J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 4 (3): 245 - 257, 2013

EFFECT OF COMPOST, COMPOST TEA AND HUMIC SUBSTANCES ENRICHED WITH K OR ZN ON RICE YIELD AND NET RETURN UNDER NITROGEN FORMS AND LEVELS

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ABSTRACT

Two field experiments were carried out at Sakha Agricultural Research Station farm, Kafr El-Sheikh Governorate, Egypt ($31^{o}05^{'}$ N latitude and $30^{o}56'$ E longitude) during the two consecutive summer seasons of 2010 and 2011 using rice (Oryza sativa L.) grains variety (Sakha,101) to study the effect of compost, compost tea and humic substances enriched with potassium or zinc elements under nitrogen forms and levels on rice yield. Split-split plot design was used with four replicates. The main plots were assigned to two nitrogen forms: anhydrous ammonia 82% N (AA) and urea 46.5% N (U). The sub-plots were assigned to three nitrogen levels (30 (N_{30}), 45 (N_{45}), 60 (N_{60}) kg N/ fed.) (fed.= 0.42 ha.). The sub sub-plots were randomly assigned to six treatments (1- control, 2- K-fulvate, 3- compost tea, 4- humic acid, 5- compost, 6- Zn-fulvate). The plot area was 3.5 x 4 = 14 m^2. Field preparation and nursery practices were performed according to the traditional local management. The results can be summarized as following:

1-No significant differences in grain or straw yield were detected between the two N forms.

2-The values of grain, straw and biological yields increased significantly as N levels increased from N_{30} to N_{45} and N_{60} on average of the two seasons.

3-The treatment of Zn-fulvate significantly increased grain, straw and biological yields on average of the two seasons.

4-The highest grain yield values (4902 kg/fed and 4899 kg/fed.) were obtained under N_{60} level. of AA or U fertilizers combined with Zn–fulvate.

5-The highest value of biological yield (12040 kg/fed.) was recorded with Zn-fulvate under AA fertilizer at N_{60} level.

6-The highest gross return values (9804 and 9798 L.E./ fed.) and net return values (9554 and 9563 L.E./ fed.) of AA and U fertilizers were obtained at N_{60} level with Zn-fulvate treatment.

7-The highest increase of net return over control value for AA (1884 L.E./ fed.) was recorded with Zn-fulvate and N_{45} level, while the highest one for U fertilizer (1232 L.E./ fed.) was obtained as Zn-fulvate used with N_{60} level.

Keywords: Nitrogen forms and levels, K-fulvate, compost tea, humic substances, compost , Zn–fulvate, net return of rice.

INTRODUCTION

In Egypt the most important goal of agriculture is the production of high quantity and quality, safe and non expensive food for an over increasing human population. Rice (Oryza sativa L.) is one of the most important summer cereal crops in the world as well as in Egypt. It is not only the staple food for nearly half of the world's population (most of them live in the developing countries) but also a source of employment key and income for the rural people (Taha et al. 2011). The yield of area unit should be increased to face the water shortage press on Egyptian Government to decrease the rice area to be 1.1 million fedden at 2012 season where it was for example 1.340 million fed. produced 5.230 million tons of paddy rice with an average yield about 3.900 tons/fed at 2002 season (Mady, 2004). By the year 2025, it will be necessary to produce about 60% more rice than is currently being produced to meet the food needs of a growing world population (Fageria, 2007).

Nitrogen fertilization plays a significant role in improving rice yield, where a high rate of nitrogen application increases leaf area development, improves leaf area duration after flowering and increases the overall crop assimilation and thus contributing to increase seed yield. In addition, N also improved grain harvest index, nitrogen harvest index and plant height which are positively associated with grain yield (Fageria, 2007). Ahmed et al. (2011) found that plant height, number of tillers/m^2 as well as 1000 grains weight, straw, and grain yields (biological yield) were achieved at the N- rate of 75 kg N/fed., while Sharief et al.(2006) and El-Hadidi et al.(2010) found that rice grain and straw yields and N, P and K-uptake by grain and straw increased with the use of nitrogen fertilizer rates up to 60 kg N/fed.

Ammonium-N or amide-N is the suitable form of nitrogen in the rice soil condition and fertilizers such as ammonium sulfate, urea, anhydrous ammonia etc…have been used preferentially in the fertilization of wetland rice (Kreem, 1993). From early time investigators had study the effect of anhydrous ammonia as a fertilizer for rice crop. El-Leboudi et al.(1975) stated that application of anhydrous ammonia was suitable for growth of rice plants and their uptake of N, P, and K.

Increasing rice production needs more mineral fertilizers, which affect soil microorganisms and causes environmental pollution as well as high cost production, less net return and NO_3 polluted rice grain (Knany and Atia, 2003). Because of these problems, much attention is being focused on alternative methods of crop production by using compost (Shaban et al. 2012), compost tea (Ghobrial, et al. 2009) and humic substances (Knany et al. 2009 b) which is safe for environment and public health.

Addition of compost, which can supply nutrient requirement of crops with released nutrient in a gradual and controlled way allows greater production with minor environmental impact. The influence of organic matter on crop growth and productivity is not just a matter of nutrient supply, but they influence the physical characteristics and the chemical properties of the soil.

Compost tea is great, because it is a very mild, organic liquid fertilizer that provides beneficial live organisms, such as bacteria, fungi, and protozoa can increase nutrient cycling and improve the soil. Compost tea, in modern terminology, is a compost extract brewed with a microbial food source like; molasses, rock dust and humic-fulvic acids. The compost-tea brewing technique, an aerobic process usually under forced aeration, extracts and grows population of microbial community (Meshref, et al. 2010 and Shaban, et al. 2012).

Humic substances are organic compounds that result from the decomposition of plant and animal materials. Humic fractions (humic acid, fulvic acid, olmic acid and humin) of the soil organic matter that are responsible for the generic improvement of soil fertility, improved productivity and change physical properties of soil, promote the chelation of many elements and make these available to plants. Antoun et al. (2010) found that addition of humic acid markedly increased wheat plant height, spike length, 1000-grain weight, grain and straw yield/fed., protein content of grain, NPK uptake of both grain and straw. Knany et al. (2009 b) found that spraying with humic substances (extracted and separated by Soil Fertility and Plant Nutrition Department, Soils, Water and Environment Institute Sakha Agric. Res. Station) increased faba bean yield, biological yield, 100 seeds weight, N%, and P%.

Zinc application is essential for rice plants, being a cofactor in enzymatic reactions. Zinc is vital for many biochemical pathways of plants, including: photosynthesis and sugar formation, protein synthesis, fertility and seed production and growth regulation. The results of addition of zinc fertilizers ($ZnSO_4$) as soil application or foliar application (2 % $ZnSO_4$) showed significant influence on growth, yield attributes, grain and straw yield as well as the concentration of N, P, and Zn in rice grain and straw (Metwally,2011).

The objectives of the present study were to assess the influence of compost, compost tea and humic substances enriched with K or Zn under nitrogen forms and levels on rice grain, straw and biological yields, harvest index and the returns from the studied treatments.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricultural Research Station farm, Kafr El-Sheikh Governorate, Egypt (31^{o}05$^{'}$ N latitude and 30^{o}56' E longitude) during the two consecutive summer seasons of 2010 and 2011 using rice (Oryza sativa L.) grains variety (Sakha101) to study the effect of compost, compost tea and humic substances enriched with potassium or zinc elements under nitrogen forms and levels on rice yield. Split-split plot design was used with four replicates. The main plots were assigned to the two nitrogen forms: anhydrous ammonia 82% N (AA) and urea 46.5% N(U). The sub-plots were assigned to the three nitrogen levels (30 (N_{30}), 45 (N_{45}), 60 (N_{60}) kg N/ fed.). The sub sub-plots were randomly assigned to the six treatments (1- control, 2- K-fulvate, 3- compost tea, 4- humic acid, 5- compost, 6- Zn-fulvate). All the six treatments were conducted as foliar spry except humic acid, and compost treatments which were soil applied. The plot area was 3.5 x 4 = 14 m^2. Field preparation and nursery practices were performed according to the traditional local management. Rice grains at the rate of 60 kg/fed was used. The anhydrous ammonia was injected into the soil ten days before transplanting as one dose, while urea was applied in two equal doses, 15 days after transplanting, and 15 days later. The recommended doses of phosphorus and potassium were applied to all plots at the rate of 100 kg super phosphate fertilizer/fed. (15%P_2O) and 50 kg potassium sulfate (48%K_2O) during preparation on the dry soil before transplanting. Compost and humic acid were mixed with the soil surface before transplanting at the rate of 10 m^3/fed., and 6 L/fed., respectively. The compost production was conducting at the farm of Agricultural Research

Center, Gimmeza, as described by Meshref et al. (2010). Compost tea was prepared at Soil Microbiology Department, Soils, Water and Environment Research Institute, Sakha Agric. Res. Station according to the method described by Ghobrial, et al. (2009). Spraying with K-fulvate (12% K_2O) and Zn-fulvate (7%Zn) (extracted and separated by Soil Fertility and Plant Nutrition Department, Soils, Water and Environment Research Institute, Sakha Agric. Res. Station, according to Page et al., 1982) at the rate of 1L/fed. Compost tea was sprayed with 10 L/fed. Both of compost tea and K-fulvate as well as Zn–fulvate were sprayed twice, the first after 2 weeks from transplanting and second two weeks later. Rice seedling were transplanted in hill (3-4 plants/hill) with 20 cm apart and 20 cm between the rows. The weeds were chemically controlled using Saturn at the rate of 1L/fed.7 days after sowing in the nursery and 4 days after transplanting in the permanent field. The two experiments were planted at 29th and 25th July in the first and second seasons, respectively. The other agriculture practices were done during the seasons as recommended. Chemical properties of compost and compost tea are presented in Table 2. At harvest, the central area of each plot were harvested, dried and threshed to estimate the grain and straw yields kg fed.$^{-1}$. Biological yield (grain and straw) and harvest index were calculated.

$$\text{Harvest Index} = \frac{\text{Grain yield (kg/fed)}}{\text{Biological yield (kg/ fed)}}$$

Some chemical and physical properties of the experimental soils were determined according to Jackson (1976) and Black et al. (1965) as shown in Table1. The analysis of compost and compost tea used in the experiments of the two seasons are found in Table 2.

Statistical analysis:

Combined analysis conducted for the data of the two growing seasons according to Cochran and Cox (1957). The differences between the mean values were compared by Duncan's Multiple Range Test (Duncan, 1955).

The net return of treatments were calculated as following according to (Atia. 2005).

Gross yield (L.E./fed) = grain yield (kg/fed.) x price of grain yield unit (L.E./kg.).

The net return of treatment (L.E./fed) = gross yield – (price of added fertilizer + price of added treatment).

The increase over control = The net return of treatment - the net return of control.

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

Season	Sand%	Silt%	Clay%	Texture	ECe* dS/m	pH**	O.M %	Available nutrients mg/kg		
								N	P	K
2010	19.8	23.1	57.1	Clayey	2.9	7.9	1.6	23	12	370
2011	19.5	22.9	57.6	Clayey	2.8	8.0	1.7	21	11	380

ECe* in the soil paste extract
pH 1:2.5 soil : water suspension**

Table 2: Analysis of compost and compost tea used in experiment of the two seasons (2010&2011)

Compost			Compost tea		
Properties	**2010**	**2011**	**Properties**	**2010**	**2011**
pH (1: 10 w/v)	7.2	7.4	pH	7.98	7.87
EC (1:10 w/v) dS/m	2.02	2.05	EC dS/m	1.94	1.89
Total moisture %	33	32	Total solid materials g/l	0.21	0.22
Bulk Density (g/cm^3)	0.61	.0.62	Total nitrogen ppm	112	114
Total nitrogen%	2.1	2.2	Total phosphorus ppm	19.8	21.6
Total phosphorus%	0.72	0.74			
Total potassium%	0.85	0.88			
Organic matter%	47.1	48.1			
Organic carbon%	27.3	27.9			
C/N ratio	13.0	12.7			

RESULTS AND DISCUSSION

1-Grain and straw yields (kg/fed.)

Data presented in Table 3 showed the effect of nitrogen forms and levels on rice grain and straw yields. Data showed that nitrogen forms affected grain yields insignificantly in the two seasons. On the other hand nitrogen levels increased grain yield significantly as N levels increased from N_{30} to N_{45} or N_{60} with no significant differences between N_{45} and N_{60} under the two N forms. Regardless N forms, raising N level from 30 to 45 and 60 kg N/fed. Increased grain yield by 21.3 and 32.2%, respectively. Straw yield showed the same trend, since the corresponding increases were 15.9 and 35.8 compared with control Table (3). It is clear from data of grain yields that the differences between AA and U decreased as N levels increased, since the differences between AA and U fertilizers were 240, 122 and 79 kg, as N levels increased from N_{30} to N_{45} and N_{60}, respectively. The grain yields increased with 18.8 and 8.4% as nitrogen levels increased from N_{30} to N_{45} and N_{60} as AA used, but it was 23.9 and 9.7% as U fertilizer used. These results may be due to presence of nitrogen of anhydrous ammonia as starter in soil before transplanting which supply the rice plant with nitrogen at early growing stages. The results was in agreement with those obtained by (El-Leboudi et al.1975, Mady, 2004, Sharief et al.2006, El-Hadidi et al.2010 and Fageria et al. 2011)

Table 3:Grain and straw yields of rice as affected by nitrogen forms and levels as a mean of two seasons (2010&2011)

Treatments	Grain yield Kg/fed.			:Straw yield Kg/fed.		
	AA	**U**	**Mean**	**AA**	**U**	**Mean**
N_{30}	3437 b	3197 b	3317 c	5212 b	4952 b	5082 c
N_{45}	4083 a	3961 a	4022 b	6379 a	5398 b	5889 b
N_{60}	4424 a	4345 a	4385 a	6978 a	6829 a	6903 a
Mean	3981	3834	3908	6189	5726	5958

Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.

The results of K-fulvate , compost tea, humic acid, compost and Zn-fulvate are shown in Table 4. Data showed that addition of K-fulvate decreased grain yield with 6.4% than control as AA used, while it increased as U fertilizer used with 7.5% while addition of K-fulvate increased straw yield with 6.3% and 10.9% as AA and U used, respectively. Knany et al. (2009 a) stated that spraying with K-fulvate increased sugar beet yield and juice quality. Addition of compost tea also decreased grain yield 1.8% than control as AA used, while the grain yield increased as U fertilizer used. Ghobrial et al. (2009) stated that addition of compost tea increased faba bean vegetative growth parameters. In addition, the use of humic acid significantly increased the grain yield compared with control. The mean value of grain yield increased from 3960 to 4026 kg/fed. under AA and from 3624 to 3807 kg/fed. under U fertilizer with humic acid treatment. Straw yield had the same trend. Similar results were reported by Zaghloul et al.(2009), who indicated that spraying Thuja Orientalis L seedlings with potassium humate increased growth compared with control plants due to the direct effect of humic acid on solubilization and transport of nutrients.Lue and Cooper (2002), Meshref, et al.(2010), El-Bassiony, et al. (2010) Shaban,et al.(2012) stated that addition of humic acid to different plants increased yield and yield components. Results in Table 4 also showed the same trend on grain yields as compost was used under AA and U fertilizers. The highest average value of grain yield (4207 kg/fed.) was obtained with Zn-fulvate, which recorded the best treatment in the two seasons. The average value of grain yield was increased with 11 % compared with control as Zn-fulvate used. The average values of grain yield can be arranged as following Zn-fulvate > compost > humic acid > K-fulvate > compost tea > control while the average values of straw yield had the following order: compost > humic acid > Zn–fulvate > compost tea > K–fulvate > control. Similar results were obtained by Matysiak et al. (2011).

Results in Table 4 showed the interaction effect between the used treatments on grain and straw yields. The highest value of grain yield obtained 4902 kg/fed. as Zn-fulvate used under 60 kg N/fed. of AA.. On the other hand the same treatment (Zn-fulvate) had the highest value of grain yield (4899 kg/fed.) under 60 kg/fed. of U fertilizer. On contrast the lowest one 2983 kg/fed. was recorded with control (N_{30}) under U fertilizer. The difference between AA and U under N_{60} level as Zn-fulvate sprayed was insignificant. The best second value as AA used was 4868 kg/fed. as Zn–fulvate under N_{45}, but the best second one of U fertilizer was 4485 kg/fed. with K-fulvate N_{60}. The highest value of straw yield was obtained (7429 kg/fed.) as K-fulvate used under AA and N_{60}. On contrast the lowest one was (4115 kg/fed.) was recorded as K-fulvate sprayed under AA and N_{30} treatment.

Table 4 :Grain and straw yields of rice as affected by nitrogen forms and levels and K-fulvate, compost tea, humic acid, compost and Zn-fulvate as a mean of two seasons (2010&2011)

Grain yield Kg /fed.									
Treatments	Anhydrous ammonia (AA)				Solid fertilizer, urea (U)				
	N_{30}	N_{45}	N_{60}	Mean	N_{30}	N_{45}	N_{60}	Mean	Average
Control	3654 a	3906 d	4320 d	3960 ab	2983 a	3625 f	4263 e	3624 b	3791 b
K-fulvate	3025 a	3813 f	4279 e	3706 b	3123 a	4080 c	4485 b	3896 ab	3801 b
Compost tea	3556 a	3893 e	4222 f	3890 ab	3080 a	3896 d	3928 f	3635 ab	3763 b
Humic acid	3571 a	4054 b	4453 b	4026 ab	3423 a	3744 e	4253 c	3807 ab	3916 ab
Compost	3570 a	3964 c	4368 c	3967 ab	3486 a	4179 b	4242 d	3969 ab	3968 ab
Zn- fulvate	3246 a	4868 a	4902 a	4339 a	3087 a	4242 a	4899 a	4076 a	4207 a
Mean	3437 b	4083 a	4424 a	3981	3197 b	3961a	4345 a	3834	3908
Straw yield Kg /fed.									
Treatments	Anhydrous ammonia (AA)				Solid fertilizer, urea (U)				
	N_{30}	N_{45}	N_{60}	Mean	N_{30}	N_{45}	N_{60}	Mean	Average
Control	5166 a	5439 f	6600 e	5735a	4157 a	4636 f	6237 f	5010 b	5373 b
K- fulvate	4115 a	6740 b	7429 a	6095a	4332 a	5790 b	6540 e	5554 ab	5824 ab
Compost tea	5844 a	6450 d	6418 f	6237a	5530 a	4882 e	7202 a	5871 ab	6054 ab
Humic acid	5039 a	6166 c	7255 b	6153a	5607 a	5776 c	7087 c	6157 a	6155 a
Compost	5951 a	6589 c	7025 d	6522a	5194 a	5954 a	6836 d	5995 ab	6258 a
Zn- fulvate	5154 a	6892 a	7138 c	6395a	4893 a	5348 d	7071 b	5771 ab	6083 ab
Mean	5212 b	6379 a	6978 a	6189	4952 b	5398 b	6829 a	5726	5958

Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.

2-Biological yield and harvest index

Data in Table 5 showed the effect of nitrogen forms and levels on biological yield and harvest index. The nitrogen forms affected biological yield and harvest index insignificantly on average of the two seasons. The results also showed that the biological yield significantly increased as nitrogen levels increased with AA and U. The values of biological rice yield due to AA and U application increased from 8649 kg/fed. to 10462 and 11402 kg/fed. and from 8149 kg/fed. to 9359 and 11174 kg/fed. as nitrogen levels increased from N_{30} to N_{45} and N_{60}, respectively. On average of the two N forms, biological yield significantly increased by 18% by increasing N level from N_{30} to N_{45} and by 34.4% by increasing N level from N_{45} to $N_{60.}$ On the other hand, the effect of nitrogen levels on harvest index, was insignificant in the two seasons.

Table 5: **Biological yield and harvest index of rice as affected by nitrogen forms and levels as a mean of two seasons (2010&2011)**

Treatments	Biological yield Kg/fed.			harvest index		
	AA	U	Mean	AA	U	Mean
N_{30}	8649 c	8149 c	8399 c	0.399 a	0.394 a	0.396 a
N_{45}	10462 b	9359 b	9911 b	0.390 a	0.424 a	0.407 a
N_{60}	11402 a	11174 a	11288 a	0.388 a	0.389 a	0.388 a
Mean	10171	9561	9866	0.392	0.402	0.397

Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.

The effect of K-fulvate, compost tea, humic acid, compost and Zn-fulvate on biological yield and harvest index are presented in Table 6. Results showed that addition of humic acid, compost and Zn-fulvate significantly increased biological yield compared with control. The Zn-fulvate treatment recorded the best treatment in this trails on rice yield, where the highest average value of biological yield (10290 kg/fed.) was recorded as Zn-fulvate used. It increased by approximately 10.7% and 14% over the control as AA and U used, respectively in the two seasons. Zinc deficiency is the most widespread micronutrient disorder in rice (Oryza sativa) due to soil types (high pH of soils and low redox potential of flooded soils). Many investigators recorded the response of rice plant and its components to addition of zinc in Egypt (Metwally,2011) and around the world (Khan, 2002).

The interaction values indicated that the highest value of biological yield (12040 kg/fed.) was obtained with Zn-fulvate under AA with N_{60} level. The lowest one of 7140 kg/fed. was recorded with control under U and N_{30}. The values of biological yield under AA and $N_{60,}$ can be arranged as following Zn-fulvate > humic acid = K-fulvate > compost > control > compost tea, but with U fertilizer was : Zn-fulvate > humic acid > compost tea > compost > K-fulvate > control. It is clear from these results that addition of Zn fulvate and humic acid had the best results. Matysiak, et al. (2011) stated that maize plants sprayed twice with extracts from seaweeds and a mixture of humic and fulvic acids had the largest shoots and roots. These results are agreeable with those obtained by Zhang and Ervin (2007) and Meshref et al.(2010), who reported that humic substances contain cytokinins and their foliar application resulted in increasing endogenous cytokinins and auxin levels which possibly leading to improve yield

The highest harvest index value of 0.424 obtained with AA and N_{30} as K–fulvate used, and the lowest one (0.361) with AA and N_{45} and the same treatment. These results mean that the rice plant which fertilized with little dose of ammonia (N_{30}) and sprayed with K-fulvate do not gave more tillers, but when the nitrogen levels of AA increased (N_{45} and N_{60}) the plant gave more tillers which do not complete its maturity, then the harvest index decreased. Sharief et al. (2006) stated that increasing nitrogen dose up to 60 kgN/fed., improved rice growth photosynthesis rate, translocation of assimilates reflected increases in tillers/m^2, flag leaf area and plant height. These results were in conformity with the results reported by Ahmed et al. (2011).

Table 6: **Biological yield and harvest index of rice as affected by nitrogen forms and levels and K-fulvate, compost tea, humic acid, compost and Zn-fulvate as a mean of tow seasons (2010&2011)**

Biological yield Kg /fed.									
Treatments	**Anhydrous ammonia (AA)**				**Solid fertilizer, urea (U)**				
	N_{30}	**N_{45}**	**N_{60}**	**Mean**	**N_{30}**	**N_{45}**	**N_{60}**	**Mean**	**Average**
Control	8820 a	9345 e	10920 d	9695 a	7140 a	8261 f	10500 f	8634 b	9164 b
K-fulvate	7140 a	10553 b	11708 b	9800 a	7455 a	9870 b	11025 e	9450 b	9625 ab
Comp. tea	9400 a	10343 c	10640 e	10128 a	8610 a	8778 e	11130 c	9506 b	9817 ab
Humic acid	8610 a	10220 d	11708 b	10179 a	9030 a	9520 d	11340 b	9963 a	10071 a
Compost	9521 a	10553 b	11393 c	10489 a	8680 a	10133 a	11078 d	9964 a	10226 a
Zn-fulvate	8400 a	11760 a	12040 a	10733 a	7980 a	9590 c	11970 a	9847 a	10290 a
Mean	8649 c	10462 b	11402 a	10171	8149 c	9359 b	11174 a	9561	9866
Harvest index									
Treatments	Anhydrous ammonia (AA)				Solid fertilizer, urea (U)				
	N_{30}	N_{45}	N_{60}	Mean	N_{30}	N_{45}	N_{60}	Mean	Average
Control	0.414 a	0.418 a	0.396abc	0.409 a	0.418 a	0.439abc	0.406ab	0.421 a	0.415 a
K-fulvate	0.424 a	0.361 abc	0.365 d	0.383 a	0.419 a	0.413bcd	0.407 a	0.413 a	0.398 a
Comp. tea	0.378 a	0.376 d	0.397 ab	0.384 a	0.357 a	0.443 a	0.353 d	0.385 a	0.384 a
Humic acid	0.415 a	0.397 bcd	0.380 cd	0.397 a	0.379 a	0.393 d	0.375 cd	0.382 a	0.390 a
Compost	0.375 a	0.376 cd	0.383 bcd	0.378 a	0.402 a	0.412 cd	0.382bc	0.399 a	0.388 a
Zn-fulvate	0.386 a	0.414 ab	0.407 a	0.403 a	0.387 a	0.442 ab	0.409 ab	0.413 a	0.408 a
Mean	0.399 a	0.390 a	0.388 a	0.392	0.394 a	0.424 a	0.389 a	0.402	0.398

Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.

3-The net return (L.E./fed.)

The gross return of grain yield (L.E./fed.) of different treatments used in trials are found in Table 7. As a general trend the values of gross return and net return of AA was higher than U fertilizer. Results showed that the gross return and net return of treatments increased as N levels increased, where the gross return increased from 7308 L.E./fed. to 7812 and 8640 L.E./fed. as nitrogen levels increased from N_{30} to N_{45} and N_{60} respectively with the control of AA fertilizer. The gross return of U fertilizer showed the same trend. The highest gross return values of AA and U fertilizers (9804 and 9798 L.E./fed.) were obtained with Zn–fulvate treatment at N_{60} level. The lowest gross return values of AA and U fertilizers at N_{60} level (8444 and 7856 L.E./fed.) were obtained with compost tea treatment. The net return of AA and U take the same trend. With regard to the values of increase over control, data showed that humic acid and Zn-fulvate had a positive values at N_{45} and N_{60} treatments as AA fertilizer used. On contrast the K-fulvate, compost tea and compost had a negative values with AA fertilizer. On the other hand K-fulvate, and Zn-fulvate had a positive values with N levels (N_{30}, N_{45} and N_{60}) of U fertilizer. Data showed that the highest increase values over control of AA and U fertilizers (1884 and 1232 L.E./fed.) were obtained as Zn-fulvate used with N_{45} and N_{60} levels. It clear from data presented in Table 7 that spraying Zn-fulvate twice at rice plants increase gross return of yield and the net return as anhydrous ammonia or urea fertilizers used with N_{60}.

Table 7: The gross return and the net return of rice grain yields (L.E. /fed.) as affected by the treatments as mean of two seasons (2010&2011)

Returns from applied fertilizers (L.E./fed.)													
Treatments		Anhydrous ammonia (AA)						Solid fertilizer, urea (U)					
		Gross return of yield L.E./ Fed.	Cost Of fert. L.E./ fed.	Cost of treat. L.E./ Fed.	Total cost L.E./ Fed.	Net return of treat. L.E./ Fed.	Increase Over control L.E./ Fed.	Gross return of yield L.E./ Fed.	Cost Of fert. L.E./ fed.	Cost of treat. L.E./ Fed.	Total cost L.E./ Fed.	Net return of treat. L.E./ Fed.	Increase Over control L.E./ Fed.
	N_{30}	7308	105	-	105	7203	-	5966	98	-	98	5868	-
	N_{45}	7812	158	-	158	7654	-	7250	146	-	146	7104	-
Control	N_{60}	8640	210	-	210	8430	-	8526	195	-	195	8331	-
	N_{30}	6050	105	40	145	5905	-1298	6246	98	40	138	6108	240
K-fulvate	N_{45}	7626	158	40	198	7428	-226	8160	146	40	186	7974	870
	N_{60}	8558	210	40	250	8308	-122	8970	195	40	235	8735	404
	N_{30}	7112	105	60	165	6947	-256	6160	98	60	158	6002	134
Compost	N_{45}	7786	158	60	218	7568	-86	7792	146	60	206	7586	482
tea	N_{60}	8444	210	60	270	8174	-256	7856	195	60	255	7601	-730
	N_{30}	7142	105	40	145	6997	-206	6846	98	40	138	6708	840
humic acid	N_{45}	8108	158	40	198	7910	256	7488	146	40	186	7302	198
	N_{60}	8906	210	40	250	8656	226	8506	195	40	235	8271	-60
Compost	N_{30}	7140	105	1500	1605	5535	-1668	6972	98	1500	1598	5374	-494
	N_{45}	7928	158	1500	1658	6270	-1384	8358	146	1500	1646	6712	-392
	N_{60}	8736	210	1500	1710	7026	-1404	8484	195	1500	1695	6789	-1542
Zn-fulvate	N_{30}	6492	105	40	145	6347	-856	6174	98	40	138	6036	168
	N_{45}	9736	158	40	198	9538	1884	8484	146	40	186	8298	1194
	N_{60}	9804	210	40	250	9554	1124	9798	195	40	235	9563	1232

Price of rice grain yield unit (1kg) = 2 L.E. Price of anhydrous ammonia unit (1 kg N) = 3.5 L.E.
Price of urea fertilizer unit (1 kg N) = 3.25 L.E. Price of K-fulvate unit (1liter) = 20 L.E.
Price of compost tea unit (1 liter)= 3 L.E Price of humic acid unit (1 liter) = 20 L.E.
Price of compost unit (1 m^3)= 150 L.E. Price of Zn-fulvate unit (1 liter) = 20

CONCLUSION

It could concluded from the results that spraying rice plant with Zn-fulvate twice as the rate of 1 L/fed, two weeks after transplanting and two weeks later, and fertilized the rice plant with 60 kg/fed of anhydrous ammonia or urea gave the best net return. Further research in field conditions is needed to give practice recommendations concerning the application of anhydrous ammonia as well as K-fulvate to improving their positive effect on the growth and development of rice

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تأثير إضافة الكمبوست وشاي الكمبوست والمواد الهيوماتية المدعمة بالبوتاسيوم والزنك علي محصول الأرز والعائد الصافي تحت مصادر ومستويات النتروجين

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أقيمت تجربتان حقليتان خلال الموسمين الصيفيين لعامي2011/2010 بمحطة البحوث الزراعية بسخا محافظة كفر الشيخ وذلك بهدف دراسة تأثير إضافة الكمبوست وشاي الكمبوست والمواد الهيوماتية الغنية بالبوتاسيوم والزنك تحت مصادر ومستويات النتروجين علي محصول الأرز.

كان التصميم المستخدم هو تصميم القطع المنشقة مرتين في أربع مكررات وكانت المعاملات تحت الدراسة هي أولا: القطع الرئيسية وكانت لمصادر النتروجين كما يلي:

1- التسميد بالأمونيا الغازية 82 % ن. 2- التسميد بسماد اليوريا 46.5%ن

ثانيا:كانت القطع الشقية لثلاثة مستويات نيتروجينية هي:30 ، 45 , 60 كجم نيتروجين للفدان،

ثالثا: كانت القطع تحت الشقية لست معاملات هي:

1- معاملة المقارنة (الكنترول). 2- الرش بسماد فولفات البوتاسيوم بمعدل 2 لتر للفدان.

3- الرش بشاي الكمبوست بمعدل 20 لتر للفدان. 4- إضافة حمض الهيومك بمعدل6 لتر للفدان

5- إضافة سماد الكمبوست بمعدل 10م3 للفدان 6- الرش بسماد فولفات الزنك بمعدل 2 لتر للفدان.

ويمكن تلخيص النتائج كما يلي:

1- كانت الفروق بين مصادر النتروجين غير معنوية.

2- زادت قيم محصول الحبوب والقش والمحصول البيولوجي زيادة معنوية مع زيادة مستويات النتروجين من 30 وحدة نتروجين إلي 45 وحدة نتروجين إلي 60 وحدة نتروجين علي التوالي.

3- أدي الرش بفولفات الزنك إلي زيادة محصول الحبوب والقش والمحصول البيولوجي زيادة معنوية خلال السنتين.

4- كانت أعلي قيمة لمحصول الحبوب 4902, 4899 كجم / فدان مع الرش بسماد فولفات الزنك عند التسميد يالأمونيا الغازية واليوريا بمستوي 60 كجم نتروجين للفدان علي التوالي.

5- كان أعلي محصول بيولوجي (12040 كجم / فدان) مع التسميد بفولفات الزنك عند التسميد يالأمونيا الغازية بمستوي 60 كجم نتروجين للفدان.

6- كان أعلي عائد إجمالي للفدان (9804 , 9798 جنيه مصري للفدان) وأعلي عائد صافي للفدان (9554,9563جنيه مصري للفدان) من إضافة سمادي الأمونيا الغازية واليوريا بمعدل 60 وحدة نتروجين للفدان مع الرش بفولفات الزنك.

7- حقق الرش بفولفات الزنك مع إضافة 45 وحدة نتروجين من الأمونيا الغازية و 60 وحدة نتروجين من اليوريا أعلي زيادة في العائد من المحصول(1884, 1232 جنيه للفدان) عن معاملة الكنترول.

التوصية

يمكن التوصية برش نبات الأرز بسماد فولفات الزنك بمعدل 2 لتر للفدان علي دفعتين الأولي بعد إسبوعين من الزراعة والثانية بعد إسبوعين من الأولي مع التسميد بالأمونيا الغازية أو اليوريا بمعدل 60 كجم نتروجين للفدان.

قام بتحكيم البحث

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