EFFICIENCY OF POTASSIUM FERTILIZATION FOR WHEAT GROWN ON SALINE SOIL AS AFFECTED BY BIOFERTILIZATION AND COMPOST APPLICATION

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(Received: Jan. 24, 2011)

ABSTRACT: *The field study was carried out through two successive growth season (2009/2010 and 2010/2011) on sandy loam soil of Galbana area, east Suze Canal of North Sina Governorate. to evaluate the efficiency of potassium mineral fertilization applied at different rate on wheat plants growth and yield grown in saline as affected by biofertilization and compost application. The effect of the studied treatments on soil pH, EC (dSm^{-1}) and its content of available macro-and micronutrients were studded. The obtained data showed that the individual mineral K fertilizers application at rates of 20, 40 and 60 K_2O Kg fed^{-1} significantly increased grains and straw yield as compared with that non treated one in both seasons. Also, K fertilization either added as an individual or under biofertilizer and compost application promoted protein content in grain wheat plant. The values of EC however, pH in soil was decreased with the increase of added rate of mineral K fertilizer. These decreases were more clear at the higher application rates of mineral K fertilization especially in the combined treatments of mineral K fertilizer with biofertilizer. Though the contents (mg/g) of Fe. Mn and Zn in soil was decreased with the increase of added rate of mineral K fertilizer.*

Key words: *Potassium, compost, saline soil, wheat, biofertilizer, potassium solubilizing bacteria.*

INTRODUCTION

Potassium is one of the essential nutrients for plant to growth and required in large amount to achieve an optimum growth. Soil salinity is considered one the constraint threatening crop production globally. Around 30% of world cultivated soils area are affected by accumulation of salts (Zhu *et al.*, 1997). Soil salinity generally results from excess accumulation of NaCl and exerts detrimental effects on crop production by causing ion toxicity and inducing osmotic stress (water deficiency) in root environment and in plants (Zhu *et al.*, 1997). Salt stress reflects an oxidative stress and induction of antioxidant defense system is critical for development of salt tolerance. Salinity caused not only K deficiency but also P deficiency, and foliar supply of KH_2PO_4 was effective in correcting both nutrient deficiencies. Accumulation of Na and impairment of K nutrition is a major characteristic of salt-stressed plants. Therefore, K : Na ratio in plants is considered a useful guide to assessing salt tolerance (Zhu, 2001).

Bio-fertilizer is a good platform to deliver this primary macronutrient by assistance of Potassium Solubilizing Bacteria (KSB). Sheng *et al.* (2002). Han and Lee (2005) reported that applied of K in soil, namely an increase of about 15 % for K as compared with the untreated the bacterial inoculums. Application of *Bacillus mucilaginosus* (potassium solubilizing bacteria) alone can improve mineral nutrient uptake , photosynthesis and the yield eggplant grown under nutrient- deficient soils leading to plant growth. Ahmad (2009) found that supply by bio-fertilizer can prevent nutrient leaching while adding nutrients to the soil via their activities. Tilak and Reddy, (2006) reported that the increase in grain yield of maize due to seed bacterization with *Bacillus cereus* and *B. circulans* was 43.8 and 50.8 % , respectively over un inoculated control. Gharib *et al* (2008) illustrated that, the application of compost and bio-fertilizers to improve soil structure, fertility and consequently development and productivity of marjoram plants has received little attention. Hameeda *et al.* (2007) found that rice straw compost applied at 2.5 t ha^{-1} showed significant improvement in shoot length, leaf area, plant biomass, root volume and mycorrhizal colonization in sorghum plant. Salama (2006) found that application of bio-fertilizer significantly increased the N, P and K content in grain and straw in wheat plant as compared with uninoculated treatment (control).

Shaban and Manal (2009) illustrated that, the decrease of soil pH was noticed in soil treated with bio-fertilizer in combination with mineral N, P and K fertilizer at the rate of 225 kg urea, 150 super phosphate and 75 kg potassium sulphate/ fed. in two growth seasons as compared with those treated with mineral fertilizer alone. The obtained values of ECe were decreased with the increase mineral fertilizer in combination with bio-fertilizer as compared with chemical fertilizers alone in both seasons. Wu. *et al* (2006) found that, the activity of bacteria *Azotobacter chroococcum*, *Bacillus megatherium* and *Bacillus mucilaginosus*, led to an increase of water dissolved organic carbon concentration and a decreased pH value, which enhanced metal mobility and bio-availability. Seddik (2006) indicate that the application of K solubilizing bacteria, which may produce bacterial acids, alkalies or chelates, enhance solubility and release of elements from potassium containing minerals in soil. Abd El-Ghany *et al.* (2010) found that the highest effect of soil microorganisms treatment in improving sandy soil (El-Sheikh Zowaied) properties (physical and chemical) and productivity of wheat plant were by amending soil combined treatment with organic matter especially in the soil amended. Rashed *et al.* (2011) reported that compost application either alone or in combination with **50%** of recommended dose of mineral fertilizer (NPK) significantly increased the soil content of total forms of N, P and K.

Wheat (Triticum aestivum L.) is one of the most important agricultural food and feed crops worldwide with an annual harvest of almost 598 million tonnes in 2006 (FAOSTAT, 2007). Humans directly consume more than 60% of this production. Thus, wheat supplies about 20% of the energy and about 25% of the protein requirements of the world population (Evans, 1993, 1998). An additional contribution to the human diet is via the nutrition of animals that provide milk and meat. Wheat is such a widely grown crop because it can be used for a wide variety of food products (e.g. bread, cakes, cereals, beer etc.) and secondary products (e.g. starch, gluten etc.). Wheat quality can most simply be defined as the suitability of the grain for the intended processes and products. It may encompass several criteria such as milling performance, dough rheology, baking quality, nutritional value for humans and animals or storage properties (MacRitchie *et al.* 1990), hence compositional requirements vary between different end-uses.

The objective of this study was to determine the effect of compost or bio-fertilization on the efficiency of mineral potassium fertilization treatments and K combination levels on yield and quality characters of wheat plants and its productivity under newly reclaimed saline soil conditions. Also, the effect of the studded treatments on the arid soil properties and its content of available nutrients were studied.

MATERIALS AND METHODS

1. Field Experiment

This experiment was conducted through two successive winter seasons in 2009 /2010 and 2010/ 2011 at a Galbana Village, East Suze Canal. Of North Sina Governorate. Lies in the north-western Mediterranean coast of Sinai, between 31250N and 32450E Kaiser (2009) to study the response of wheat (*Triticm aestivum .L*) cv. Sakh 93 to potassium fertilization individual or combination with either of biofertilization or compost.

Surface sample (0-20 cm) of the tested soil was collected, air –dried, ground and sieved through a 2 mm sieve. The prepared soil sample was analyzed for some physical and chemical properties and its content of some available macro and micronutrients according to the methods described by Black (1965), Cottenie *et al* 1982 and Page *et al.* (1982). The obtained data were recorded in Table (1).

Experimental treatments

The individual effect mineral K fertilizer or and its combined with *Bacillus megatherium* (potassium solubilizing bacteria). Compost containing 219 g kg^{-1} organic carbon, 18.3 g kg^{-1} total nitrogen, 12.0 C/N ratio, 10.6 g kg^{-1} phosphorus, 53.3 g kg^{-1} potassium, 86.9 g kg^{-1} calcium, 5.2 g kg^{-1} magnesium, pH was 7.5) and EC 3.6 dSm^{-1}. Mineral potassium fertilization was added as potassium sulphate (46 % K_2O) rates of 0, 20, 40 and 60 kg K_2O fed^{-1} which applied in three equal splits, at sowing and after 40 and 60 days from sowing. Compost was added at rate of 20 m^3 fed^{-1} befor planting. The experimental design was split plot with three replications. Fertilizers (bio- and organic compost and mineral) treatments were arranged as main plots (A) while the rates of mineral potassium were assigned as sub plots (B). Grains of wheat Sakh 93 were sown at the rate of 60 kg fed^{-1} in 25th and 20th October in the first and second season, respectively. The area of experimental plot unit was 5 X10 m (50 m^2). Mineral nitrogen fertiliser was applied in the form of urea (46% N) at recommended rate (100 kg N fed^{-1}) was applied in three equal doses for each at 21, 42 and 65 days from sowing respectively. Phosphorus fertilizer was applied during soil tillage before sowing at rate of 31.00 kg P_2O_5 /fed in from of calcium super-phosphate (15.5% P_2O_5). Other farming practices were performed as recommended for wheat production.

Bacillus megatherium (potassium solubilizing bacteria) Preparation

This strain was chosen as inoculant because it is an effective PGPR (Plant Growth Promoting Rhizobacteria) (Siddiqui, 2006) and has undergone commercialisation as phytostimulator of cereals (ARC, Egypt). Wheat seeds were mixed with *Bacillus megatherium* cells present in the commercial peat-based Cerialen formulation (kindly supplied by ARC (Egypt) and distilled water: about 2Kg of wheat seeds were used for 100 g Cerialen containing about 5.5 × 109 *Bacillus megatherium* cells. Therefore, inoculum level was approximately 2.8 × 10^7 CFU added per seed, which was confirmed by colony counts on NB media.

Table (1). Physical and chemical properties of the studied soil.

Particles size distribution (%)				Texture	O.M (%)	$CaCO_3$ (%)
Crosse sand	Fin sand	Silt	Clay			
6.87	70.32	5.20	17.61	Sandy Loam	0.44	10.00

pH (1:2.5) (soil: water) sus.	EC (dS/m)	Soluble cations (meq/l)				Soluble anions (meq/l)		
		Ca^{++}	Mg^{++}	Na^+	K^+	HCO^-_3	Cl^-	$SO^=_4$
8.05	12.50	10.29	16.83	98.00	0.88	8.20	89	27.80

Available macronutrients (mg/kg)			Available micronutrients (mg/kg)			
N	P	K	Fe	Mn	Zn	Cu
38	4.21	189	2.95	1.27	0.84	0.010

RESULTS AND DISCUSSION

Straw and grain yields;

Data presented in Table (2) show that, the effect of individual mineral K fertilizers application at rates of 20, 40 and 60 K_2O Kg fed^{-1} significantly increased grains and straw yield as compared with non treated one in both seasons. This increase may be attributed to the important role of K in plant growth and biochemically reaction within plant tissues (Mengel and Kirkby, 1987; Marschner, 1998, and Courtney and Mullen 2008). Under individual treatments of K, the obtained grains and straw yield at the second season was higher than that found at the first one. Similar results were obtaned by EL Zemrany *et al.* (2010).

Also, effect of either bio-fertilizer inoculated or compost with and without mineral fertilizer applications significantly increased both of grains and straw yield of wheat plant as compared with non treated one in both growth seasons. In addition, there were insignificant differences between individual application of compost or potassium solubilizing bacteria (KDB). The application of compost in combination with each of 20, 40 and 60 kg K_2O/fed showed a significant increase of weight yield grain (g/m^2), straw yield (g/m^2), weight of 1000 grain (g), grain yield (ton/fed) and straw yield (ton/fed) in both seasons.

The obtained data in Table (2) also show that, both individual and combined treatments of either of biofertilizer or compost with mineral K fertilizer in the two growth seasons resulted in an increase of the determined growth parameter, i. e. spikes (g/m2) weight grains (g/m^2), weight straw (g/m^2) and weight of 1000 grain (g). All the determined growth parameters of wheat plants in the second growth season were higher than those found in the first one season. This may be ascribed to the more decomposition of the organic materials added to the soil with the time. So, increased the released nutrients and organic acids in the soil, consequently promoting the nutrients uptake which reflected on the growth parameters of plants. These findings are in agreement with those obtained by El-Gamal (2008).

NPK concentration;

The individual mineral treatments either of K fertilizers at different rates (20, 40 and 60 K_2O Kg fed^{-1}), biofertilizer or compost significantly increased N, P and K % content in both grain and straw of wheat plant compared with non treated plants in both seasons (Table 3). Based on the mean values of the obtained concentration of N in grain and straw of treated wheat plant, it can be noticed that, there are a clear differences between the effect of mineral, biofertilizer and compost treatments. The high concentration of N , P and K in grain and straw of wheat plant was obtained with the combined treatments of biofertilizer or compost with 60 K_2O Kg fed^{-1} which were 1,93 and 1,89% for N, 0,5 and 0,52% for P and 2,33 and 2,34% for K respectfully. This may be due to the increases the important role of K in the physiological processes, metabolism in plant consequently, nutrients uptakeon its concentration in plant, enzymes activation (Mengel and Kirkby 1987). Also, the obtained increases in these contents associated the treatments of biofertilizer and compost that may be attributed to the increase of these nutrients availability in soil, improving physical and chemical of soil properties and released nutrients from the added compost. This trend was found in both growth seasons. These results are in agreement with the findings of Dahdouh *et al.* (1999) Zayed and Abdel-Motaal (2005) .

Also, the obtained data reveal that K fertilization individual and under biofertilizer or compost application resulted in an increases of protein content in grain wheat plant, where these increases were significantly in the first season and were insignificant in the second one (Table 3).

Fe, Mn and Zn Concentration;

The recorded data in Table (4) revel the effect of different treatments of K as individual or in together with either of bio-fertilizer or compost on wheat plants (straw and grain) content (mg/kg) of micronutrients (Fe Mn and Zn) in two growth seasons.

Table (2). Yield and yield component of wheat plants as affected by the studied fertilization treatments under saline conditions.

Fertilization treatments			Growth Season											
			2009/2010						2010/ 2011					
Bio fertilizr	Compost	K_2O (kg fed^{-1})	spikes (g/m^2)	grain (g/m^2)	straw (g/m^2)	grain (ton fed^{-1})	straw Yield (ton fed^{-1})	1000 grain(g)	spikes (g/m^2)	grain (g/m^2)	straw (g/m^2)	grain (ton fed^{-1})	straw Yield (ton fed^{-1})	1000 grain (g)
without	without	0	470	450	1005	1.50	2.10	33.70	475	453	1110	1.54	2.15	33.80
		20	549	510	1125	1.82	2.69	40.36	583	523	1136	1.86	2.77	41.59
		40	573	522	1146	1.96	2.87	42.18	612	536	1159	1.99	2.96	42.88
		60	593	533	1155	1.99	2.96	42.36	624	544	1162	2.06	3.01	42.93
With	Without	0	560	515	1090	1.70	2.35	37.50	56.5	524	1098	1.80	2.37	37.60
		20	680	620	1189	1.98	2.90	41.59	700	630	1210	2.16	3.00	42.58
		40	697	637	1220	2.06	2.99	42.89	720	648	1223	2.19	3.12	43.15
		60	714	698	1226	2.10	3.02	43.00	732	701	1229	2.12	3.10	43.26
without	With	0	582	570	1100	1.88	2.60	38.90	585	575	1105	1.88	1.64	38.95
		20	685	634	1182	2.02	3.00	41.52	710	698	1236	2.18	3.19	43.35
		40	692	639	1220	2.10	3.06	42.69	719	701	1245	2.23	3.20	43.40
		60	717	699	1227	2.19	3.14	43.02	729	703	1248	2.30	3.21	43.42
Fertilizer – L.S.D at 0.05 level			ns	0.90	0.97	0.0034	7.06	0.34	2.01	0.99	0.68	0.61	ns	0.0019
Rates – L.S.D at 0.05 level			44.09	0.87	0.87	0.0044	1.56	0.42	2.39	1.00	0.87	ns	2.21	0.0025

Table (3). Concentration (%) of macronutrients in straw and grain wheat plant as affected by the studied fertilization treatments under saline conditions.

Fertilization treatments			Growth Season 2009/2010							Growth Season 2010/ 2011						
			Macronutrients (%)						Protein (%)	Macronutrients (%)						Protein (%)
Biofertilizr	Compost	K_2O (kg fed^{-1})	N		P		K			N		P		K		
			S	G	S	G	S	G		S	G	S	G	S	G	
without	without	0	0.65	1.40	0.18	0.30	2.01	2.01	8.75	0.68	1.42	0.20	0.30	2.10	2.07	8.87
		20	0.76	1.64	0.22	0.35	2.36	2.16	9.43	0.81	1.69	0.26	0.38	2.38	2.20	9.72
		40	0.79	1.71	0.25	0.39	2.45	2.25	9.83	0.83	1.77	0.28	0.42	2.47	2.28	10.18
		60	0.82	1.78	0.28	0.42	2.49	2.29	10.23	0.84	1.80	0.31	0.45	2.50	2.30	10.35
With	Without	0	0.69	1.65	0.21	0.40	2.15	2.20	10.05	0.70	1.70	0.23	0.42	2.18	2.30	10.62
		20	0.79	1.77	0.26	0.39	2.38	2.28	10.18	0.85	1.90	0.29	0.41	2.41	2.34	10.92
		40	0.83	1.86	0.32	0.45	2.48	2.33	10.70	0.80	1.96	0.35	0.48	2.53	2.36	11.27
		60	0.86	1.93	0.37	0.50	2.55	2.35	11.10	0.87	1.99	0.39	0.52	2.58	2.40	11.44
without	With	0	0.68	1.60	0.20	0.35	2.10	2.22	10.00	0.70	1.63	0.25	0.37	2.20	2.22	10.18
		20	0.78	1.74	0.28	0.44	2.41	2.26	10.00	0.82	1.78	0.30	0.47	2.44	2.30	10.23
		40	0.81	1.82	0.34	0.49	2.47	2.30	10.46	0.85	1.94	0.35	0.53	2.50	2.33	11.15
		60	0.85	1.89	0.35	0.52	2.51	2.34	10.87	0.91	1.98	0.37	0.56	2.53	2.38	11.38
Fertilizer – LSD 5%			ns	3.53	0.0068	0.0032	0.007	ns	0.33	0.0034	ns	0.006	ns	4.99	0.0068	ns
Rates –LSD 5%			5.51	ns	0.0087	0.0041	0.009	1.53	0.43	0.0043	ns	0.008	ns	ns	0.0087	ns

S- Straw
G-grain

Table (4). Concentration (mg/Kg) of micronutrients in straw and grain wheat plant as affected by the studded fertilization treatments under saline conditions.

Fertilization treatments			Growth Season											
Biofertilizr	Compost	K_2O ($kgfed^{-1}$)	2009/2010						2010/ 2011					
			Fe		Mn		Zn		Fe		Mn		Zn	
			S	G	S	G	S	G	S	G	S	G	S	G
without	without	0	95	71	40	24	27	18	98	73	42	26	28	19
		20	110	78	48	28	32	21	115	82	49	30	38	24
		40	126	82	52	33	39	23	129	86	55	35	41	26
		60	133	89	59	34	42	28	136	90	62	37	45	31
With	Without	0	103	75	45	26	31	20	105	78	47	27	33	21
		20	124	80	55	35	44	27	126	83	57	38	47	30
		40	138	96	63	38	48	33	140	98	64	42	50	34
		60	147	99	68	41	53	34	149	101	71	44	55	38
without	With	0	110	79	47	25	29	20	112	80	48	27	28	21
		20	128	90	54	32	35	28	132	94	57	35	38	30
		40	138	98	59	36	44	30	139	102	63	41	39	33
		60	148	99	62	40	55	35	150	104	65	43	57	39
Fertilizer – LSD 5%			3.08	3.99	0.34	0.96	0.68	5.65	2.26	ns	0.68	ns	ns	ns
Rates –LSD 5%			3.92	3.36	0.43	0.87	0.87	ns	ns	ns	0.87	ns	1.76	ns

S- Straw
G-grain

These data pointed out, the content of Fe. Mn and Zn was augmented with the increase of added rate of K mineral fertilizer. These increases were more clear at the higher application rates of mineral fertilization. More increases of these micronutrients in both straw and grains of wheat plants were found in the combined treatments of K mineral fertilizer with either of biofertilizer or compost. This trend was very clear in the first growth season compared with that found in second one. These increase were significant only in the first seasons, but were not significant in the second one.

Chemical Soil Properties;

The recorded data in Table (5) show the effect of added K as individual or together with either bio-fertilizer or compost on soil EC (dS m^{-1}) and pH, in two growth seasons. These data display that, the values of EC and pH diminished with the increase of added rate of mineral K fertilizer. These decreases were obviously appeared at higher application rates of mineral K fertilization especially in the case of combination with biofertilizer. This trend was clear in the first growth season compared with that occurred in second growth season. On the other hand, compost application or in combination with mineral K fertilizer resulted in an increase of soil EC compared with unfertilized soil and the soil fertilizer only with K fertilizer. Those decreases were significant in the first seasons, however it were not significant in the second one. Recently, Abou Hussian *et al.* (2012) and Gohar (2011) obtained similar results. The value of soil pH was 8.06 with 20 Kg K_2O fed^{-1} added to the soil. The individual treatments, of biofertilizer resulted in a slight decrease of soil pH compared with unfertilized soil. Also, Table (5) show the effect of different treatments of K fertilizer as individual or together with either of bio-fertilizer or compost on the soil content (mg Kg^{-1}) available macronutrients (N, P and K) in the two growth seasons. These data reveal that, the higher contents of N , P and K in soil were obtained with the combined treatments of either biofertilizer or compost with 60 K_2O Kg fed^{-1} which were 54 and 63 for N, 4,89 and 4,83 (mg Kg^{-1}) for P and 216 and 228 (mg Kg^{-1}) for K respectfully. The obtained enhancement in these availability induced with the treatments of biofertilizer and compost may be ascribed to its released from the added compost. This trend was observed in both growth seasons. Gohar (2011) and Zayed and Abdel-Motaal (2005) reported a similar results.

Data presented in Table (6) declare the effect of different treatments of mineral K fertilizer as an individual or together with either of bio-fertilizer or compost on the soil available content (mg/kg) of micronutrients (Fe, Mn and Zn) in the two growth seasons. These data denote that, the available (mg/kg) Fe. Mn and Zn was increased with the increase of added rate of mineral K fertilizer. These decreases were obvious clear at higher application rates of mineral fertilization. This may be due to the beneficial effect of added compost or biofertilizer on chelating micronutrients and keep it in the available form in soil. On the other hand an increases of the soil available (mg/kg) micronutrients (Fe Mn and Zn) were occurred with the treatments of either biofertilizer or compost. These data show that, the higher content of available micronutrients (Fe Mn and Zn) in soil was induced with the individual treatments of compost. These findings were observed in the two growth seasons. These results are in coincidence with Gohar (2011).

Table (5). pH , EC and its content (mg/Kg) of available macronutrients in soil as affected by the studded fertilization treatments under saline conditions.

Fertilization treatments			Growth Seasons									
			2009/2010					2010/ 2011				
Biofertilizr	Compost	K_2O (kgfed^{-1})	pH (1:2.5) Soil : Water	EC (dS/m)	Macronutrient (mgkg^{-1})			pH (1:2.5) Soil : Water	EC (dS/m)	Macronutrient (mgkg^{-1})		
					N	P	K			N	P	K
without	without	0	8.06	9.50	38	4.20	189	8.05	8.13	38	4.20	189
		20	8.06	9.52	53	4.73	195	8.04	8.20	55	4.91	201
		40	8.05	9.20	49	4.82	203	8.03	8.10	52	4.86	209
		60	8.02	8.96	45	4.86	206	8.01	7.89	49	4.82	214
With	Without	0	8.05	8.35	65	5.10	188	8.03	7.40	68	5.10	190
		20	8.04	8.41	62	4.86	200	8.00	7.43	66	4.97	210
		40	8.00	8.26	59	4.89	208	7.98	7.20	62	4.92	218
		60	7.96	8.10	50	4.93	214	7.95	7.05	51	4.89	225
without	With	0	8.02	8.30	67	5.06	195	8.00	7.20	68	5.08	198
		20	8.01	8.36	63	4.80	204	7.99	7.23	67	4.95	215
		40	7.98	8.10	59	4.87	210	7.96	7.10	63	4.90	225
		60	7.92	7.85	54	4.89	216	7.90	7.03	57	4.83	228
Fertilizer–L.S.D at 0.05 level			0.33	0.0045	0.68	0.012	ns	ns	ns	0.34	ns	ns
Rates – L.S.D at 0.05 level			0.33	0.0075	0.87	0.011	ns	3.12	ns	0.43	ns	ns

Table (6). Micronutrients available content in soil (mg/Kg) as affected by the studded fertilization treatments under saline conditions.

Fertilization treatments			Fe		Mn		Zn	
			Season					
Biofertilizr	Compost	K_2O ($kgfed^{-1}$)	1st	2nd	1st	2nd	1st	2nd
without	without	0	2.95	2.94	1.27	1.28	0.84	0.85
		20	3.10	3.11	1.37	1.38	1.07	1.09
		40	3.06	3.08	1.33	1.37	1.06	1.08
		60	3.02	3.05	1.29	1.32	1.02	1.04
With	Without	0	3.17	3.18	1.48	1.50	1.15	1.13
		20	3.11	3.13	1.44	1.46	1.13	1.12
		40	3.08	3.10	1.42	1.43	1.08	1.09
		60	3.05	3.06	1.39	1.41	1.04	1.06
Without	With	0	3.25	3.26	1.60	1.62	1.24	1.25
		20	3.15	3.17	1.56	1.58	1.18	1.20
		40	3.12	3.14	1.52	1.54	1.15	1.17
		60	3.08	3.12	1.46	1.49	1.10	1.14
Fertilizer – L.S.D at 0.05 level			ns	0.0034	0.0068	0.007	0.0076	0.031
Rates – L.S.D at 0.05 level			ns	0.0044	0.0087	0.009	0.0075	0.039

Conclusion

From the obtained data it could be concluded that the potassium application rate 60 K_2O kg fed^{-1} either combined with compost or beofertilization gave economically grain yield it was sufficient to produce high quality of wheat crop under saline condition.

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كفاءة التسميد البوتاسي للقمح النامي في الأراضي الملحية تحت تأثير التسميد الحيوي و الكمبوست

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الملخص العربي

أجريت هذه الدراسة فى منطقة جلبانه محافظة شمال سيناء – مصر خلال موسمي نمو متتاليين (٢٠٠٩/٢٠١٠ و ٢٠١٠/٢٠١١) علي الأراضي الطميية الرملية لتقييم كفاءة التسميد المعدني (البوتاسيوم المعدني المضاف بمعدلات مختلفة) على نمو و محصول نبات القمح النامي في أرض ملحية وتأثر ذلك بالتسميد الحيوي و إضافة الكمبوست. كذلك تم دراسة تأثير معاملات الدراسة علي رقم حموضة الأرض ومحتواها من الأملاح الكلية الذائبة و محتوي الأرض من المغذيات الكبرى و الصغرى الميسرة.

وقد أوضحت النتائج المتحصل عليها زيادة محصول القمح من الحبوب والقش فى موسم الزراعة الأول والثاني زيادة معنوية نتيجة إضافة البوتاسيوم المعدني بمعدلات ٢٠ و٤٠ و٦٠ كيلوجرام/ فدان. كذلك أوضحت النتائج المتحصل عليها زيادة محتوي النبات من النيتروجين و البوتاسيوم وكذلك محتوي حبوب القمح من البروتين في معاملات إضافة البوتاسيوم المعدني بمفردة أوفي معاملات إضافة البوتاسيوم المعدني مع إضافة الكمبوست أو مع استخدام التسميد الحيوي. وأظهرت النتائج أن هناك انخفاض قليل في الـ E C وpH التربة وكذلك إرتفاع محتوي التربة من العناصر سواء مع إضافة البوتاسيوم المعدني بمفردة أوفي معاملات إضافة البوتاسيوم المعدني مع الكمبوست أو مع استخدام التسميد الحيوي. وكذلك إرتفاع محتوي التربة من العناصر الصغرى مثل الحديد و المنجنيز والزنك مع إضافة البوتاسيوم المعدني.