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Effect of Organic Manure , Zinc and Sulfur Application on Rice Yield and Some Nutrient Uptake

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ABSTRACT

Two field trials were conducted at El-Serw Agricultural Research Station, Dammietta governoratethrough summer season 2014 and 2015, to study the effect of organic matter as compost (20 m^3.fed^{-1}) (hectare = 2.4 fed), sulfur fertilization (0, 10, 20 and 40 kg S fed^{-1}) and zinc fertilization (0, 4, 8 and 16 $kgZnfed^{-1}$) on rice grain and straw yield, N, P and K uptake for rice crop (*Oryza sativa*), variety Giza 178. The results showed that rice grain and straw yield and N, P and K-uptake in grain and straw increasing with the use of zinc fertilization rates up to 16 kg Znfed,. As well as the results showed that 40 kg S fed^{-1}, 20 and 10 kg S fed^{-1} of sulfur fertilizers, respectively gave the highest values of the previous parameters. Also, the results showed that the use of organic matter as a compost gave the highest values of the previous parameters for rice crop. Organic matter + 40kg S fed^{-1} + 16 kg $Znfed^{-1}$ gave high rice grain and straw yield and N, P and K-uptake in grain and straw.Therefore,it preferably add zinc (16 kg Zn fed^{-1} in form $ZnSO_4$) and mineral sulfur fertilization (40 kg S fed^{-1}) with organic fertilizer to produce high rice crop under saline soil in North Delta.

Keywords: Rice, sulfur, *zinc*, compost, organic matter, uptake,

INTRODUCTION

More than half the world's population depends on rice, which is grown on nearly 150 millions hectares of land for a global production of more than 520 million tons. Wetlands where rice grows in flooded fields during all or part of the cropping period make up about 80% of the world's rice area, accounting for 93% of all rice production, (Roger, 1996).

The compost was prepared from crop residues, leaves, grass chippings, plant stalks, wines, weeds, twigs and branches are very good alternative which proved useful in many countries of the world. Use of compost has not only been adopted to enhance soil organic matter and enrich it with different nutrients but also to control the environmental pollution from debris (Kuepper, 2003).

Compost proved greatly helpful in increasing the yield of rice crop and N-P-K-uptake (Jeyabal and Kuppuswamy,2001and Satyanarayana*et al*., 2002).

In recent years sulfur (S) deficiency has become an increasing problem for agriculture, resulting in decreased crop quality parameters and yields. Sulfur (S) fertilization has become an issue due to reduced industrial emissions of S to the atmosphere and the consequent decreased deposition of S onto agricultural land in many areas of the world (McGrath *et al*., 1996).

Shehata et al. ,(2009);Zayed et al., (2011) and Zayed, (2012) found that sulfur fertilizer at the rate of 50 kg $Sfed^{-1}$ in the form of elemental S significantly increased rice growth, yield and yield components.

In higher plants, Zn is either required for, or at least modulates, the activity of a large number of various types of enzymes, including dehydrogenases, aldolases, isomerases, transphosphorylases and RNA and DNA polymerases(Broadley, et al, 2012).

Shehata et al., (2009), under saline soil condition, found that zinc fertilizer had a positive effect on rice growth traits,i.e. dry matter production, leaf area index and yield attributes, i.e. panicle $numberhill^{-1}$, plant height, panicle length, panicle weight, filled $grainspanicle^{-1}$, 1000-grain weight, straw and grain yields. Also, Bharat, (2006), under saline sodice conditions, recognized that zinc application significantly increased grain and straw yields and harvest index. Many previous investigators reported that increasing zinc rate increased grain yield and its attributes (Ghose et al.,1999; Rao and Shukla, 1999; Zia et al., 2000; Hussain, 2004; Tariq et al., 2007 and Khan et al.,2009).

The aim of this investigation is studying the combined effect of using organic matter as compost, mineral sulfur and zinc fertilization on rice grain and straw yield, and nutrients uptake, for rice crop.

MATERIALS AND METHDOS

Two field trials were conducted at El-Serw Agricultural Research Station, Damietta Governorate during the two summer seasons of 2014 and 2015. Split Split Plot design with four replications was conducted to study the effect of using organic matter as compost treatments (the main plots) (Without organic matter and with organic matter at a level of $20m^3$,fed^{-1} of mature compost rice straw and farmyard manure), the sulfur fertilizers (control without sulfur fertilization, 10, *20*and*40 kg S fed*$^{-1}$) (the sub plots) and zinc fertilizer levels (the sub subplots) (4, 8 and 16 kg Znfed) on rice (Oryza sativa L.) variety Giza 178,growth and nutrients uptake.

Dates of planting nurseries, transplanting and harvesting for the growing seasons are presented in Table (1).

Table 1. Dates of rice nurseries, transplanting and harvest processes in the tow growing seasons.

Operation	Season 2014	Season 2015
Rice nurseries	15 of May 2014	11 of May 2015
Rice transplanting	20 of June 2014	20 of June 2015
Rice harvesting	4 of October 2014	5 of October 2015

Disturbed soil samples were taken from the experimental site before conducting the experiment from 0-30, 30-60 and 60-90 cm depth. Soil samples were air-dried and ground to pass through a 2 mm sieve. The different determinations of soil chemical and physical properties were carried out as follows:

Particle size distribution of the composite sample was determined according to the international method (Piper 1950). Soil acidity (pH) values were measured in the soil water suspensions (1:2.5). Cations, anions and total soluble salts were estimated in the 1:5 soil water extract,but organic matter was determined by using Walkley& Black method, while total nitrogen was determined by using the micro kjeldhal procedure and available potassium was extracted by ammonium acetate then measured by flame photometer (Jackson 1967).Available phosphorus was extracted by sodium bicarbonate and then determined colorimetrically according to (Olsen and Dean 1965).

Soil physical and chemical properties of the experimental soil are presented in Tables (2-3).

Mature compost (rice straw and farmyard manure) (20m^3,fed^{-1}) were added to the soil and mixed with the upper layer after transplanting (Table, 4).

Table (2): Physical and chemical properties of the soil samples taken from the experimental field before rice cultivation in the 2014 growing season.

Depth, cm	Particle size distribution: Coarse sand %	Fine sand %	Silt %	Clay %	Texture	O.M %	$CaCO_3$ %	C.E.C (meq /100g soil)	pH of soil susp-end (1:2.5)	EC dSm^{-1} at 25 °C
0-30	1.45	10.34	22.28	65.93	Clayey	0.88	1.33	44.5	8.3	5.43
30-60	2.10	15.20	25.25	57.45	Clayey	0.64	2.22	40.5	8.2	5.54
60-90	2.75	35.30	22.1	39.85	S.C.L*	0.49	2.45	39.5	8.4	5.14

Depth, cm	Cations and anions in the soil extract (1:5), meq/100 g soil — Cations: Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Anions: CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}	Total N %	Avail-able P ppm	Avail-able K ppm
0-30	3.12	2.79	11.40	0.28	n.d.	1.70	12.21	3.68	0.033	7.94	479
30-60	2.49	3.13	13.72	0.29	n.d.	1.65	13.62	4.36	0.030	6.17	463
60-90	2.81	3.24	14.82	0.34	n.d.	2.42	14.46	4.33	0.023	4.69	414

*** S = Silt. C = Clay. L = Loam. O.M= Organic matter**

Table (3): Physical and chemical properties of the soil samples taken from the experimental field before rice cultivation in the 2015 growing season.

Depth, cm	Particle size distribution: Coarse sand %	Fine sand %	Silt %	Clay %	Texture	O.M %	$CaCO_3$ %	C.E.C (meq /100g soil)	pH of soil susp-end (1:2.5)	EC dSm^{-1} at 25 °C
0-30	1.09	11.23	21.67	66.01	Clayey	0.77	1.41	44.1	8.2	5.32
30-60	1.97	16.03	24.64	57.63	Clayey	0.53	2.28	39.7	8.1	5.36
60-90	2.63	33.94	22.15	41.28	S.C.L*	0.42	2.57	38.9	8.3	5.94

Depth, cm	Cations and anions in the soil extract (1:5), meq/100 g soil — Cations: Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Anions: CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}	Total N %	Avail-able P ppm	Avail-able K ppm
0-30	2.95	2.81	11.21	0.27	n.d.	1.59	12.02	3.63	0.031	8.01	483
30-60	2.24	3.21	12.99	0.29	n.d.	1.51	13.43	3.79	0.028	6.21	471
60-90	2.79	3.29	14.21	0.32	n.d.	1.97	13.95	4.69	0.021	4.76	422

*** S = Silt. C = Clay. L = Loam.O.M= Organic matter**

Table (4): Analysis of compost at 2014 and the 2015 seasons.

Season	pH	EC dSm^{-1} at 25 °C	O.C. %	Total N %	Total P %	C/N
2014	7.55	2.86	29.81	1.57	0.28	19.13
2015	7.56	2.89	30.05	1.60	0.26	18.69

Meniral sulfur and zinc fertilizer ($ZnSO_4$) treatments was added on dry soil before rice transplanting. Uniform application of superphosphate (15%P_2O_5) at the rate of 100 Kgfed^{-1} was applied as basal of each plot before rice transplanting.

After the rice harvest, grain and straw yield, N-P-K-uptake in grains and straw were estimated.

RESULTS AND DISCUSSION

Rice grain and straw yield tonfed^{1}:

Data pertaining to rice grain and straw yield recorded in ton fed^{-1} as affected byorganic matter as compost, sulfur fertilization, different zinc fertilization application, and their interactions are presented in Table (4 and 5).

There was a significant increase in rice grain and straw yield by using organic matter, mineral sulfur and zinc fertilization treatments in both seasons 2014-2015. The highest values of these parameters were obtained when applying organic manure treatment, 40 kg S fed^{-1} and 16 kg Zn fed^{-1}. In general, these results agree with those obtained by Hussain et al., (2006), when he indicated that compost proved greatly helpful in increasing the yield of rice and wheat crops in saline sodic soils. But, Shehata et al. (2009)., Zayed et al., (2011) and Zayed, (2012) found that sulfur fertilizer at the rate of 50 kg S fed^{-1} in the form of elemental S significantly increased rice growth, yield and yield components. On the other hand, Metwally, (2011) reported that 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 (Table, 4).

Data in Table 5 showed the interaction effect between sulfur fertilization and organic matter treatments. This interaction effect on rice grain and straw yield was a significant for rice grain yield and it was a significant at 5% level for rice straw yield in both 2014 and the 2015 seasons. The highest values of grain and straw yield were obtained when (40 kg S fed^{-1}) with organic matter treatment.

Data in Table 5 showed the interaction effect between zinc fertilization application rates and organic matter treatments. This interaction effect on rice grain and straw yield was a significant for rice grain and straw in both 2014 and the 2015 seasons. Applying (16 kg Zn fed^{-1}) with organic matter treatment gave the highest results of rice grain and straw yield in the both seasons.

Data in Table 5indicated that the interaction effect between zinc fertilization application rates and sulfur fertilization. This interaction effect on rice grain yield was a significantly at 5% level in both 2014 and the 2015 seasons, but this effect was a significantly at 5% level at the 2014 season and it was no significantly at the 2015 season on rice straw yield. The highest results of rice grain and straw yield were obtained with (16 kg Zn fed^{-1}) + (40 kg S fed^{-1}).

Data in Table 5 showed the interaction effect between zinc fertilization application rates, sulfur fertilization and organic matter treatments. This interaction effect on rice grain and straw yield was a significantly in both 2014 and the 2015 seasons. The highest results were obtained with (16 kg Zn fed^{-1})+ (40 kg S fed^{-1})+ (organic matter).

Table 5- Grain and straw yield (ton fed^{-1}) for rice as affected by organic manure, sulfur fertilization rates andzinc fertilization treatments in 2014and the 2015 seasons.

Treatments	Grain yield (t.fed-1) 2014	Grain yield (t.fed-1) 2015	Straw yield (t.fed-1) 2014	Straw yield (t.fed-1) 2015
organic manureTreatments				
O_0	3.33	3.43	3.88	4.04
O_1	3.79	3.90	4.16	4.33
F. test	**	**	**	**
LSD 5%	0.130	0.130	0.020	0.089
LSD 1%	0.219	0.239	0.027	0.163
Mineral Sulfur Levels				
S_0	3.35	3.43	3.71	3.84
S_{10}	3.56	3.67	4.03	4.19
S_{20}	3.62	3.73	4.10	4.27
S_{40}	3.71	3.83	4.24	4.43
F. test	**	**	**	**
LSD 5%	0.025	0.063	0.128	0.031
LSD 1%	0.034	0.087	0.139	0.043
Mineral Zinc Levels				
Zn_0	3.19	3.28	3.56	3.71
Zn_4	3.60	3.70	4.07	4.24
Zn_8	3.61	3.72	4.09	4.26
Zn_{16}	3.84	3.95	4.35	4.52
F. test	**	**	**	**
LSD 5%	0.028	0.031	0.121	0.024
LSD 1%	0.037	0.040	0.284	0.050

**** Significant at 1% level.**
O_0 = Control treatment without organic manure.
O_1 =Organic matter "Compost".

Nitrogen, Phosphor and Potassium uptake in rice grain and straw.

The data in Tables (6, 7, 8 and 9) showed the effect of mineral Zn-fertilizer levels, sulfur fertilizer application , organic matter treatments, and their interaction on NPK uptake by rice grains and straw.

There was a significant increase in NPK uptake in rice grain and straw by using organic matter, mineral sulfur and Zinc fertilization treatments in both seasons 2014-2015. The highest values of these parameters were obtained when applying organic manure treatment, 40 kg S fed^{-1} and 16 kg Zn fed^{-1}. Ofori et al., (2005) and Fahmy et al., (2008) found that the application of organic amendments to all the soils improved uptake of nitrogen. While Pooniyaand Shivay., (2013) found that Zn fertilization had significant effects on the concentrations and uptake of N and K in basmati rice grain and straw (Tables 6 and 8).

Table 6- Grain and straw yield (ton fed^{-1}) for rice as affected byorganic manure, zinc fertilization rates, sulfur fertilization treatments and their interaction in 2014and the 2015 seasons.

Organic Manure	Sulfur Fert.	Zinc Fert.	Grain yield ($t.fed^{-1}$) 2014	Grain yield ($t.fed^{-1}$) 2015	Straw yield ($t.fed^{-1}$) 2014	Straw yield ($t.fed^{-1}$) 2015
O_0	S_0	Zn_0	2.77	2.84	2.86	2.96
		Zn_4	3.22	3.30	3.81	3.98
		Zn_8	3.23	3.31	3.83	4.00
		Zn_{16}	3.50	3.58	3.87	4.00
	S_{10}	Zn_0	3.03	3.12	3.10	3.23
		Zn_4	3.32	3.42	3.94	4.10
		Zn_8	3.33	3.43	3.96	4.12
		Zn_{16}	3.57	3.68	4.41	4.59
	S_{20}	Zn_0	3.08	3.18	3.54	3.69
		Zn_4	3.35	3.46	3.98	4.14
		Zn_8	3.36	3.47	4.00	4.16
		Zn_{16}	3.61	3.72	4.35	4.53
	S_{40}	Zn_0	3.15	3.26	3.62	3.78
		Zn_4	3.50	3.62	4.13	4.31
		Zn_8	3.51	3.63	4.15	4.33
		Zn_{16}	3.67	3.79	4.54	4.74
O_1	S_0	Zn_0	3.06	3.13	3.54	3.66
		Zn_4	3.54	3.62	3.83	3.96
		Zn_8	3.55	3.63	3.85	3.98
		Zn_{16}	3.91	4.00	4.06	4.20
	S_{10}	Zn_0	3.39	3.49	3.86	4.02
		Zn_4	3.88	4.00	4.26	4.43
		Zn_8	3.90	4.02	4.28	4.45
		Zn_{16}	4.07	4.19	4.43	4.61
	S_{20}	Zn_0	3.46	3.57	3.84	4.00
		Zn_4	3.96	4.08	4.29	4.47
		Zn_8	3.98	4.10	4.31	4.49
		Zn_{16}	4.16	4.29	4.48	4.67
	S_{40}	Zn_0	3.55	3.67	4.13	4.31
		Zn_4	4.00	4.13	4.35	4.54
		Zn_8	4.02	4.15	4.37	4.56
		Zn_{16}	4.24	4.38	4.65	4.85
F. Test			**	**	**	**
LSD 5%			0.201	0.211	0.316	0.078
LSD 1%			0.267	0.281	0.420	0.104
Organic manure			**	**	**	**
Sulfur fertilization			**	**	**	**
Zinc Fertilization			**	**	**	**
Organic × Sulfur			**	**	*	*
Organic × Zinc			**	**	**	**
Sulfur × Zinc			*	*	ns	*
Organic × Sulfur ×Zinc			**	**	**	**

**** Significant at 1% level.**
O_0 = Control treatment without organic matter.
O_1 =Organic matter "Compost".

Results in Tables 7&9 showed that the interaction effect between Sulfur fertilization and organic matter treatments was a significant on nutrients uptake in rice grain and straw in both seasons. Data in same tables indicated that the highest values were obtained with $o_1 s_{40}$

Data in Tables 7&9 showed that the interaction effect between zinc fertilization application and organic matter treatments was a significant on NPK-uptake in rice grain and straw in both 2014 and the 2015 seasons.Data in Tables 5&6 indicated that nutrients uptake for rice grains and straw in both seasons 2014 and 2015 were obtained with $Zn_{16}O_1$.

Data in Tables 7&9 showed that the interaction effect between Zinc fertilization and sulfur fertilization was a significant on N-uptake in rice grain in the both seasons, but this effect on N-uptake in rice straw was a significantly in 1^{st} season and in significant in 2^{ad} season.

Table7- Nitrogen, Phosphorus and Potassium uptake for rice grain as affected by organic manure, sulfur fertilization rates andzinc fertilization treatments in 2014 and the 2015 seasons.

Treatments	N-Uptake ($kg\ N\ fed^{-1}$) 2014	N-Uptake 2015	P-Uptake ($kg\ P\ fed^{-1}$) 2014	P-Uptake 2015	K-Uptake ($kg\ K\ fed^{-1}$) 2014	K-Uptake 2015
organic manure Treatments						
O_0	41.688	43.566	7.725	8.058	7.107	7.461
O_1	50.222	52.366	9.161	9.552	8.376	8.799
F. test	**	**	**	**	**	**
LSD 5%	1.507	1.925	0.139	0.311	0.213	0.152
LSD 1%	2.766	3.535	0.255	0.570	0.391	0.279
Mineral Sulfur Levels						
S_0	41.366	42.939	7.648	7.915	7.000	7.320
S_{10}	44.783	46.780	8.388	8.753	7.660	8.049
S_{20}	47.482	49.621	8.710	9.101	7.971	8.388
S_{40}	50.189	52.524	9.026	9.452	8.336	8.763
F. test	**	**	**	**	**	**
LSD 5%	0.534	1.141	0.100	0.201	0.084	0.092
LSD 1%	0.724	1.546	0.135	0.272	0.114	0.125
Mineral Zinc Levels						
Zn_0	36.546	38.164	6.259	6.539	3.876	4.104
Zn_4	46.719	48.772	8.202	8.541	7.860	8.245
Zn_8	47.103	49.168	8.253	8.598	7.904	8.290
Zn_{16}	53.452	55.760	11.059	11.542	11.327	11.882
F. test	**	**	**	**	**	**
LSD 5%	0.389	0.500	0.069	0.148	0.178	0.129
LSD 1%	0.518	0.665	0.092	0.196	0.236	0.171

**** Significant at 1% level.**
O_0 = Control treatment without organic manure.
O_1 =Organic matter "Compost".

While this effect on P-uptake in rice grain was no significant in the both seasons but this effect on P-uptake in rice straw was a significant in the both seasons. But effect of this interaction on K-uptake was a significant in rice grain in the 2015 season and in rice straw in the 2014 season, while this effect was no significant in rice grain in the 2014 season and in rice straw in the 2015 season. Data in Tables 5&6 indicated that nutrients uptake for rice grains and straw in both seasons 2014 and 2015 were obtained with $Zn_{16}S_{40}$.

Results in Tables 7&9 showed that the interaction effect between Zinc fertilization, sulfur fertilization and organic manure treatments was a significant on N-uptake in rice grain in the both seasons, but this effect on N-uptake in rice straw was a significantly in the 2014 season and no significant in the 2015 season. While this effect on P-uptake in rice grain was a significant at 5% level in the 2014 season and it was in significant in the 2015 season, but this effect on P-uptake in rice straw was a significant at 5% level in the 2014 season and it was a significant in the 2015 season. But effect of this interaction on K-uptake was no significant in rice grain in the both seasons and in rice straw this effect was a significant at 5% level in the 2014 season and in significantly in the 2015 season. Data in Tables 5&6 indicated that nutrients uptake for rice grains and straw in both seasons 2014 and 2015 were obtained with $Zn_{16}S_{40}O_1$.

Table8- Nitrogen, Phosphorus and Potassium uptake for rice grain as affected by the interactionbetween zinc fertilization rates and sulfur fertilization with organic matter treatments in 2014 and the 2015 seasons.

Organic manure.	Sulfur Fert.	Zinc Fert.	N-Uptake ($kg\ N\ fed^{-1}$) 2014	N-Uptake 2015	P-Uptake ($kg\ P\ fed^{-1}$) 2014	P-Uptake 2015	K-Uptake ($kg\ K\ fed^{-1}$) 2014	K-Uptake 2015
O_0	S_0	Zn_0	29.501	30.700	5.069	5.254	3.075	3.266
		Zn_4	37.706	39.237	6.923	7.161	6.601	6.897
		Zn_8	37.985	39.521	6.945	7.183	6.654	6.951
		Zn_{16}	46.235	47.936	9.660	10.024	9.8	10.203
	S_{10}	Zn_0	32.906	34.382	5.757	6.022	3.545	3.775
		Zn_4	41.234	43.092	7.370	7.661	7.105	7.421
		Zn_8	41.525	43.390	7.393	7.683	7.126	7.443
		Zn_{16}	47.909	50.048	10.139	10.598	10.353	10.893
	S_{20}	Zn_0	34.065	35.680	6.006	6.296	3.727	3.943
		Zn_4	44.019	46.122	7.571	7.889	7.37	7.716
		Zn_8	44.352	46.463	7.594	7.946	7.392	7.738
		Zn_{16}	48.663	50.890	10.397	10.862	10.577	11.086
	S_{40}	Zn_0	35.784	37.588	6.269	6.585	3.969	4.173
		Zn_4	46.480	48.689	8.015	8.398	7.77	8.181
		Zn_8	46.823	49.041	8.073	8.458	7.792	8.204
		Zn_{16}	51.820	54.273	10.423	10.915	10.863	11.484
O_1	S_0	Zn_0	35.159	36.433	5.814	6.010	3.611	3.787
		Zn_4	46.055	47.748	7.823	8.073	7.469	7.855
		Zn_8	46.399	48.098	7.846	8.095	7.526	7.877
		Zn_{16}	51.886	53.840	11.104	11.520	11.261	11.72
	S_{10}	Zn_0	39.934	41.636	6.746	7.050	4.102	4.363
		Zn_4	49.315	51.560	8.885	9.280	8.497	8.92
		Zn_8	49.764	52.059	8.970	9.367	8.541	8.965
		Zn_{16}	55.678	58.073	11.844	12.361	12.007	12.612
	S_{20}	Zn_0	41.243	43.090	7.024	7.354	4.36	4.641
		Zn_4	52.866	55.121	9.385	9.792	8.91	9.384
		Zn_8	53.372	55.637	9.472	9.881	8.955	9.471
		Zn_{16}	61.277	63.964	12.230	12.784	12.48	13.127
	S_{40}	Zn_0	43.772	45.802	7.384	7.744	4.615	4.881
		Zn_4	56.080	58.605	9.640	10.077	9.16	9.582
		Zn_8	56.602	59.138	9.728	10.168	9.246	9.67
		Zn_{16}	64.151	67.058	12.678	13.271	13.271	13.928
F. Test			**	**	*	ns	ns	ns
LSD 5%			1.268	1.581	0.218	---	---	---
LSD 1%			1.686	2.103	---	---	---	---
Organic manure			**	**	**	**	**	**
Sulfur fertilization			**	**	**	**	**	**
Zinc Fertilization			**	**	**	**	**	**
Organic × Sulfur			**	**	**	*	**	**
Organic × Zinc			**	**	**	**	**	**
Sulfur × Zinc			**	**	ns	ns	ns	**
Organic × Sulfur ×Zinc			**	**	*	ns	ns	ns

**** Significant at 1% level. O_0 = Control treatment without organic matter. O_1 =Organic matter "Compost".**

Table9 Nitrogen, Phosphorus and Potassium uptake for rice straw as affected by organic manure, sulfur fertilization rates andzinc fertilization treatments in 2014 and the 2015 seasons.

Treatments	N-Uptake (kg N fed^{-1})		P-Uptake (kg P fed^{-1})		K-Uptake (kg K fed^{-1})	
	2014	2015	2014	2015	2014	2015
organic manure Treatments						
O_0	24.305	25.953	1.199	1.637	40.681	44.211
O_1	25.950	27.683	1.617	1.981	48.050	51.993
F. test	**	**	**	**	**	**
LSD 5%	0.382	0.168	0.048	0.050	0.747	1.223
LSD 1%	0.702	0.309	0.088	0.092	1.371	2.244
Mineral Sulfur Levels						
S_0	22.858	24.300	1.045	1.339	40.851	44.407
S_{10}	25.144	26.822	1.365	1.766	44.063	47.930
S_{20}	25.692	27.441	1.515	1.904	45.209	48.839
S_{40}	26.816	28.709	1.707	2.227	47.339	51.232
F. test	**	**	**	**	**	**
LSD 5%	0.133	0.207	0.023	0.030	0.259	0.333
LSD 1%	0.181	0.280	0.031	0.042	0.351	0.451
Mineral Zinc Levels						
Zn_0	17.230	18.392	0.850	1.071	36.607	38.449
Zn_4	25.413	27.164	1.321	1.708	44.690	48.534
Zn_8	25.660	27.398	1.327	1.716	45.109	48.955
Zn_{16}	32.207	34.318	2.135	2.740	51.057	56.471
F. test	**	**	**	**	**	**
LSD 5%	0.219	0.104	0.022	0.026	0.254	0.434
LSD 1%	0.291	0.139	0.030	0.034	0.337	0.578

**** Significant at 1% level. O_0 = Control treatment without organic manure. O_1 =Organic matter "Compost".**

Table 10- Nitrogen, Phosphorus and Potassium uptake for rice straw as affected by the interactionbetween zinc fertilization rates and sulfur fertilization with organic matter treatments in 2014 and the 2015 seasons.

Treatments Zinc Fert.	Sulfur Fert.	Organic Matter	N-Uptake (kg N fed^{-1}) 2014	N-Uptake 2015	P-Uptake (kg P fed^{-1}) 2014	P-Uptake 2015	K-Uptake (kg K fed^{-1}) 2014	K-Uptake 2015
O_0	S_0	Zn_0	13.471	14.297	0.486	0.592	27.513	29.393
		Zn_4	23.546	25.233	0.838	1.154	39.129	42.506
		Zn_8	23.784	25.480	0.843	1.160	39.526	42.880
		Zn_{16}	28.174	29.840	1.432	1.840	45.898	50.760
	S_{10}	Zn_0	14.787	15.795	0.682	0.808	30.442	32.397
		Zn_4	24.507	26.158	1.064	1.476	40.818	44.362
		Zn_8	24.750	26.409	1.069	1.483	41.224	44.743
		Zn_{16}	32.590	34.746	1.808	2.616	47.452	52.280
	S_{20}	Zn_0	17.098	18.266	0.779	0.996	35.046	37.417
		Zn_4	24.875	26.579	1.154	1.656	41.710	45.333
		Zn_8	25.120	26.790	1.160	1.664	42.120	45.718
		Zn_{16}	32.321	34.473	2.045	2.627	46.589	51.506
	S_{40}	Zn_0	17.738	19.013	0.869	1.134	36.091	37.762
		Zn_4	25.978	27.843	1.363	1.853	43.489	47.281
		Zn_8	26.228	28.058	1.370	1.862	43.907	47.673
		Zn_{16}	33.914	36.261	2.225	3.271	49.940	55.363
O_1	S_0	Zn_0	16.744	17.751	0.708	0.915	34.692	36.673
		Zn_4	23.593	25.027	1.111	1.386	43.930	47.678
		Zn_8	23.832	25.273	1.117	1.393	44.352	48.118
		Zn_{16}	29.719	31.500	1.827	2.268	51.765	57.246
	S_{10}	Zn_0	18.528	19.778	0.965	1.206	41.032	44.099
		Zn_4	26.455	28.219	1.534	1.861	48.436	52.584
		Zn_8	26.707	28.480	1.541	1.869	48.835	53.044
		Zn_{16}	32.826	34.990	2.259	2.812	54.268	59.930
	S_{20}	Zn_0	18.739	20.040	1.075	1.320	41.741	41.880
		Zn_4	26.898	28.787	1.673	2.056	49.592	53.819
		Zn_8	27.153	29.005	1.681	2.065	50.039	54.284
		Zn_{16}	33.331	35.585	2.554	2.849	54.835	60.757
	S_{40}	Zn_0	20.733	22.197	1.239	1.595	46.297	47.970
		Zn_4	27.449	29.465	1.827	2.225	50.417	54.707
		Zn_8	27.706	29.686	1.835	2.234	50.867	55.176
		Zn_{16}	34.782	37.151	2.930	3.638	57.707	63.923
F. Test			ns	**	*	**	*	ns
LSD 5%			---	0.331	0.069	0.082	0.801	---
LSD 1%			---	0.440	---	0.108	---	---
Organic manure			**	**	**	**	**	**
Sulfur fertilization			**	**	**	**	**	**
Zinc Fertilization			**	**	**	**	**	**
Organic × Sulfur			**	**	**	**	**	**
Organic × Zinc			**	**	**	**	**	**
Sulfur × Zinc			ns	**	**	**	**	ns
Organic × Sulfur ×Zinc			ns	**	*	**	*	ns

**** Significant at 1% level. O_0 = Control treatment without organic matter. O_1 =Organic matter "Compost".**

CONCLUSION

It could be concluded that preferably add mineral zinc and sulfur fertilization with organic fertilizer to produce high rice crop under saline soil in North Delta.

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تأثير التسميد العضوي واضافه الزنك والكبريت علي محصول الارز وامتصاص بعض العناصر الغذائية.

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أجريت تجربتان حقليتان فى محطة البحوث الزراعية بالسرو بمحافظة دمياط خلال الموسمين الصيفيين لعامي ٢٠١٥,٢٠١٤ لدارسة تأثير كل من التسميد العضوي فى صورة كمبوست بمعدل ٢٠ م٣/الفدان ،أربع معدلات من التسميد الكبريتي (٠-١٠-٢٠-٤٠كجم كبريت /فدان)أربع معدلات من التسميد الزنك(٠,٤ ،٨ و١٦كجم زنك /فدان) على محصول الأرز من الحبوب والقش، امتصاص كل من النيتروجين والفسفور والبوتاسيوم فى الحبوب والقش لمحصول الأرز صنف جيزة ١٧٨. أوضحت النتائج أن قيم كل من محصول الأرز من الحبوب والقش وإمتصاص النيتروجين واللفوسفور والبوتاسيوم فى الحبوب والقش تزيد مع استخدام معدلات التسميد االزنك حتى ١٦ كجم زنك /فدان، كذلك أوضحت النتائج أن٤٠كجم كبريت /فدان ثم ٢٠كجم كبريت /فدان ثم ١٠كجم كبريت /فدان على التوالى أعطت أعلى القيم من المدلولات السابقة. أيضا أوضحت النتائج أن استخدام التسميد العضوى فى صورة كومبوست أعطى أعلى قيم المدلولات السابقة. كما أوضحت النتائج أنه باستخدام التسميد العضوي مع ٤٠كجم كبريت /فدانمع ١٦ كجم زنك /فدان أعطت أعلى القيم لمحصول الحبوب والقش وكذلك امتصاص عناصر النيتروجين والفسفور والبوتاسيوم للحبوب والقش. وبالتالى فى الأراضى المتأثرة بالأملاح بشمال الدلتا يفضل اضافة كبريت معدنى بمعدل ٤٠ كجم كبريت/فدان وزنك بمعدل ١٦ كجم زنك/فدانفى صورة كبريتات زنك مع التسميد العضوى للحصول على محصول أرز عالى.