	70.40	358.73	380.13	369.43	7.01	7.95	7.48
Average	N_0	56.17	61.17	58.67	269.83	271.17	270.50	5.52	6.47	5.99
	N_{25}	61.84	66.66	64.25	343.81	207.00	275.40	6.59	7.15	6.87
	N_{50}	66.67	70.00	68.93	365.17	365.0	365.00	7.29	7.90	5.79
	N_{75}	70.84	74.00	72.42	372.67	400.33	386.50	7.70	8.42	8.06
	N_{100}	75.00	78.83	76.91	404.67	461.83	433.25	8.21	8.92	8.57
	Mean	66.14	70.13	68.13	349.17	363.66	353.91	7.05	7.77	7.41
L.S.D at 5%										
Compost		0.77			0.25			0.49		
N-level		1.219			0.40			0.40		
Humic		0.771			0.25			0.25		
Compost x N		1.90			n.s			n.s		
Compost x humic		n.s			n.s			0.50		
N x humic		n.s			n.s			0.50		
CompostxNxhumic		n.s			n.s			n.s		

Table (4): Effect of different nitrogen levels, compost and humic acid and their combinations on yield of wheat plants (A mean of two seasons 2007/08 and 2008/09

Treatment		Weight of 1000 grain(g)			Grain yield (kg/fed)			Straw yield (kg/fed)		
Compost	N-fertilizer	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean
Without compost	N_0	22.70	28.36	25.53	630.30	651.00	640.65	1875.30	1941.90	1908.60
	N_{25}	26.10	33.89	30.00	718.20	768.60	743.40	2028.60	2261.90	2145.25
	N_{50}	26.24	34.80	30.52	816.60	859.20	837.90	2503.20	2555.40	2529.30
	N_{75}	28.55	36.16	32.36	858.90	1012.00	935.45	2972.90	2993.00	2982.95
	N_{100}	32.56	38.22	35.39	987.00	1486.80	1236.90	3278.70	4592.70	3935.70
	Mean	27.23	34.29	30.76	802.20	955.52	878.86	2531.74	2868.98	2700.36
With compost	N_0	24.33	29.50	26.92	680.40	819.00	749.70	2015.50	2457.60	2236.55
	N_{25}	29.67	34.91	32.29	981.00	1255.80	1118.40	2874.90	3969.90	3422.40
	N_{50}	32.58	36.37	34.48	1041.60	1262.10	1151.85	3044.00	3983.00	3513.50
	N_{75}	33.56	36.59	35.08	1100.00	1665.30	1382.65	3381.00	5154.80	4267.90
	N_{100}	35.04	42.61	38.83	1245.30	1709.40	1477.35	3853.20	5184.90	4519.05
	Mean	31.04	36.00	33.52	1009.66	1342.32	1175.99	3033.72	4150.04	3591.88
Average	N_0	23.52	28.93	26.22	655.35	735.00	695.18	1945.40	2199.75	2072.58
	N_{25}	27.89	34.40	31.14	849.60	1012.20	930.90	2451.75	3115.90	2783.83
	N_{50}	29.41	35.59	32.50	929.10	1060.65	994.88	2773.60	3269.20	3021.40
	N_{75}	31.06	36.38	33.72	979.45	1338.65	1159.05	3176.95	4073.90	3625.43
	N_{100}	33.80	40.42	37.11	1116.15	1598.10	1357.13	3565.95	4888.80	4227.38
	Mean	29.13	35.14	32.14	905.93	1148.92	1027.43	2782.73	3509.51	3146.12
L.S.D at 5%										
Compost		0.49			34.70			267.17		
N-level		1.20			334.0			997.8		
Humic		0.75			211.0			631.01		
Compost x N		1.50			340.7			998.0		
Compost x humic		1.2			2.15			818.18		
N x humic		1.35			445			1028.8		
CompostxNxhumic		1.71			479			n.s		

Effect of interaction between N-levels, compost and humic acid

Data in Tables (3 and 4) show the effect of the interaction between mineral N-levels and humic on yield components (plant height, No. of spike/m^2, spike length, 1000-grain weight and wheat yield/fed. (grain and straw). It is clear from the data that in general, plants received 100 kg N/fed in the presence of humic gave the highest yield components and wheat yield (grain and straw) The obtained results are in harmony with those of Tawfik and Gommaa (2005) and El-Kouny (2007).

Effect of interaction between N-levels and humic acid:-

Data in Tables (3 and 4) clearly show that significant increments for all aforementioned parameters were scored with the application of compost, along with the highest level of nitrogen fertilization treatment and the presence of humic

Nitrogen, phosphorus and potassium, concentrations (%) and uptake by wheat grain and straw as affected by N fertilization, compost and humic:

Data in Tables (5 and 6) clear that application of compost significantly increased N concentration and uptake of wheat grains in comparison with no compost. This may be due to the decomposition of organic manure which supplied more available nutrient elements and formation of organic and inorganic acids during decomposition which slightly reduced the soil pH which affected the solubility and availability of N, P and K. These beneficial effects were also reported by El-Kouny (2007). On the other hand, P and K concentration were not significantly affected by compost but their uptake did. The results illustrated in Tables (5 and 6) show that increasing the rate of applied nitrogen fertilizer gradually increased the amount of NPK uptake by both wheat grains and straw at maturity stage. The highest amounts of NPK taken up were recorded by application of 100 kg N/fed. This might be attributed to the role of nitrogen nutrient in increasing the root surface unit of soil volume and also the high capacity of the plant supplied with N in building metabolites, which increases the dry matter content and subsequently increase nutrients uptake by wheat plant. These findings are in harmony with those obtained by Abd El-Hady *et al*. (2006) who concluded that nitrogen level had significant effect on grain and biological yield as well as yield components.

Application of humic acid recorded highly significant increases in N, P and K-uptake by grains and straw of wheat plant. These results may be due to the improvement of soil fertility status. Presence of humic acid induced a decrease in soil pH and increasing macro and micronutrients availabilities and consequently increased nutrients uptake by crops. Theses results are in agreement with El-Kouny (2007) and Ragab *et al*. (2010).

Regarding the effect of interaction between compost and humic acid on NPK concentration and uptake by wheat grains and straw, the highest values of NPK concentration and uptake were obtained by this interaction while the lowest one was attained when compost or humic acid was not added.

The statistic analysis shows that the highest significant effect of the interaction between nitrogen treatments and humic acid on NPK uptake by wheat grains and straw was obtained by addition of 100 kg N/fed and humic.

In regard to the effect of interaction between compost, nitrogen fertilizer and humic on NPK uptake by wheat grains and straw, it was found that only N uptake in grains was significantly affected by this interaction and the highest value was obtained by applying compost, 100 kg N/fed and humic acid.

Protein as affected by N fertilization , compost and humic:

As shown in Table (7), protein (%) and protein yield (kg/fed.) in wheat grain and straw increased considerably upon the combined or single application of mineral nitrogen, compost and humic acid and the highest values were (13.97 and 238.72) for protein (%) and protein yield (kg/fed.) in grain respectively, when using N100 and compost with humic. These results are in agreement with those of Laila (2004) who mentioned that combined application of N-mineral and organic manure gave the highest grain protein yield compared to the other treatments.

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تأثير اضافة الكمبوست والنيتروجين المعدنى وحمض الهيوميك على المحصول والمكونات الكيميائية لنباتات القمح

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معهد بحوث الأراضى والمياة والبيئه- مركز البحوث الزراعية- الجيزة

أجريت تجربتان حقليتان في المزرعة البحثية لمحطة البحوث الزراعية بالإسماعيلية خلال موسمي الزراعة 2007/2008 ، 2008/2009 وذلك لدراسة تأثير مستويات مختلفة من التسميد النيتروجينى (0,25،50،75،100كجم نتروجين/فدان) من النيتروجين الموصى به (100كجم/فدان) مع إضافة أو عدم إضافة كمبوست قش الأرز وكذلك استخدم حمض الهيوميك على محصول الحبوب ومحصول القش والامتصاص الكلى للنيتروجين والفسفور والبوتاسيوم (الحبوب والقش) والنسبة المئوية للبروتين وبعض مكونات وخصائص المحصول. وقد صممت التجربة (تجارب عامليه كاملة العشوائية) مع ثلاث مكررات.

وكانت النتائج المتحصل عليها كالاتى:

١ - أدى ارتفاع معدل التسميد النيتروجينى إلى زيادة معنوية فى ارتفاع النبات، طول السنبلة، وزن 1000 حبة، محصول الحبوب والقش/فدان وأيضا محتوى البروتين في الحبوب والقش وكذلك زاد امتصاص النيتروجين والفسفور والبوتاسيوم زيادة معنوية.

٢ - أدى استخدام الكمبوست مع حمض الهيوميك إلى زيادة معنوية في محصول الحبوب، القش، وأيضا المحتوى من النيتروجين والفوسفور والبوتاسيوم وكذلك محتوى البروتين.

٣ - أدت زيادة معدلات النيتروجين تدريجيا مع إضافة الكمبوست إلى تحسين محصول القمح كما ونوعا.

٤ - إضافة حمض الهيوميك أدى إلى زيادة مميزة في ارتفاع النبات، طول السنبلة، وزن ال1000 حبة، محصول الحبوب والقش للفدان، محتوى بروتين الحبوب وامتصاص النيتروجين والفسفور والبوتاسيوم فى كل من الحبوب والقش.

٥ - أدى إضافة الكمبوست مع معدلات النتروجين المعدني إلى تأثير معنوي على محصول الحبوب وامتصاص الينتروجين.

٦ - أعلى قيم للمحصول ومكوناته وجدت عند إضافة حمض الهيوميك مع المعدل العالي للتسميد النيتروجينى المعدني وأيضا إضافة الكمبوست مقارنة بالكنترول.

لذلك يمكن التوصية بأن إضافة الكمبوست + 100كجم نيتروجين للفدان + حمض الهيوميك يعطى أعلى قيم لمحصول القمح.

قام بتحكيم البحث

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Table (5): Effect of different nitrogen levels, compost and humic acid and their combinations on NPK concentration and uptake by grain(A mean of two seasons 2007/08 and 2008/09)

Treatment		N(%)			N-uptake(kg/fed)			P(%)			P-uptake (kg/fed)			K (%)			K-uptake (kg/fed)		
Com-post	N-fertilizer	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean
Without compost	N0	0.92	0.98	0.95	5.80	6.38	6.09	0.12	0.18	0.15	0.76	1.17	0.96	0.27	0.34	0.31	1.70	2.21	1.96
	N25	1.10	1.12	1.11	7.90	8.61	8.25	0.14	0.20	0.17	1.01	1.54	1.27	0.30	0.35	0.33	2.15	2.69	2.42
	N50	1.32	1.33	1.33	10.78	11.43	11.10	0.16	0.23	0.20	1.31	1.98	1.64	0.31	0.36	0.34	2.53	3.09	2.81
	N75	1.53	1.57	1.55	13.14	15.89	14.51	0.17	0.24	0.21	1.46	2.43	1.94	0.33	0.37	0.35	2.83	3.74	3.29
	N100	1.88	1.90	1.89	18.56	28.25	23.40	0.20	0.26	0.23	1.97	3.87	2.92	0.35	0.38	0.37	3.45	5.65	4.55
	Mean	1.35	1.38	1.37	11.23	14.11	12.67	0.16	0.22	0.19	1.30	2.20	1.75	0.31	0.36	0.34	2.54	3.48	3.01
With compost	N0	1.02	1.10	1.06	6.94	9.01	7.97	0.19	0.19	0.19	1.29	1.56	1.42	0.32	0.33	0.33	2.18	2.70	2.44
	N25	1.13	1.18	1.16	11.09	14.82	12.95	0.20	0.22	0.21	1.96	2.76	2.36	0.33	0.35	0.34	3.24	4.40	3.82
	N50	1.45	1.58	1.52	15.10	19.94	17.52	0.23	0.23	0.23	2.40	2.90	2.65	0.35	0.38	0.37	3.65	4.80	4.22
	N75	1.90	1.98	1.94	20.90	32.97	26.94	0.25	0.27	0.26	2.75	4.50	3.62	0.38	0.40	0.39	4.18	6.66	5.42
	N100	2.03	2.45	2.24	25.28	41.88	33.58	0.27	0.29	0.28	3.36	4.96	4.16	0.39	0.41	0.40	4.86	7.01	5.93
	Mean	1.51	1.66	1.58	15.86	23.72	19.79	0.23	0.24	0.23	2.35	3.34	2.84	0.35	0.37	0.36	3.62	5.11	4.37
Average	N0	0.97	1.04	1.01	6.37	7.69	7.03	0.16	0.19	0.17	1.02	1.36	1.19	0.30	0.34	0.32	1.94	2.46	2.20
	N25	1.12	1.15	1.13	9.49	11.71	10.60	0.17	0.21	0.19	1.48	2.15	1.82	0.32	0.35	0.33	2.70	3.54	3.12
	N50	1.39	1.46	1.42	12.94	15.68	14.31	0.20	0.23	0.21	1.85	2.44	2.15	0.33	0.37	0.35	3.09	3.94	3.52
	N75	1.72	1.78	1.75	17.02	24.43	20.73	0.21	0.26	0.23	2.11	3.46	2.78	0.36	0.39	0.37	3.51	5.20	4.35
	N100	1.96	2.18	2.07	21.92	35.06	28.49	0.24	0.28	0.26	2.67	4.41	3.54	0.37	0.40	0.38	4.16	6.33	5.24
	Mean	1.43	1.52	1.47	13.55	18.92	16.23	0.19	0.23	0.21	1.83	2.77	2.30	0.33	0.37	0.35	3.08	4.30	3.69
L.S.D at 5%																			
Compost		0.03			0.85			0.0067			0.08			0.006			0.21		
N-level		0.14			5.2			0.0105			0.127			0.013			1.61		
Humic		0.09			3.34			0.0067			0.18			0.008			1.02		
Compost x N		0.015			5.9			n.s			0.18			0.01			1.7		
Compostx humic		0.10			3.8			0.0121			0.18			0.01			1.1		
N x humic		0.15			6.5			n.s			0.253			0.02			1.6		
Compost x N x humic		0.20			8.3			n.s			0.293			n.s			2.0		

Table (6): Effect of different nitrogen levels, compost and humic acid and their combinations on NPK concentration and uptake by straw(A mean of two seasons 2007/08 and 2008/09)

Treatment		N (%)			N-uptake(kg/fed)			P (%)			P-uptake (kg/fed)			K (%)			K-uptake (kg/fed)		
Compost	N-fertilizer	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean
Without compost	N_0	0.18	0.19	0.19	3.38	3.69	3.53	0.016	0.018	0.017	0.300	0.350	0.325	0.32	0.39	0.36	6.00	7.57	6.79
	N_{25}	0.19	0.20	0.20	3.85	4.52	4.19	0.017	0.019	0.018	0.345	0.430	0.387	0.36	0.40	0.38	7.30	9.05	8.18
	N_{50}	0.20	0.21	0.21	5.01	5.37	5.19	0.018	0.021	0.020	0.451	0.537	0.494	0.39	0.42	0.41	9.76	10.73	10.25
	N_{75}	0.21	0.23	0.22	6.24	6.88	6.56	0.020	0.021	0.021	0.595	0.629	0.612	0.40	0.44	0.42	11.89	13.17	12.53
	N_{100}	0.22	0.25	0.24	7.21	11.48	9.35	0.021	0.022	0.022	0.689	1.010	0.849	0.41	0.45	0.43	13.44	20.67	17.05
	Mean	0.20	0.22	0.21	5.14	6.39	5.76	0.018	0.020	0.019	0.476	0.591	0.533	0.38	0.42	0.40	9.68	12.24	10.96
With compost	N_0	0.20	0.25	0.26	4.03	6.14	5.09	0.019	0.022	0.021	0.383	0.541	0.462	0.36	0.40	0.38	7.26	9.83	8.54
	N_{25}	0.23	0.33	0.26	6.61	13.10	9.86	0.019	0.024	0.022	0.546	0.953	0.750	0.41	0.42	0.42	11.79	16.67	14.23
	N_{50}	0.33	0.34	0.35	10.05	13.54	11.79	0.022	0.028	0.025	0.670	1.115	0.892	0.44	0.46	0.45	13.39	18.32	15.86
	N_{75}	0.35	0.37	0.43	11.83	19.07	15.45	0.025	0.031	0.028	0.845	1.598	1.222	0.45	0.48	0.47	15.21	24.74	19.98
	N_{100}	0.38	0.40	0.31	14.64	20.74	17.69	0.028	0.033	0.031	1.079	1.711	1.395	0.47	0.52	0.50	18.11	26.96	22.54
	Mean	0.30	0.34	0.32	9.43	14.52	11.98	0.023	0.028	0.025	0.705	1.184	0.944	0.43	0.46	0.44	13.15	19.31	16.23
Average	N_0	0.19	0.22	0.22	3.70	4.92	4.31	0.018	0.020	0.019	0.341	0.445	0.393	0.34	0.40	0.37	6.63	8.70	7.67
	N_{25}	0.21	0.27	0.23	5.23	8.81	7.02	0.018	0.022	0.020	0.446	0.691	0.568	0.39	0.41	0.40	9.55	12.86	11.20
	N_{50}	0.27	0.28	0.28	7.53	9.45	8.49	0.020	0.025	0.022	0.560	0.826	0.693	0.42	0.44	0.43	11.58	14.53	13.05
	N_{75}	0.28	0.30	0.32	9.04	12.98	11.01	0.023	0.026	0.024	0.720	1.113	0.917	0.43	0.46	0.44	13.55	18.96	16.25
	N_{100}	0.30	0.33	0.27	10.93	16.11	13.52	0.025	0.028	0.026	0.884	1.361	1.122	0.44	0.49	0.46	15.78	23.81	19.80
	Mean	0.25	0.28	0.27	7.29	10.45	8.87	0.021	0.024	0.022	0.590	0.887	0.739	0.40	0.44	0.42	11.42	15.77	13.59

L.S.D at 5%	N (%)	N-uptake	P (%)	P-uptake	K (%)	K-uptake
Compost	0.007	0.71	0.0007	0.10	0.0051	0.92
N-level	0.032	4.1	0.003	0.11	0.028	2.26
Humic	0.020	2.630	0.001	0.07	0.017	1.43
Compost x N	0.029	3.8	0.008	0.13	0.029	2.9
Compost x humic	0.02	2.3	0.004	0.15	0.021	2.3
N x humic	0.03	5.7	0.002	0.17	0.035	3.6
CompostxNxhumic	0.049	6.1	0.011	0.19	0.04	4.1

Table (7): Effect of different nitrogen levels, Compost and humic acid and their combinations on protein percentage and yield(Mean of two seasons 2007/08 and 2008/09)

Treatment		Protein%(grain)			Protein%(straw)			Protein kg/fed(grain)			Protein kg/fed(straw)		
Compost	N-fertilizer	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean	Without humic	With humic	Mean
Without compost	N_0	5.24	5.59	5.42	1.03	1.08	1.05	33.05	36.36	34.71	19.24	21.03	20.14
	N_{25}	6.27	6.38	6.33	1.08	1.14	1.11	45.03	49.07	47.05	21.97	25.79	23.88
	N_{50}	7.52	7.58	7.55	1.14	1.20	1.17	61.44	65.14	63.29	28.54	30.59	29.56
	N_{75}	8.72	8.95	8.84	1.20	1.31	1.25	74.90	90.56	82.73	35.59	39.24	37.41
	N_{100}	10.72	10.83	10.77	1.25	1.43	1.34	105.77	161.02	133.39	40.98	65.45	53.21
	Mean	7.70	7.87	7.78	1.14	1.23	1.19	64.04	80.43	72.23	29.26	36.42	32.84
With compost	N_0	5.81	6.27	6.04	1.14	1.43	1.28	39.56	51.35	45.45	22.98	35.02	29.00
	N_{25}	6.44	6.73	6.58	1.31	1.88	1.60	63.19	84.47	73.83	37.69	74.67	56.18
	N_{50}	8.27	9.01	8.64	1.88	1.94	1.91	86.09	113.66	99.88	57.26	77.19	67.22
	N_{75}	10.83	11.29	11.06	2.00	2.11	2.05	119.13	187.95	153.54	67.45	108.71	88.08
	N_{100}	11.57	13.97	12.77	2.17	2.28	2.22	144.09	238.72	191.41	83.46	118.22	100.84
	Mean	8.58	9.45	9.02	1.70	1.93	1.81	90.41	135.23	112.82	53.77	82.76	68.27
Average	N_0	5.53	5.93	5.73	1.08	1.25	1.17	36.31	43.86	40.08	21.11	28.03	24.57
	N_{25}	6.36	6.56	6.46	1.20	1.51	1.35	54.11	66.77	60.44	29.83	50.23	40.03
	N_{50}	7.89	8.29	8.09	1.51	1.57	1.54	73.76	89.40	81.58	42.90	53.89	48.39
	N_{75}	9.78	10.12	9.95	1.60	1.71	1.65	97.02	139.25	118.14	51.52	73.98	62.75
	N_{100}	11.14	12.40	11.77	1.71	1.85	1.78	124.93	199.87	162.40	62.22	91.83	77.03
	Mean	8.14	8.66	8.40	1.42	1.58	1.50	77.23	107.83	92.53	41.52	59.59	50.55
L.S.D at 5%													
Compost		0.16			0.03			5.6			3.7		
N-level		0.81			0.18			5.92			17.9		
humic		0.51			0.11			3.7			11.32		
Compost x N		0.90			0.07			9.5			19.02		
Compost x humic		0.60			0.1			8.3			14.0		
N x humic		1.00			0.20			9.1			20.0		
Compost x N x humic		1.20			0.29			10.4			22.2		