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RESPONSE OF SUGAR BEET PLANTS TO DIFFERENT COMPOST TYPES AND BORON SPRAYING AND THEIR EFFECT ON GROWTH CHARACTERS AND QUALITY UNDER RAS SUDR GONDITIONS

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ABSTRACT

Two field experiments were carried out in Ras Sudr Research Station, Desert Research Center, at South Sinai Governorate, Egypt during two successive growing winter seasons i.e. 2011/2012 and 2012/2013 to study the effect of nine treatments of compost produced from animal waste, town refuse and plant waste applied at three rates (10, 20 and 30 m^3/fed.) and three rates of foliar application of boron (control, 0.4 and 0.6 g/L.) and their interactions on growth (leaf area, root length, root diameter and total soluble solids (T.S.S %), root fresh and dry weight / plant, top fresh and dry weight / plant) and chemical composition (sugar, juice purity and crude protein %) of sugar beet plants. Split plot design was used. The results indicated that the highest values of growth parameters were recorded in plants treated with 30 m^3 / fed. compost produced from animal waste in the first and second seasons. There were significant differences in chemical composition in sugar beet of roots among the tested sources of different compost types during first and second seasons. The highest values of sugar and crude protein percentage were recorded in plants treated with 30 m^3/fed. animal waste. While, the highest value of juice purity % was obtained by using 30 m^3 / fed. of animal waste and 10 m^3 / fed. town refuse at the first and second seasons, respectively. Boron foliar application showed significantly responses in the two seasons with respect to growth characters of sugar beet. Increasing boron foliar application from 0 to 0.4 g/L. increased growth characters of sugar beet at the first and second seasons. Application of boron spray exerted a significant increase in sugar, juice purity and crude protein %. The interaction between compost types and boron foliar had a significant effect on leaf area in the first and T.S.S. % in the second season. The interaction between different compost types and boron foliar had a significant effect on sugar, juice purity and crude protein %.

Keywords: compost types, boron foliar, sugar beet, South Sinai, growth, chemical composition.

INTRODUCTION

Sugar beet crop has an important position in Egyptian crop rotation as winter crop not only in the fertile soils, but also in poor, saline alkaline and calcareous soils. Whereas, it could be economically grown in the newly reclaimed soils such as South Sinai of Egypt as one of the most tolerant crops to salinity and wide range of climates. Sugar beet being, often, the most important cash crop in the rotation, it leaves the soil in good conditions for the benefit of the following cereal crops. By-products of sugar production, such as pulp, molasses and lime, flow bath into agriculture to increase livestock production and improve soil fertility as well as provide various middle products as alcohol, forage and other many products.

Arid and semi-arid regions represent about 30% of the total global land surface, and could contribute significantly to the agricultural production, considering constraints limiting factors for growth and production were paved away. High salts concentration results in high osmotic potential of the soil solution, so the plant has to use more energy to absorb water. Under extreme salinity conditions, plants may be unable to absorb water and will wilt, even when the surrounding soil is saturated. When a plant absorbs water containing ions of harmful salts (e.g. sodium, chloride, excess of boron etc.), visual symptoms might appear, such as stunted plant growth, small leaves, marginal necrosis of leaves or fruit distortions.

Benefit from the remnants of cities and farm wastes that pollute the environment and recycled into compost and use it as fertilizer landslide in the cultivation of sugar beet plant. In this respect, Esawy *et al*. (2009) mentioned that the highest fruit and dry shoot weights of cucumber were in the plots treated with the plant compost compared to animal and mixed composts. However, El-Nagdi and Abd El Fattah (2011) showed that all plant residues, biofertilizer, and organic compost alone or in combination with biocides significantly increased fresh weight of roots and shoots of sugar beet plants. On the other hand, Luna *et al.* (2011) studied the effect of five compost i.e. compost1(30 % Sludge paper manufacturer + 30% Sludge soft drink manufacture + 30% Chili pepper residues + 10% Corn stubble), compost 2 (0 % Sludge paper manufacturer + 35% Sludge soft drink manufacture + 55% Chili pepper residues + 10% Corn stubble), compost 3 (45 % Sludge paper manufacturer + 25% Sludge soft drink manufacture + 25% Chili pepper residues + 5% Corn stubble), compost 4 (0 % Sludge paper manufacturer + 0% Sludge soft drink manufacture + 75% Chili pepper residues + 25% Corn stubble), compost 5 (45 % Sludge paper manufacturer + 45% Sludge soft drink manufacture + 0% Chili pepper residues + 10% Corn stubble) and without compost on growth of bean plants. They found that compost 5 gave the highest growth compared with other treatments.

Boron is essential for many plant functions. Some of them are: maintaining a balance between sugars and starch, the translocation of sugar and carbohydrates. it is necessary for normal cell division, nitrogen metabolism, and protein formation. Several investigations concluded that increasing boron increased the growth and chemical composition of sugar beet and another crops has been well documented by Ibrahim (2006), Tabrizi *et al.* (2008), Abou EL-Yazied and Mady. (2012) and Aparna and Puttaiah. (2012).

The aim of this study is to evaluate the effect of nine compost treatments produced and three levels of boron spraying on growth and chemical composition of sugar beet (*Beta vulgaris* L.) grown in a calcareous soil at Ras Sudr conditions.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm of the Desert Research Center (DRC) at Ras Sudr region, South Sinai Governorate, during the successive winter seasons of 2011/2012 and 2012/2013 to study the effect of two factors, i.e. compost types and boron on growth and chemical composition of sugar beet.

The soil of the location was highly calcareous and saline. Some physical and chemical analyses of the experiment soil are presented in Table (1). The physical and chemical analysis was carried out according to the methods described by Jackson (1970).

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

Physical analysis							
Depth (cm)	**$CaCO_3$%**	**Coarse sand %**	**Fine sand %**	**Silt %**	**Total sand**	**Clay**	**Texture**
			%				
0-30	**55.85**	**54.51**	**25.88**	**8.36**	**80.39**	**11.25**	Sandy loam
30-60	**51.21**	**25.49**	**64.12**	**7.20**	**89.61**	**6.45**	Sandy loam

Chemical analysis										
			Soluble anions (meq / L)				Soluble cations (meq / L)			
Depth (cm)	**pH**	**EC dS/m**	**CO_3^{--}**	**HCO_3^-**	**SO_4^{--}**	**Cl^-**	**Ca^{++}**	**Mg^{++}**	**Na^+**	**K^+**
0-30	7.7	4.77	0.00	6.00	10.50	31.20	24.00	11.00	10.52	2.18
30-60	7.4	4.16	0.00	3.00	16.10	22.50	16.83	6.00	17.80	0.97

***In soil paste**

The experimental treatments

A-Different compost types

1- compost produced from animal waste at rates of (10, 20 and 30 m^3/fed).
2- compost produced from town refuse at rates of (10, 20 and 30 m^3/fed).
3- compost produced from plant waste at rates of (10, 20 and 30 m^3/fed).

These amounts of mature compost were added to the soil after dividing plots, and then mixed with the soil in each plot before cultivation. The analysis of compost types are given in Table (2).

B-Boron foliar application:

1- Control (tap water)
2- 0.4 g / L.
3- 0.6 g / L.

Boron were applied as foliar application in the form of borax (Na_2 B_4 O_7 . loH_2O, 11.3%B) ,was sprayed at two times , i.e. after 40 and 60 days from sowing with 400 liter / fed.

The design of experiment was split plot with four replication, each replicate included 27 treatments which were the combination between nine different compost types treatments and three treatments of boron. The main plots were devoted to the boron, while the sub-plots were occupied by compost types. The experimental plots area 10.5 m^2 (3 x 3.5 m), consisting of 6 ridges, each of 50 cm width and 3.5 m length, 50 cm were between hills and four seeds were planted in each hill. Before sowing all plots received 150 kg calcium super phosphate / fed. (15.5% P_2O_5) were added during seed-bed preparation before planting and was mixed with the surface layer. In addition, 150 kg ammonium sulphate / fed. (20.5% N) and 200 kg potassium sulphate / fed. (48% K_2O) were applied at two doses, the first and second dose were applied after one and two months from sowing, respectivly.

Table (2): Chemical analysis of compost types.

Characters \ Compost types	Animal wastes	Town refuses	Plant wastes
Temperature	27.0	27.5	26.6
Carbon dioxide %	5.4	6.5	6.6
Moisture content	52.5	56.9	55.4
pH	6.9	7.6	7.4
EC dS/m	5.1	7.1	5.5
Organic carbon %	30.9	27.3	31.2
Organic matter %	53.1	46.9	53.7
Nitrogen %	1.07	0.88	0.96
C/N ratio	26.99	31.02	32.50
Phosphorus %	0.72	0.66	0.70
Potassium %	1.45	1.03	1.39
Cadmium (mg/kg)	0.66	0.76	0.54
Lead(mg/kg)	3.4	4.4	2.4
Copper(mg/kg)	2.8	3.6	1.7
Zinc(mg/kg)	96.4	112.8	86.4
Boron(mg/kg)	1.59	2.61	1.35

Sugar beet seeds of Gazelle variety (*Beta vulgaris*, L) were sown on 15^{th} of October in the two growing seasons (2011/2012 and 2012/2013), the plants were thinned to one plant per hill fifteen day after planting date. The experiment was irrigated immediately after sowing by water pumped from a well (3500 ppm). The analysis of irrigation water is given in Table (3).

Five plants were taken from each sub-plot at 180 days from sowing date to determine leaf area, root length, root diameter and total soluble solids (T.S.S. %), also chemical composition was determined in roots. Sugar percentage was determined in the juice of the sugar beet root using Saccharimeter equipment on a lead acetate extract of fresh macerated roots according to the method of Le-Docte, (1927). Juice purity % was determined according to Carruthers and Oldfield (1961) as a ratio between sucrose % and T.S.S %. Total nitrogen was determined by using micro-Kjeldahl method as described by Peach and Tracey (1956). Crude protein was calculated by multiplying total nitrogen by 6.25.

Statistical analysis:

All data obtained from the experiment were subjected to the proper statistical analysis of variance of the split plot design according to the procedure outlined by Snedecor and Cochran (1969). Mean values of treatments were differentiated by using L.S.D at 5% level as mentioned by Steel (1960).

Table (3). Chemical analysis of the irrigation water.

salinity (ppm)	pH	ECdS/m	Anions meq /L				Cations meq /L			
			CO_3^{--}	HCO_3^-	SO_4^{--}	Cl^-	Ca^{++}	Mg^{++}	Na^+	K^+
3500	7.8	5.47	0.00	2.55	81.23	16.22	23.65	19.18	65.62	0.45

RESULTS AND DISCUSSION

Effect of different compost types, boron foliar spraying and their interactions:

1- Growth characteristics of sugar beet:

Data presented in Tables (4 and 5) clearly indicate that there were significant differences in growth characters i.e. leaf area, root length, root diameter and total soluble solids % (T.S.5%), root fresh and dry weight / plant and top fresh and dry weight / plant of sugar beet between the tested sources of different compost types during both seasons. The highest values of growth characters were recorded in plants treated with 30 m^3 / fed.of animal waste (75 % organic manure + 25 % plant residues) in the first and second seasons. The lowest value was obtained from 10 m3 / fed. town refuse (75% towns refuse + 12.5 % organic manure + 12.5% plant residues) in two growing seasons. In all treatments, increasing compost production from 10 to 30 m^3/fed. increased growth characters. These results are in agreement with those obtained by Essam *et al.* (2011), Ismail and Mohamed (2012), El-Quesni *et al.* (2013) and Ramadan *et al.* (2013).

The results in Tables (6 and 7) indicate that boron foliar application showed significantly responses in two seasons in respect to leaf area, root length, root diameter, total soluble solids (T.S.5%), root fresh and dry weight / plant and top fresh and dry weight / plant of sugar beet. Increasing boron foliar application from 0 to 0.4 g/L. increased growth characters of sugar beet at the first and second seasons. On the contrary, control treatment (nil boron treatment) gave the lowest value of all growth characters in the first and second seasons. These results are in harmony with those obtained by Abido (2012), Abou EL-Yazied and Mady. (2012), Aparna and Puttaiah. (2012) and Konthoujam *et al.* (2012).

Table (4). Leaf area, root length, root diameter and total soluble solids of sugar beet at harvest as affected by compost types in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters	Leaf area (cm^2)	Root length (cm)	Root diameter (cm)	Total soluble solids (T.S.S%)
Compost types	**2011/2012**			
10 m^3 A.W	3455	25.7	11.7	20.12
20 m^3 A.W	3599	26.9	12.2	20.35
30 m^3 A.W	3772	27.8	11.4	20.74
10 m^3 T.R	2652	21.6	9.6	20.12
20 m^3 T.R	2822	22.1	10.4	19.84
30 m^3 T.R	3088	22.9	10.4	20.23
10 m^3 P.W	2905	24.4	10.7	19.91
20 m^3 P.W	3080	25.5	11.1	19.98
30 m^3 P.W	3333	26.4	11.5	20.45
LSD at 5%	**42**	**0.7**	**0.7**	**0.37**
2012/2013				
10 m^3 A.W	3021	22.7	10.0	19.51
20 m^3 A.W	3218	23.9	10.0	19.77
30 m^3 A.W	3432	24.7	11.0	20.08
10 m^3 T.R	2266	18.5	7.6	18.51
20 m^3 T.R	2455	19.0	8.4	18.90
30 m^3 T.R	2703	19.6	9.0	19.28
10 m^3 P.W	2795	21.3	8.7	18.99
20 m^3 P.W	2967	22.4	9.4	19.37
30 m^3 P.W	3133	23.1	9.9	19.72
LSD at 5%	**33**	**0.8**	**0.5**	**0.07**

A.W = Animal waste T.R. = Town refuse P.W = Plant waste

Table (5). Root fresh and dry weight / plant and tops fresh and dry weight / plant of sugar beet at harvest as affected by compost types in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters	Root fresh weight / plant (kg)	Root dry weight / plant (kg)	Top fresh weight / plant (kg)	Top dry weight / plant (kg)
Compost types	**2011/2012**			
10 m^3 A.W	1.114	0.251	0.489	0.058
20 m^3 A.W	1.255	0.287	0.532	0.064
30 m^3 A.W	1.408	0.327	0.582	0.071
10 m^3 T.R	0.790	0.170	0.420	0.047
20 m^3 T.R	0.906	0.199	0.452	0.052
30 m^3 T.R	1.021	0.227	0.486	0.057
10 m^3 P.W	1.005	0.222	0.458	0.053
20 m^3 P.W	1.123	0.251	0.489	0.058
30 m^3 P.W	1.248	0.284	0.524	0.063
LSD at 5%	**0.102**	**0.025**	**0.723**	**0.004**
2012/2013				
10 m^3 A.W	0.914	0.198	0.314	0.037
20 m^3 A.W	1.055	0.234	0.357	0.042
30 m^3 A.W	1.208	0.277	0.407	0.049
10 m^3 T.R	0.590	0.121	0.245	0.026
20 m^3 T.R	0.706	0.148	0.277	0.030
30 m^3 T.R	0.821	0.177	0.311	0.036
10 m^3 P.W	0.805	0.171	0.283	0.031
20 m^3 P.W	0.923	0.201	0.314	0.035
30 m^3 P.W	1.048	0.234	0.349	0.041
LSD at 5%	**0.055**	**0.012**	**0.022**	**0.002**

A.W = Animal waste T.R. = Town refuse P.W = Plant waste

Table (6). Leaf area, root length, root diameter and total soluble solids of sugar beet at harvest as affected by boron spraying in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters	Leaf area (cm^2)	Root length (cm)	Root diameter (cm)	Total soluble solids (T.S.5%)
Boron spraying	**2011/2012**			
Control	2954	22.3	9.1	20.54
0.4 g / L.	3423	26.4	12.5	19.71
0.6 g / L.	3192	25.7	11.4	20.33
LSD at 5%	**68**	**1.0**	**1.1**	**0.16**
2012/2013				
Control	2586	20.4	8.6	20.31
0.4 g / L.	3143	22.5	10.0	18.51
0.6 g / L.	2934	22.2	9.3	19.23
LSD at 5%	**263**	**1.3**	**0.2**	**0.12**

A.W = Animal waste T.R. = Town refuse P.W = Plant waste

Table (7). Root fresh and dry weight / plant and tops fresh and dry weight / plant of sugar beet at harvest as affected by compost types in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters	Root fresh weight / plant (kg)	Root dry weight / plant (kg)	Top fresh weight / plant (kg)	Top dry weight / plant (kg)
boron spraying	**2011/2012**			
Control	0.927	0.204	0.390	0.045
0.4 g / L.	1.245	0.285	0.594	0.072
0.6 g / L.	1.118	0.251	0.494	0.058
LSD at 5%	**0.204**	**0.052**	**0.009**	**0.004**
2012/2013				
Control	0.677	0.143	0.240	0.027
0.4 g / L.	1.095	0.244	0.394	0.046
0.6 g / L.	0.918	0.200	0.319	0.036
LSD at 5%	**0.024**	**0.006**	**0.072**	**0.008**

A.W = Animal waste T.R. = Town refuse P.W = Plant waste

Results in Tables (8 and 9) indicate that the interaction between compost types and boron foliar was insignificant effect on root length, root diameter, root fresh and dry weight plant and top fresh weight / plant of sugar beet in the two growing seasons. While, leaf area was significant in the first season, also total soluble solid and top dry weight / plant were significant during second season. In this respect, the combination of 30 m^3 / fed. animal waste and boron spraying at 0.4 g / L. recorded the maximum values of all growth characters of sugar beet plant in 2011/2012 and 012/2013 seasons. While, under control (without fertilizer) for boron and 30 m^3 / fed. town refuse gave the minimal values of growth characters in the two growing seasons.

Table (8). Leaf area, root length, root diameter and total soluble solids of sugar beet at harvest as affected by interaction in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Interaction C.T	Characters B	Leaf area (cm^2) 2011/2012	Leaf area (cm^2) 2012/2013	Root length (cm) 2011/2012	Root length (cm) 2012/2013	Root diameter (cm) 2011/2012	Root diameter (cm) 2012/2013	Total soluble solids (T.S.5%) 2011/2012	Total soluble solids (T.S.5%) 2012/2013
10 m^3 A.W	Control	3154	2615	23.8	21.8	9.9	9.2	20.29	20.59
	0.4 g / L.	3712	3297	27.1	23.3	13.2	11.0	19.62	18.70
	0.6 g / L.	3500	3150	26.1	23.1	12.1	9.2	20.43	19.26
20 m^3 A.W	Control	3320	2897	25.1	23.1	10.1	9.6	20.74	20.74
	0.4 g / L.	3818	3499	28.3	24.6	13.7	11.0	20.02	19.00
	0.6 g / L.	3659	3259	27.2	23.9	12.7	9.6	20.28	19.58
30 m^3 A.W	Control	3520	3118	25.4	23.4	10.4	10.0	21.05	20.95
	0.4 g / L.	4012	3650	29.5	25.4	14.2	12	20.37	19.37
	0.6 g / L.	3784	3529	28.6	25.2	9.7	10.0	20.80	19.93
10 m^3 T.R	Control	2429	2000	19.7	17.6	7.2	6.6	20.47	19.51
	0.4 g / L.	2889	2500	23.1	19.1	10.9	8.3	19.55	17.56
	0.6 g / L.	2637	2298	22.0	18.7	10.7	6.6	20.34	18.44
20 m^3 T.R	Control	2602	2197	20.0	18.1	8.1	7.7	20.21	19.73
	0.4 g / L.	3061	2750	23.5	19.5	11.5	9.0	19.26	17.95
	0.6 g / L.	2802	2419	22.9	19.4	11.5	7.7	20.04	19.02
30 m^3 T.R	Control	2865	2490	20.6	18.5	8.7	8.2	20.64	20.25
	0.4 g / L.	3338	2921	24.2	20.2	12.0	9.6	19.72	18.35
	0.6 g / L.	3060	2698	23.8	20.0	10.6	8.2	20.32	19.24
10 m^3 P.W	Control	2700	2505	20.8	18.9	8.9	8.3	20.32	19.97
	0.4 g / L.	3133	3053	26.7	22.6	11.7	9.1	19.38	18.18
	0.6 g / L.	2882	2828	25.8	22.5	11.4	8.3	20.03	18.82
20 m^3 P.W	Control	2909	2656	22.5	20.6	9.3	9.0	20.30	20.43
	0.4 g / L.	3287	3216	27.4	23.4	12.3	9.8	19.54	18.53
	0.6 g / L.	3045	3029	26.6	23.1	11.8	9.0	20.11	19.15
30 m^3 P.W	Control	3085	2798	23.2	21.2	9.6	9.0	20.82	20.61
	0.4 g / L.	3557	3405	28.2	24.2	12.9	11.0	19.94	18.95
	0.6 g / L.	3358	3196	27.9	23.9	12.1	9.0	20.58	19.60
LSD at 5%		**75**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**0.12**

A.W=Animal waste T.R.=Town refuse P.W = Plant waste C.T = Compost types B = Boron

2- Chemical composition of sugar beet:

The results in Table (10) indicate that the highest values of sugar and crude protein percentage were recorded in plants treated with 30 m^3/fed. animal waste and the lowest value was attained by using 10 m^3/fed. town refuse in the two seasons. In all treatments increasing compost production from 10 to 30 m^3/fed. increased sugar and crude protein % in plant tissues at the first and second seasons. While, the highest value of juice purity % was obtained by using 30 m^3 / fed. animal waste and 10 m^3 / fed. town refuse at the first and second seasons, respectively. The lowest values of juice purity were recorded by using 10 m^3 / fed. for town refuse and animal waste during the first and seasons, respectively. These results were reported by El-Nagdi and Abd El Fattah (2011) and Meherunnessa and Zakir (2011).

The results summarized in Table (11) show that application of boron fertilizer exerted a significant increase in sugar, juice purity and crude protein % in two seasons. Increasing boron spraying from 0 to 0.6 g/L. increased all chemical composition in the first and second seasons, except crude protein % (0.4 g/ L.) gave the highest value of protein). On the other, hand the lowest value of chemical composition of sugar beet was obtained with control (without boron) during 2011/2012 and 2012/2013 seasons. These results are in agreement with those obtained by Vince (2010), Abido (2012) and Konthoujam *et al.* (2012).

The data illustrated in Table (12) reveal that the interaction between different compost types and boron foliar had a significant effect on sugar % and crude protein % in roots of sugar beet plants in the two growing seasons. While, juice purity % was significant in second season. The maximum value of sugar % was obtained by boron foliar at 0.6 g / L. with either 30 m^3 animal waste / fed. in two seasons. While, the highest value of juice purity % was obtained by adding animal waste as compost at rate 30 m^3 / fed. with control (nil boron) in the first season, boron foliar application at 0.4 g / L. with 20 m^3 / fed. town refuse gave the highest value of juice purity % in the second season. The maximum value of crude protein was obtained by boron foliar at 0.4 g / L. with either 30 m^3 animal waste / fed. in both seasons.

Table (9). Root fresh and dry weight / plant and tops fresh and dry weight / plant of sugar beet at harvest as affected by interaction in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters / Interaction		Root fresh weight / plant (kg)		Root dry weight / plant (kg)		Top fresh weight / plant (kg)		Top dry weight / plant (kg)	
C.T	B	2011/ 2012	2012/ 2013	2011/ 2012	2012/ 2013	2011/ 2012	2012/ 2013	2011/ 2012	2012/ 2013
10 m^3 A.W	Control	0.945	0.695	0.208	0.146	0.378	0.228	0.043	0.026
	0.4 g / L.	1.273	1.123	0.294	0.249	0.613	0.413	0.074	0.050
	0.6 g / L.	1.123	0.923	0.252	0.199	0.476	0.301	0.056	0.035
20 m^3 A.W	Control	1.059	0.809	0.237	0.174	0.415	0.265	0.049	0.030
	0.4 g / L.	1.407	1.257	0.329	0.285	0.655	0.455	0.080	0.056
	0.6 g / L.	1.298	1.098	0.295	0.243	0.525	0.35	0.063	0.041
30 m^3 A.W	Control	1.205	0.955	0.274	0.213	0.474	0.324	0.057	0.038
	0.4 g / L.	1.575	1.425	0.372	0.333	0.697	0.497	0.087	0.062
	0.6 g / L.	1.445	1.245	0.335	0.284	0.575	0.400	0.070	0.048
10 m^3 T.R	Control	0.675	0.425	0.142	0.082	0.317	0.167	0.035	0.017
	0.4 g / L.	0.899	0.749	0.197	0.157	0.515	0.315	0.059	0.034
	0.6 g / L.	0.797	0.597	0.172	0.123	0.429	0.254	0.047	0.027
20 m^3 T.R	Control	0.764	0.514	0.164	0.103	0.359	0.209	0.040	0.022
	0.4 g / L.	1.039	0.889	0.232	0.191	0.539	0.339	0.063	0.038
	0.6 g / L.	0.915	0.715	0.201	0.150	0.458	0.283	0.052	0.031
30 m^3 T.R	Control	0.848	0.598	0.185	0.124	0.401	0.251	0.046	0.028
	0.4 g / L.	1.191	1.041	0.27	0.230	0.573	0.373	0.069	0.044
	0.6 g / L.	1.023	0.823	0.227	0.176	0.485	0.310	0.056	0.035
10 m^3 P.W	Control	0.809	0.559	0.175	0.116	0.354	0.204	0.040	0.022
	0.4 g / L.	1.185	1.035	0.265	0.225	0.552	0.352	0.065	0.039
	0.6 g / L.	1.021	0.821	0.225	0.173	0.469	0.294	0.054	0.032
20 m^3 P.W	Control	0.949	0.699	0.209	0.147	0.387	0.237	0.044	0.026
	0.4 g / L.	1.254	1.104	0.284	0.246	0.585	0.385	0.071	0.044
	0.6 g / L.	1.165	0.965	0.261	0.211	0.496	0.321	0.058	0.036
30 m^3 P.W	Control	1.085	0.835	0.242	0.180	0.422	0.272	0.049	0.031
	0.4 g / L.	1.383	1.233	0.319	0.281	0.613	0.413	0.076	0.050
	0.6 g / L.	1.275	1.075	0.29	0.24	0.536	0.361	0.064	0.042
LSD at 5%		**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**0.004**

A.W=Animal waste T.R.=Town refuse P.W=Plant waste C.T = Compost types B = Boron

Table (10). Sugar %, juice purity %, Crude protein %, and boron (mg/kg) of sugar beet roots at harvest as affected by compost types in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters	**Sugar %**	**Juice purity %**	**Crude protein %**
Compost types			
10 m^3 A.W	17.17	85.33	10.42
20 m^3 A.W	17.70	86.96	10.71
30 m^3 A.W	18.17	87.58	11.14
10 m^3 T.R	15.67	77.89	9.77
20 m^3 T.R	16.20	81.64	10.10
30 m^3 T.R	16.74	82.75	10.40
10 m^3 P.W	15.87	79.67	10.04
20 m^3 P.W	16.54	82.77	10.35
30 m^3 P.W	17.03	83.29	10.79
LSD at 5%	**0.09**	**1.52**	**0.07**
10 m^3 A.W	16.64	85.35	9.57
20 m^3 A.W	16.87	85.39	9.82
30 m^3 A.W	17.16	85.50	9.99
10 m^3 T.R	15.94	86.21	8.98
20 m^3 T.R	16.26	86.10	9.22
30 m^3 T.R	16.57	86.02	9.51
10 m^3 P.W	16.28	85.78	9.26
20 m^3 P.W	16.59	85.73	9.57
30 m^3 P.W	16.90	85.73	9.80
LSD at 5%	**0.06**	**0.37**	**0.05**

A.W = Animal waste   T.R. = Town refuse   P.W = Plant waste

Table (11). Sugar %, juice purity %, Crude protein %, and boron (mg/kg) of sugar beet roots at harvest as affected by boron spraying in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters	**Sugar %**	**Juice purity %**	**Crude protein %**
Boron spraying	**2011/2012**		
Control	16.06	81.42	10.00
0.4 g / L.	16.86	82.93	10.77
0.6 g / L.	17.45	84.94	10.47
LSD at 5%	**0.04**	**0.45**	**0.04**
2012/2013			
Control	16.23	83.18	9.05
0.4 g / L.	16.61	86.40	10.20
0.6 g / L.	16.89	87.70	9.36
LSD at 5%	**0.04**	**0.72**	**0.04**

A.W = Animal waste   T.R. = Town refuse   P.W = Plant waste

Table (12). Sugar %, juice purity %, Crude protein %, and boron (mg/kg) of sugar beet roots at harvest as affected by interaction in 2011/2012 and 2012/2013 seasons at Ras Sudr.

Characters / Interaction		Sugar %		Juice purity %		Crude protein %	
C.T	B	2011/2012	2012/2013	2011/2012	2012/2013	2011/2012	2012/2013
10 m^3 A.W	Control	17.93	16.88	88.39	81.97	9.81	9.18
	0.4 g / L.	16.37	16.31	83.40	87.25	10.85	10.28
	0.6 g / L.	17.20	16.72	84.22	86.84	10.61	9.25
20 m^3 A.W	Control	18.37	17.15	88.54	82.69	10.28	9.42
	0.4 g / L.	16.90	16.60	84.39	87.35	11.11	10.50
	0.6 g / L.	17.83	16.86	87.94	86.13	10.75	9.54
30 m^3 A.W	Control	18.73	17.40	88.97	83.07	10.97	9.31
	0.4 g / L.	17.60	16.85	86.42	86.99	11.41	10.66
	0.6 g / L.	18.17	17.22	87.34	86.43	11.05	10.01
10 m^3 T.R	Control	16.27	16.39	79.52	83.99	9.40	8.51
	0.4 g / L.	14.90	15.44	76.27	87.93	10.08	9.59
	0.6 g / L.	15.83	15.99	77.87	86.71	9.82	8.85
20 m^3 T.R	Control	16.97	16.65	83.95	84.40	9.64	8.77
	0.4 g / L.	15.50	15.85	80.48	88.32	10.39	9.83
	0.6 g / L.	16.13	16.28	80.48	85.60	10.26	9.07
30 m^3 T.R	Control	17.33	16.89	83.97	83.42	10.06	9.04
	0.4 g / L.	15.97	16.19	80.95	88.28	10.59	10.14
	0.6 g / L.	16.93	16.62	83.33	86.37	10.55	9.35
10 m^3 P.W	Control	16.37	16.52	80.53	82.71	9.49	8.73
	0.4 g / L.	15.23	15.96	78.59	87.78	10.60	9.89
	0.6 g / L.	16.00	16.35	79.87	86.86	10.04	9.14
20 m^3 P.W	Control	17.37	16.91	85.55	82.75	9.90	9.08
	0.4 g / L.	15.67	16.30	80.19	87.95	10.80	10.24
	0.6 g / L.	16.60	16.57	82.57	86.50	10.37	9.39
30 m^3 P.W	Control	17.70	17.23	85.02	83.6	10.48	9.37
	0.4 g / L.	16.37	16.57	82.07	87.46	11.10	10.40
	0.6 g / L.	17.03	16.88	82.77	86.12	10.79	9.64
LSD at 5%		0.16	0.10	N.S	0.67	0.48	0.08

A.W = Animal waste T.R.=Town refuse P.W=Plant waste C.T=Compost types B = Boron

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استجابة نباتات بنجر السكر لمصادر مختلفة من الكمبوست والرش بالبورون وتأثيرهم على صفات النمو والجودة تحت ظروف منطقة رأس سدر

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أقيمت تجربتان حقليتان على نبات بنجر السكر بمحطة بحوث رأس سدر بمحافظة جنوب سيناء خلال موسمى 2012/2011 و 2013/2012 وذلك لدراسة تأثير تسع معاملات من الكمبوست المصنع من سماد المخلفات الحيوانية و سماد مخلفات المدن وسماد المخلفات النباتية أضيفت بمعدل (10 و 20 و 30 م^3 / فدان) وثلاثة معاملات من الرش بالبورون (بدون – 0.4 جم / لتر - 0.6 جم / لتر) والتداخل بينهما على صفات النمو والتركيب الكيماوى. حيث وزعت المعاملات فى تصميم قطع منشقة مرة واحدة. وكانت أهم النتائج المتحصل عليها مايلى:-

أمكن الحصول على اعلي زيادة معنوية لصفات النمو المختلفة (مساحة الأوراق – طول الجذر – قطر الجذر – المواد الصلبة الكلية الذائبة – الوزن الغض والجاف لكل من الجذور والأوراق) وكذلك بعض الصفات الكيميائية (نسبة السكر و البروتين الخام و نسبة نقاوة العصير) لنبات بنجر السكر باستخدام 30 م ^{3} / فدان من الكمبوست المصنع من المخلفات الحيوانية. أدت زيادة معدل الكمبوست المصنع من المصادر المختلفة من 10 إلى 30 م ^{3} / فدان إلى زيادة صفات النمو والتركيب الكيماوى. بينما أدت إضافة الكمبوست المصنع من مخلفات المدن بمعدل 10 م ^{3} / فدان الى الحصول على أقل القيم لصفات النمو والتركيب الكيماوى خلال الموسمين.

أدت زيادة معدلات الرش بالبورون من صفر إلى 0.4 جم / لتر الى زيادة صفات النمو لنبات بنجر السكر خلال موسمى الزراعة. أدت زيادة معدلات الرش بالبورون من صفر الى 0.6 جم / لتر إلى زيادة كل من نسبة السكر و نسبة نقاوة العصير ونسبة البروتين الخام فى جذور نباتات بنجر السكر.

أدت معاملة التفاعل بين 30 م 3 / فدان كمبوست منتج من مخلفات حيوانية والرش بالبورون بمعدل 0.4 جم / لتر إلى الحصول على اعلي القيم لكل من صفات النمو المختلفة لنبات بنجر السكر. أمكن الحصول على أعلى القيم من نسبة السكر نتيجة التفاعل بين 30 م 3 / فدان كمبوست منتج من مخلفات حيوانية والرش بالبورون بمعدل 0.6 جم / لتر خلال الموسمين. أعلى قيمة من نسبة نقاوة العصير أمكن الحصول عليها نتيجة التفاعل بين 30 م^3 / فدان كمبوست منتج من مخلفات حيوانية وبدون رش بالبورون خلال الموسم الأول , أمكن الحصول على اعلى نسبة من البروتين الخام نتيجة التفاعل بين اضافة 30 م^3 / فدان كمبوست منتج من مخلفات حيوانية والرش بالبورون بمعدل 0.4 جم / لتر خلال الموسمين.