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CREATE ENVIRONMENTAL CONDITIONS FOR SUGAR BEET PRODUCTION BY ADDING BIO AND ORGANIC FERTILIZER UNDER NEWLY RECLAIMED SALINE SOIL IN NORTH SINAI.

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ABSTRACT

Two field experiments were conducted in Galbana village, North Sinai Governorate during two winter seasons 2011/2012 and 2012/ 2013, to evaluate the environmental effect of mineral nitrogen fertilizer rate, compost and bio-fertilizer on some soil properties and sugar beet productivity under newly reclaimed saline soil. The seeds of sugar beet (*Beta vulgaris*) variety Loil were inoculated with *Rhizobium radiobacter* strain (salt tolerant PGPR). Results indicated that the soil pH was not significant as affected by bio-fertilizer or compost alone or in combination with different rates of mineral nitrogen fertilizer. The soil salinity decreased with increasing rate of mineral nitrogen combined with bio-fertilizer or compost. The relative increases of soil available N content in soil due to mineral nitrogen fertilizer; compost and bio-fertilizer after sugar beet cultivation, followed the descending order: bio-fertilizer> compost > mineral N as compared with initial soil for available N content. The relative increases in both P and K followed the descending order: compost > bio-fertilizer > mineral N fertilizer as compared with soil initial contents of P and K. The available micronutrients ie Fe, Mn, and Zn in soil were not significantly affected by the different fertilization treatments in both the first and second seasons. Also, available Fe was not significantly affected with rate of the used fertilizers whereas the effects of different rates on the available contents of both Mn and Zn were significant in the second season, however in the first one such rates were of significant effect of Zn only. The interactions among bio-fertilizer, compost and mineral nitrogen rates were of significant effects on Mn content in soil in both seasons whereas such an effect was significant on Fe in both seasons and Mn in the first one. The highest mean values of fresh and dry root yield, sugar yield, total soluble solids (TSS), purity and sucrose were achieved due to treating soil with bio-fertilizer together with the mineral nitrogen fertilizer. The highest values of N (1.14 %) concentration in root was observed at soil treated with compost plus 100 kg mineral N fertilizer, while the maximum values of P and K concentration (0.28 % for P and 1.29 % for K) was observed as affected by bio-fertilizer plus 100 kg mineral N, respectively. On the other hand, the effect of all treatments tested on Fe, Mn and Zn concentration in root of sugar beet was non significant. As a conclusion, bio-fertilizer and compost application in sugar beet could increase characteristics of sugar beet root and reduced consumption of mineral nitrogen fertilizer and successfully reduced the hazard effect of soil salinity condition.

Keywords: Soil salinity; bio-fertilizer; compost; mineral nitrogen; sugar beet productivity.

INTRODUCTION

Bio-fertilizers are applied to reduce the use of mineral fertilizers and supports an effective and environmentally safe tool for desert development beside of decreasing agricultural costs and at the same time maximizing crop yield. Also, biofertilization provides plant with some nutritive elements and growth promoting substances (Arafa *et al.* 2009). Bassal *et al.* (2001) recorded that inoculation of sugar beet seeds with Azotobacterin significantly increased TSS %, sucrose %, and purity % and root as well as sugar yields/fed. Ramadan *et al.* (2003) showed that biofertilization had a significant effect on root, top and sugar yields/fad^{-1}. but on the other hand, exhibited insignificantly effect on sucrose % and purity %. Calderon *et al*. (2004) found that the urea fertilizer application was of slightly alkaline effect on soil pH. EL-Geddawy *et al.* (2001) found that levels of nitrogen (60, 80 and 100 kg N fed^{-1}) had no statistical differences with relation to total soluble solids (TSS) %, sucrose %, root and sugar yields fed-1 of sugar beet. Mousa (2004) observed that, nitrogen fertilizer sources such as ammonium nitrate had a significant effect on the parameters of growth of sugar beet but each of ammonium nitrate and urea gave the highest sugar yield with non significant differences between them. Selim *et al*. (2010) found that increasing application rate of N increased fresh weights of roots and shoots, sugar yield and juice purity as compared with the control treatment. Nitrogen fertilization of sugar beet crop can be used as a bioremediation mean of sodic soils through removing high Na ions especially at the high applied doses of N fertilization. Fathy *et al*. (2009) reported that the effect of application of mineral N fertilizer on the roots and foliage fresh and dry weights and sugar yield of sugar beat significantly increased with increasing N fertilizer rates over two seasons.

Organic matter is known to improve soil health and availability of plant nutrients, (Guillaumes *et al*., 2006). Compost results in suppression of pathogens and improvement in the C:N ratio, and is easy to handle, store, transport and apply in soil compared with non-composted organic residues, (Hachicha *et al*., 2006). Helmy *et al*. (2013) suggested that the application of compost + 179 kg N ha^{-1} caused soil pH to decrease probably due to the effect of microorganisms on decomposing organic matter and hence releasing organic acids. Tandon (2000) found that physical properties (hydraulic conductivity, bulk density and total porosity) of salt affected soil greatly improved when compost was applied. Siam *et al*. (2013) indicated that lowest of soil EC was obtained by 100 kg N/fed as urea combined with compost in the both seasons. Sherif *et al*. (2012) indicated that the applying organic matter significantly increased the availability of N, P, K, Fe, Mn and Zn in soil as compared with control. These results may be due to the chelating effect of the organic components on the nutritive metal ions that keeps them in an available form. Shaban *et al*. (2011) suggested that the amount soil available nutrients N, P and K (mgkg^{-1} soil) increased with increasing rates of compost in combination with applied mineral N at a rate of (120 kg N fed^{-1}). Likewise, available micronutrients Fe, Mn, and Zn (mgkg^{-1} soil) increased when compost and organic manure were combined with different mineral N- fertilizer levels. Sarwar *et al*. (2008) reported that the combined application of both organic and inorganic fertilizers improved chemical properties of soil and enriched the fertility status of soil. Negm *et al*. (2003) indicated that adding organic manure increased soil productivity and available contents of micronutrients (*i.e,*Fe, Mn, Zn and Cu) , in some newly reclaimed soils. Mohamed *et al*. (2008) found that the addition of organic manure increased crop productivity as a result of increasing soil bio-availability of micronutrients (*i.e,* Fe, Mn, Zn and Cu) and cation exchange capacity as well as improving most of the physical properties in the newly reclaimed soils.

The current study aims at:-

1. Evaluating the effects of some environmental friendly products such as compost, and biofertilizer on alleviating the negative effects of salinity conditions.
2. Evaluating the effects of compost and bio-fertilizer in combination with mineral nitrogen fertilizer at different rates on yield and its components of sugar beet grown on a newly reclaimed saline soil.
3. Rationalization of using nitrogen fertilizer to reduce pollution resulting from the extra use of these fertilizers.
4. Reducing the high cost of buying inorganic fertilizers and maintaining the long term productivity of soils for sustainable agriculture.

MATERIALS AND METHODS

A field experiment was carried out at the Sahl El-Tina, North Sinai Governorate, during the two winter successive seasons of 2011/2012 and 2012/ 2013, to study the efficiency of used bio-or compost fertilization combined with mineral nitrogen at different rates on soil fertility and sugar beet (*Beta vulgaris*, variety Loil) productivity and quality under saline soil conditions.Some physical and chemical properties of the investigated soil are presented in Table (1).

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

<table>
<tr><td colspan="5">Particle size distribution</td><td colspan="2"></td></tr>
<tr><td>Coarse sand (%)</td><td>Fine sand (%)</td><td>Silt (%)</td><td>Clay (%)</td><td>Textural class</td><td>O.M. g kg^{-1}</td><td>$CaCO_3$ g kg^{-1}</td></tr>
<tr><td>7.44</td><td>68.44</td><td>9.60</td><td>14.52</td><td>Sandy clay</td><td>4.1</td><td>78.5</td></tr>
</table>

<table>
<tr><td rowspan="2">pH (1:2.5)</td><td rowspan="2">EC (dS/m)</td><td colspan="4">Cations (m molel^{-1})</td><td colspan="3">Anions (m molel^{-1})</td></tr>
<tr><td>Ca^{++}</td><td>Mg^{++}</td><td>Na^{+}</td><td>K^{+}</td><td>HCO^{-}_{3}</td><td>Cl^{-}</td><td>SO^{--}_{4}</td></tr>
<tr><td>8.11</td><td>13.42</td><td>10.58</td><td>21.13</td><td>101</td><td>0.90</td><td>10.00</td><td>90</td><td>34.20</td></tr>
</table>

<table>
<tr><td colspan="3">Available Macronutrients (mg/kg)</td><td colspan="4">Available Micronutrients (mg/kg)</td></tr>
<tr><td>N</td><td>P</td><td>K</td><td>Fe</td><td>Mn</td><td>Zn</td><td>Cu</td></tr>
<tr><td>30</td><td>3.10</td><td>186</td><td>2.13</td><td>1.45</td><td>0.72</td><td>0.008</td></tr>
</table>

Soil tillage:

Soil surface was leveled using laser technique. Deep sub-soiling plough, and establishment of field drains at a distance of 10 m between each of two drains at a depth of 90 cm at the drain beginning, establishment of an irrigation canal in the middle part of the experimental plot unit were carried out. The plot units were subjected to continuous and alternative leaching processes before sugar beet planting. Compost was added 25 days before sugar beet transplanting at a rate of 5 ton fed^{-1}.The chemical properties of the used compost shown in Table (2). The compost analyses were done according to the standard methods described by Brunner and Wasmer (1978).

Table (2). Chemical properties of the used compost.

Moisture content %	EC dSm^{-1} (1: 5)	pH (1:2.5)	C	C/N	O.M	N	P	K	Fe	Mn	Zn
			(%)						($mgkg^{-1}$)		
20.25	2.35	7.65	29	10.10	35	2.87	0.73	1.57	215	120	94

Seeds were inoculated with *Rhizobium radiobacter* strain (salt tolerant PGPR) biofertilizer isolated from the rhizosphere soil of Sahl El-Tina and deposited in the Gen bank under number of HQ395610 Egypt by Bio-fertilizer Production Unit, Department of Microbiology, Soils, Water and Environment Research Institute, Agricultural Research Center, Giza, Egypt. The inoculated grain plots were soil applied with liquid bacteria strain three times after 21, 42 and 62 days from planting as described by **Shaban and Omar (2006)**. The experimental design was a randomized complete block with three replicates.

Sugar beet seeds were hand sown using one side of the ridge in hills 25 cm apart at a rate of 3-5 seeds /hill during the first and second seasons. Plants were thinned at the age of 35 days from planting leaving one plant/hill. The seeds were sown on October 10^{th} and 15^{th} for the first and second seasons, respectively. The area of each plot was 50 m^2 (10 m lengths X 5 m width). Nitrogen fertilizer as urea (46 % N) was added at a rate of (0, 50, 75 or 100 kg N fed^{-1}) in three equal doses just after thinning and then 45 and 60 days later. Potassium sulphate (48 % K_2O) at a rate of 75 K_2O kg was applied in two doses after 21 and 50 days from sowing. Calcium super phosphate (15.5 % P_2O_5) was applied at a rate of 200 kg fed^{-1} during preparation.

Soil analysis:

A surface soil sample (0- 30 cm) was collected, air - dried, sieved to pass through a 2 mm sieve and mixed thoroughly. Calcium carbonate, organic matter, total soluble ions and electrical conductivity (EC) were determined in the saturated soil paste extract while the pH was measured using a pH meter in soil suspension (1: 2.5) as described by Page *et al*. (1982). Available nitrogen was measured according to the modified Kjeldahal method by Black, (1965). Available phosphorous, potassium and micronutrients (Fe, Mn, and Zn) were extracted using ammonium bicarbonate (DTPA) as described by Soltanpour (1985) and determined using Inductively Coupued Plasma (ICP) Spectrometry model 400**.**

Plant analysis: At harvest, ten plants were sampled randomly from each plot. The roots were separated, dried at 70 C^o for three days to determine their dry weight. Dry root samples were ground digested using H_2SO_4 and $HClO_4$ acid mixture according to the method described by Black, (1965). then plant contents of N, P, K, Fe, Mn and Zn were determined in the plant digests using the methods described by Cottenie *et al*. (1982). Sucrose was determined according to the method of Le-Docte (1927).Total soluble solids (TSS) were measured in juice of fresh roots by using a Hand Refractometer.

Sugar yield (t/fad) was calculated by multiplying dray root yield by sucrose percentage. All data were statistically analyzed for least significant difference as described by Snedecor and cochran (1979).

RESULTS AND DISCUSSIONS

Soil chemical properties

Soil pH.

Data in Table (3) show that the soil pH was not significantly affected by the studied treatments in the two growing seasons, however, it was decreased to lower values due to application of compost combined with 75 and 100 kg N fed^{-1} than the other treatments did. These results are in agreement with those of Aguilera *et al*. (2012) who found that the addition of organic or inorganic fertilizers slightly decreased soil pH. The soils of all the experimental plots were of moderately alkaline pH ranging from 7.96 to 8.09. Such decreases in soil pH can be attributed to the effect of nitrification process from basic (ammonium) form to mildly acidic (nitrate) form through the activity of the nitrifying bacteria in soil Nasef *et al*. (2009).The reduction of soil pH may be attributed to the production of organic acids resulted from the microbial activity Rashad *et al*. (2006). The reducing effect of bio-fertilizer combined with mineral nitrogen on soil pH from 8.06 to 7.98 might be attributed to associated increase in activity of dehydrogenase enzyme as well as the release of carbon dioxide in the rhizosphere due to exhalation of the microorganisms Shaban and Omar (2006).

Soil salinity:

Data in Table (3) reveal that a significant effect was shown due to the different rates of applied mineral nitrogen on decreasing the soil salinity, while non of the fertilization treatments could significantly effect the soil salinity. The combination of bio-fertilizer or compost with mineral nitrogen fertilizer was of significant effect on decreasing of soil salinity. The corresponding relative decreases in mean values of soil salinity (EC dSm^{-1}) were 36.36 and 42.25% in the first and second seasons for soil treated with the mineral nitrogen, 40.01 and 50.07 % in first and second seasons for soil treated with the compost and 41.21 and 51.19 % in the first and second seasons for soil treated with the bio-fertilizer compared with soil initial.

These results are in agreement with those obtained by Nasef *et al.* (2009) who indicated that application of bio and organic fertilizers combined with different mineral nitrogen fertilizer levels decreased soil salinity probably because the bio- fertilizer and compost could improve the soil physical properties (increasing soil porosity). and consequently enhanced leaching process through irrigation fractions. Bio-fertilizers promote plant growth and reduced the salinity stress. Abd El-All *et al*. (2013) and Ali *et al*. (2014) reported that application of biofertilizer slightly decreased the soil EC compared with the control. Rifat (2010) reported that the reduction in soil salinity might be attributed to the activity effect of microorganisms on improving soil structure and increasing drainable pores and consequently enhanced leaching process.

Table (3). Soil pH, EC and macronutrients contents in the studied soil after harvesting of the sugar beat.

Treatment	Rate of N kgfed-[1]	pH (1:2.5)		EC (dSm^{-1})		Available macronutrients ($mg\ kg^{-1}$)					
						N		P		K	
Seasons		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Mineral- N	0	8.09	8.08	10.53	9.43	38.54	39.76	3.52	3.61	193	195
	50	8.06	8.04	8.14	7.98	41.20	41.62	3.61	3.74	197	198
	75	8.02	8.01	7.95	6.88	42.59	42.66	3.74	3.77	203	207
	100	8.00	8.00	7.53	6.72	43.52	44.12	3.81	3.83	206	213
	Mean	---	----	8.54	7.75	41.46	42.04	3.67	3.74	200	203
Compost + Mineral- N	0	8.07	8.05	9.88	8.97	40.82	40.93	3.54	3.58	196	196
	50	8.02	8.01	7.83	6.44	42.19	42.53	3.88	3.92	203	207
	75	8.00	7.99	7.66	6.23	43.18	43.68	4.03	4.05	209	214
	100	7.98	7.96	6.83	5.14	44.03	44.15	4.07	4.09	212	216
	Mean	---	---	8.05	6.70	42.56	42.82	3.88	3.91	205	208
Bio-fertilizer + Mineral- N	0	8.06	8.04	9.83	8.65	40.68	40.63	3.57	3.62	194	198
	50	8.03	8.02	7.55	6.25	42.29	42.33	3.76	3.84	201	204
	75	8.01	8.00	7.43	6.10	43.96	44.27	3.84	3.88	207	210
	100	8.00	7.98	6.75	5.22	43.58	43.69	3.93	3.97	213	215
	Mean	----	-----	7.89	6.55	42.63	42.73	3.78	3.83	204	207
Mean 0		---	----	10.08	8.02	40.01	40.44	3.54	3.60	194	196
Mean 50		-----	-----	7.84	6.89	41.89	42.16	3.75	3.83	200	203
Mean 75		----	-----	7.68	6.40	43.24	43.54	3.87	3.90	206	210
Mean 100		----	---	7.04	5.69	43.71	43.99	3.94	3.96	210	215
General mean		-----	-----	8.16	7.00	42.21	42.53	3.78	3.82	202	215
LSD. 5 % fertilizer		----	-----	ns	ns	ns	ns	ns	ns	ns	ns
LSD.5 % rate		-----	-----	0.95	0.86	0.88	0.68	ns	ns	1.14	0.63
Interaction		----	-----	**	**	**	**	**	**	**	**

Available macronutrient contents in soil:

Results in Table (3) show significant increases in available N and K contents in soil of both two seasons while the P content in soil was not significantly affected by different rates of the applied mineral nitrogen fertilizer. The application of fertilizers on available contents of N, P and K in soil after harvest did not show a significant effect. The interaction between compost or bio-fertilizers and different N rates showed significantly effect on availability of N, P and K contents in soil in both seasons. According to the relative increases of soil available N content after sugar beet harvesting, the used fertilization treatment can be arranged as the following descending order: bio-fertilizer > compost > mineral N. The corresponding descending order for P and K was Compost > bio-fertilizer > mineral N. These results are in agreement with those of Kavitha and Subramanian (2007) who reported that the available soil N content was higher in soil treated with bio-fertilizer in combination with mineral fertilizer. The available P and K in the soil also increased with increasing compost application. Rashed (2006) found that the soil content of available N declined at highest rate of the mineral nitrogen fertilization i.e. 100 kg N fed^{-1}. Rifat et al. (2010) reported that PGPR as a bio-fertilizer helps in fixing N_2, solubilizing mineral phosphates and other nutrients as well as enhancing tolerance to stress.

Availability of micronutrients in the studied soil:

Table (4) show that the soil available micronutrient contents (Fe, Mn, and Zn) was increased due to the applied treatments and increases were more pronounced with compost + 100 kg N fertilizer than the other treatments in both seasons. These increases might be attribute to potential decrease due to release of organic acids up on decomposition of the applied organic matter on one hand beside of the organic matter itself is considered a source of Fe, Mn and Zn. Table (4) show also that Fe, Mn and Zn tended to increase in soil with increasing rate of the applied mineral nitrogen combined with compost or bio-fertilizer. These results are in agreement with those of Abdel Aal, et al. (2003) who found that the application of organic materials caused a substantial increase in Fe, Mn and Zn in soil. Shaban et al (2012) indicated that, Fe, Mn and Zn tended to increase in soil with increasing rate of mineral N fertilizer in combination with organic and bio-fertilizer.

Table (4). Available Micronutrients contents in soil in the studied soil after harvesting of the sugar beat.

Treatment	Rate of N $kgfed^{-1}$	Available micronutrients ($mg\ kg^{-1}$)					
		Fe		Mn		Zn	
Seasons		1st	2nd	1st	2nd	1st	2nd
Mineral- N	0	2.26	2.27	1.56	1.59	0.77	0.80
	50	2.38	2.40	1.64	1.66	0.82	0.85
	75	2.44	2.47	1.69	1.70	0.89	0.94
	100	2.48	2.51	1.72	1.74	0.95	0.98
	Mean	2.39	2.41	1.65	1.67	0.86	0.89
Compost + Mineral- N	0	2.28	2.32	1.59	1.61	0.82	0.87
	50	2.40	2.44	1.72	1.75	0.88	0.93
	75	2.62	2.66	1.77	1.80	0.93	0.97
	100	2.68	2.72	1.82	1.85	0.97	1.02
	Mean	2.50	2.54	1.73	1.75	0.90	0.95
Bio-fertilizer+ Mineral-N	0	2.27	2.31	1.58	1.60	0.81	0.84
	50	2.39	2.42	1.70	1.73	0.87	0.89
	75	2.55	2.57	1.75	1.76	0.92	0.97
	100	2.60	2.63	1.78	1.80	0.95	0.98
	Mean	2.45	2.48	1.70	1.72	0.89	0.92
Mean 0		2.27	2.30	1.58	1.60	0.80	0.84
Mean 50		2.39	2.42	1.69	1.71	0.86	0.89
Mean 75		2.54	2.57	1.74	1.75	0.91	0.96
Mean 100		2.59	2.62	1.77	1.80	0.96	0.99
General mean		2.45	2.48	1.69	1.71	0.88	0.92
LSD. 5 % fertilizer		ns	ns	ns	ns	ns	ns
LSD.5 % rate		ns	ns	ns	0.052	0.022	0.044
Interaction		ns	ns	ns	***	***	**

In general, the positive effects of the used different mineral nitrogen fertilizer rates, compost and bio-fertilizer on available Fe, Mn and Zn could be arranged in following descending order : Compost > bio-fertilizer > mineral N fertilizer.

It is worthy to mention that the contents of the available Fe and Mn are within the sufficient limits while the content of Zn is in critical limit according to (FAO, 1992).

Sugar beet yield:

Effect of mineral nitrogen fertilizer; compost and bio-fertilizer on yield and yield components are presented in Table (5) which shows that weight of fresh roots (Mg fed^{-1}) significantly increased as affected by mineral nitrogen, compost and bio-fertilizer and the increases more obvious with increasing rate of the mineral N in both seasons. The effects rate of the applied mineral N on dry root (Mg fed^{-1}), sugar yield (Mg fed^{-1}), purity (%) and sucrose (%) were significant in both studied seasons. Also, the interaction between rate and each of compost and bio-fertilizer on fresh root, dry root sugar yield and purity (%) were significant in both seasons. On the other hand, the application of the used fertilizers did not affect significantly the sugar yield, TSS (%), purity (%) and sucrose (%) in both seasons. Concerning the purity sugar (%) and sucrose (%), they were increased with soil treated by bio-fertilizer combined with 50 kg N fertilizer compared with other treatments. These results are in agreement with Bahman *et al* (2013) who found that increasing the nitrogen fertilizer caused a meaningful reduction in the sucrose (%) and the purity of sugar (%), while the application of biological fertilizer showed an increase in root yield, sucrose and purity of sugar (%). Kandil *et al*., (2004) reported that seed treatment of sugar beet by biological basis fertilizer of Rhizobacterium caused significant increases in dry and fresh root weight, leaf area index, crop growth rate and the rate of photosynthesis. Bacterial (R. radiobacter) are plant growth promoting rhizobacteria and some are endophytes which can produce phytohormones, siderphores, solubilize sparingly soluble organic and inorganic phosphates, also might influenced cytokinins and IAA hormone contents. Rhizobium radiobcter has an effect on promoting plant growth and increasing pathogen resistance against powdery mildew and can colonize the roots of many non-legumes (Sessitsch et al., 2002). (Ben Romdhane *et al*., (2005). and Sinha *et al.,* (2014) suggested that bio-fertilizers keep the soil environment rich in all kinds of micro- and macro-nutrients via nitrogen fixation, phosphate and potassium solubalization or mineralization, release of plant growth regulating substances, production of antibiotics and biodegradation of organic matter in the soil. Bio-fertilizer inoculation positively affected productivity and physiological criteria as well as salinity tolerance of the tested plants (Tawfik *et a.l* (2011).

Macronutrients concentrations in root:

Data presented in Table (6) show that application of compost, bio-fertilizer alone or in combined with mineral nitrogen affected significantly effect on N concentration in roots but did not show such an effect on P and K in both seasons.

Table (5). Yield and yield components of sugar beat.

Treatment	Rate of N kgfed-1	Root fresh weight *(Mg fed-1)		Root dry weight (Mg fed-1)		Sugar yield (Mg fed-1)		**TSS (%)		Purity (%)		Sucrose (%)	
Seasons		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Mineral -N	0	2.59	2.75	0.695	0.703	0.39	0.41	22.18	22.36	73.80	73.96	14.96	15.21
	50	8.93	9.14	1.960	2.160	1.36	1.41	23.30	23.54	79.63	81.25	15.27	15.49
	75	9.47	10.22	2.495	2.522	1.52	1.66	23.71	23.85	83.24	84.61	16.10	16.23
	100	11.83	12.13	2.837	2.850	1.98	2.04	23.83	23.91	85.19	85.29	16.75	16.82
	Mean	8.21	8.56	2.00	2.06	1.31	1.38	23.26	23.42	80.47	81.28	15.77	15.94
Compost + Mineral- N	0	3.74	3.85	0.846	0.863	0.63	0.65	22.20	22.83	82.16	83.07	16.82	16.95
	50	14.67	14.96	3.286	3.318	2.74	2.80	23.65	23.89	85.72	86.41	18.66	18.73
	75	18.52	19.14	3.729	3.749	3.48	3.60	23.86	23.92	88.39	89.76	18.79	18.83
	100	22.41	23.08	4.533	4.660	4.23	4.37	24.37	23.94	92.18	92.45	18.88	18.94
	Mean	14.84	15.26	3.10	3.15	2.77	2.86	23.52	23.65	87.11	87.92	18.29	18.36
Bio-fertilizer+ Mineral- N	0	3.70	3.88	0.839	0.845	0.62	0.66	22.81	22.96	88.39	89.13	16.92	17.02
	50	14.32	14.55	3.349	3.369	2.76	2.84	23.78	23.89	95.47	97.19	19.28	19.55
	75	21.19	22.59	4.120	4.231	3.95	4.26	25.17	25.22	92.78	93.22	18.66	18.88
	100	20.93	21.16	4.115	4.126	3.87	4.01	23.93	23.98	91.96	92.59	18.53	18.74
	Mean	15.04	15.55	3.11	3.14	2.80	2.94	23.92	24.01	92.15	93.03	18.35	18.55
Mean 0		3.34	3.49	0.79	0.80	0.55	0.57	22.40	22.72	81.45	82.05	16.23	16.39
Mean 50		12.64	12.88	2.87	2.95	2.29	2.35	23.58	23.77	86.94	88.28	17.74	17.92
Mean 75		16.39	17.32	3.45	3.50	2.98	3.17	24.25	24.33	88.14	89.20	17.85	17.98
Mean 100		18.39	18.79	3.83	3.88	3.36	3.47	24.04	23.94	89.78	90.11	18.05	18.17
General mean		12.70	13.12	2.74	2.78	2.29	2.39	23.57	23.69	86.58	87.41	17.47	17.62
LSD. 5 % fertilizer		2.420	1.087	ns	0.230	ns	ns	ns	ns	Ns	ns	ns	ns
LSD.5 % rate		4.560	1.865	0.579	0.621	1.140	0.840	ns	ns	2.73	3.70	2.216	1.860
Interaction		***	***	**	**	***	**	***	ns	***	**	ns	ns

*** Mg = ton = 1000 kg** ****TSS Total Soluble Solids**

Table (6). Macro and micronutrient concentrations in root of sugar beet.

Treatment	Rate of N kgfed-1	Macronutrient concentration in root (%)						Micronutrient concentration in root (mg kg-1)					
		N		P		K		Fe		Mn		Zn	
Seasons		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Mineral -N	0	0.89	0.85	0.11	0.14	1.07	1.08	45.25	45.36	29.88	29.91	14.85	14.88
	50	0.92	0.94	0.15	0.17	1.12	1.14	45.69	45.75	31.54	31.66	16.52	16.58
	75	0.97	0.99	0.19	0.20	1.18	1.20	45.88	45.93	31.63	31.72	16.66	16.72
	100	1.02	1.03	0.22	0.23	1.23	1.25	46.10	46.18	31.72	31.85	16.82	16.85
	Mean	0.95	0.95	0.17	0.18	1.15	1.17	45.73	45.81	31.19	31.29	16.21	16.26
Compost + Mineral- N	0	0.92	0.95	0.13	0.15	1.03	1.05	45.63	45.65	30.85	30.94	15.71	15.74
	50	0.97	0.99	0.18	0.19	1.08	1.09	46.23	46.38	31.66	31.75	16.83	16.88
	75	1.06	1.08	0.22	0.22	1.30	1.32	46.39	46.45	32.12	32.15	17.93	17.96
	100	1.12	1.14	0.25	0.26	1.32	1.34	47.22	47.35	32.18	32.20	17.98	18.00
	Mean	1.02	1.04	0.20	0.19	1.18	1.20	46.37	46.46	31.70	31.76	17.11	17.15
Bio-fertilizer+ Mineral- N	0	0.90	0.95	0.12	0.16	1.06	1.08	45.67	45.88	30.91	30.95	15.69	15.75
	50	1.03	1.08	0.18	0.23	1.13	1.15	46.58	46.69	31.72	31.88	16.55	16.63
	75	1.07	1.13	0.22	0.25	1.18	1.22	47.38	49.14	31.88	31.96	17.83	17.85
	100	0.98	1.05	0.26	0.28	1.25	1.29	47.39	49.20	32.14	32.20	17.92	17.96
	Mean	1.00	1.05	0.20	0.23	1.16	1.19	46.76	47.73	31.66	31.75	17.00	17.05
Mean 0		0.90	0.92	0.12	0.15	1.05	1.07	45.52	45.63	30.55	30.60	15.42	15.46
Mean 50		0.97	1.00	0.17	0.20	1.11	1.13	46.17	46.27	31.64	31.76	16.63	16.70
Mean 75		1.03	1.07	0.21	0.22	1.22	1.25	46.55	47.17	31.88	31.94	17.47	17.51
Mean 100		1.04	1.07	0.24	0.25	1.27	1.29	46.90	47.58	32.01	32.08	17.57	17.60
General mean		0.99	1.01	0.19	0.20	1.16	1.19	46.29	46.67	31.52	31.60	16.77	16.82
LSD.5 % fertilizer		0.022	0.030	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
LSD.5 % rate		0.041	0.071	0.012	0.046	ns	ns	ns	ns	ns	ns	ns	ns
Interaction		***	**	**	***	**	**	ns	ns	ns	ns	ns	ns

Increasing rate of the mineral N significantly increased N and P concentrations in roots in both seasons, but the effect of different rate of fertilizers application on K was not significant in both seasons. Also, the interaction of compost or bio-fertilizer in combination with different rates of N significantly effected N, P and K concentrations in roots in both seasons, but the effect of rate of fertilizer application on K was not significant in both seasons. While, the interaction between compost or bio-fertilizer in combination with different rates of N significantly affected N, P and K concentrations in roots in both seasons.

These results are in agreement with those of ElKoca et al., (2008) who indicated that inoculation with the bio-fertilizer (PGPR) strains increased N, P and K content in root. Generally, the increases occurred in macronutrient concentrations in roots of sugar beet may be due to decrease in soil pH, soil salinity and increase of the activity of microorganisms in soil due to the aforementioned treatments

Micronutrient concentrations in root of sugar beet:

Table (6) show that applying compost, bio-fertilizer and mineral N fertilizer caused significant increases in concentrations of Fe, Mn and Zn in root whoever, the increases were more pronounced by increasing rate of the applied mineral N fertilizer. These results are in agreement with those obtained by Adewole and Ilesanmi (2011) who found that the organic fertilizer may have enhanced the availability, mobility and uptake of these nutrients in the roots. El-Shaikh and Mohammed (2009) went to the same results and reported that bio-fertilizer enhanced the uptake of micronutrients, such as Zn, Fe, Mn and Cu.

CONCLUSION

Bio-fertilizer and compost application in agriculture will have greater impact on organic agriculture and also to control the environmental pollution, soil health improvement. So, using a mixture of selected effective microorganisms active in nitrogen fixation, hormonal and enzyme production in combination with compost can partially meet the nutrient requirements of sugar beet production under saline soil conditions. However, sugar beet would have to develop growth, which responds to the integrated use of compost and bio-fertilizer inoculation to reduce the dose of mineral nitrogen fertilizers needed. As a result, biological fertilizer, with a lower cost, had a more usage of the soil.

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تهيئة الظروف البيئية لانتاج بنجر السكر باضافة الأسمدة الحيوية والعضوية تحت ظروف الأراضى الملحية المستصلحة حديثا بشمال سيناء.

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اجريت تجربتان حقليتان خلال الموسم الشتوى 2012/2011 و الموسم الشتوى 2012/ 2013 م لدراسة أثر إستخدام الأسمدة العضوية والحيوية منفردة أو متداخلة مع معدلات مختلفة من التسميد النيتروجين المعدنى على بعض خواص التربة وانتاجية بنجر السكر تحت ظروف الأراضى الملحية حديثة الأستصلاح . تم تلقيح بذور بنجر السكر صنف Loil بريزوبيم راديوباكتريا معزولة من الأراضى الملحية والمتحملة للملوحة والمثبة للنيتروجين والمحتوية على مجموعات PGPR .

أشارت النتائج إلى ان حموضة التربة لم تتأثر معنويا باستخدام الأسمدة الحيوية أو الكمبوست فى وجود أو عدم وجود النيتروجين المعدنى . إنخفضت ملوحة التربة مع التسميد الحيوى والعضوى المتحدين مع المعدل العالى من التسميد النتروجينى المعدنى. الزيادة النسبية لمتوسط العناصر الكبرى النتروجين والفوسفور والبوتاسيوم الميسر فى التربة بإضافة التسميد النيتروجين المعدنى والعضوى والحيوى كان ترتيبهم كالتالى للنيتروجين : التسميد الحيوى > الكمبوست >التسميد المعدنى لعنصر النتروجين بينما كان الكمبوست > التسميد الحيوى > التسميد النيتروجين المعدنى للفوسفور والبوتاسيوم بالمقارنة بالعناصر فى التربة قبل الزراعة. كان تاثير السماد الجيوى والكمبوست ومعدلات النيتروجين غير معنوية فى الموسمين على تيسر عنصر الحديد بينما كان تأثير معدلات التسميد النيتروجينى والتداخل بين الأسمدة معنوى التأثير على تيسر عنصر المنجنيز فى الموسم الثانى وتيسر عنصر الزنك فى الموسم الأول والثانى.

وجد أن أعلى متوسط للمحصول الطازج لجذور البنجر (ميجا جرام /للفدان) ووزن محصول البنجر جاف (ميجا جرام / فدان) ومحصول السكر (ميجا جرام / فدان)و نسبة المادة الصلبة المذابة ونسبة النقاوة ونسبة السكروز فى التربة المعاملة بالتسميد الحيوى بالمقارنة بباقى الأسمدة المضافة. وجد ان تركيز النيتروجين فى الجذور (1.14 %) كانت للتربة المعاملة بالكمبوست + 100 كجم نيتروجين بينما أعلى قيمة للفوسفور والبوتاسيوم كانت 0.28 % للفوسفور و 1.29 للبوتاسيوم نتيجة معاملة التربة بالتسميد الحيوى + 100 كجم نيتروجين على التوالى.

من ناحية اخرى وجد ان التسميد الحيوى والكمبوست والمعدنى لم يكن لهم تاثير معنوى على تركيز العناصر الحديد والمنجنيز والزنك فى بنجر السكر خلال الموسمين .

من النتائج السابقة وجد أن إضافة التسميد الحيوى والكمبوست لبنجر السكر أدى الى زيادة فى محصول الجذور والصفات المحصولية والتقليل من التسميد النيتروجين المعدنى وتكلفتة. حيغ ان افضل انتاجية لمحصول السكر كانت عند استخدام التسميد الحيوى مع 50 كجم من التسميد النتروجين المعدنى.