Australian Journal of Basic and Applied Sciences, 6(10): 664-674, 2012
ISSN 1991-8178

Comparative Study of the Effects of Some Organic Extract on Sugar Beet Yield Under Saline Conditions

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Abstract: A field experiment was conducted to study the effect of three different organic extracts; compost tea (C.T), fermented olive mill wastewater (OMWW) and Amino Green compound (A.A), as well as yeast on sugar beet yield (*Beta vulgaris* L.) cultivated in saline calcareous soil at Ras Sudr Experimental Station, South Sinai, Egypt, and irrigated with saline water (4.32 dS/m). Three application methods were used; foliar spray, soil drench and foliar spray with soil drench. Two treatments, with and without yeast (*Saccharomyces cerevisiae*) were added as soil drench. The results indicated that, the plots treated with the (A.A), (OMWW) or (C.T) significantly increased the yield of roots, leaves, sugar comparing with the untreated plots. The corresponding increment values were respectively 49.5%, 59.8% and 23.9%, for roots, 50.5%, 47.0% and 79.7% for leaves, and for sugar yield were 58.8%, 63.7% and 25.2%. Both of OMWW and A.A treatments significantly increased the yield of roots and sugar comparing with C.T. While, C.T. increased the yield of leaves comparing with A.A. or OMWW, regardless of application method or addition of yeast. Yeast treatments significantly increased the yield of roots, leaves, sugar and sucrose content, recording increments of 22.1%, 30.4%, 28.4% and 5%, respectively. The interaction effect between yeast and organic extracts on yields was non significant .The application methods as soil drench of OMWW and as foliar spray plus soil drench of A.A gave the highest values of roots yield. The C.T, A.A and OMWW treatments significantly increased soil nutrients availability of N, P, Fe, Mn, Zn and K, compared with the control. Microbiological analysis of sugar beet rhizosphere revealed that the highest counts of total microbes, yeast, fungi and actinomycetes were detected in plots treated with A.A, OMWW with yeast and A.A with yeast, respectively. It could be concluded that the highest significant increases in roots and sugar yields were obtained by using yeast integrated with the treatment of (soil + foliar application of A.A) or (soil application of OMWW).These organic fertilizers successfully reduced the hazard effect of soil salinity conditions.

Key words: organic extracts amino acids, olive mill waste water, compost tea, yeast, sugar beet, saline condition, soil treatments.

INTRODUCTION

Sugar beet crop (*Beta vulgaris* L.) is considered to be the second source for sugar production in Egypt. It tolerates soil salinity and soil water stress (Hills *et al.*, 1990). One third of the Egyptian cultivated lands are already salinized. Overcoming salt stress is a main issue in the arid and semi-arid regions to secure crop productivity (Ghassemi *et al.* 1995).

Soil salinity is adversely affecting physiological and metabolic processes, finally diminishing growth and yield (Ashraf and Harris, 2004). Excessive salts injure plants by disturbing the uptake of water into roots and interfering with the uptake of competitive nutrients (David Franzen, 2007). The inhibitory effect of salinity on plant growth and yield has been ascribed to osmotic effect on water availability, ion toxicity, nutritional imbalance, reduction in enzymatic and photosynthetic efficiency and other physiological disorders (Khan *et al.*, 1995). Saline calcareous soils are frequently characterized by the low bioavailability of plant nutrients. Among the nutrients in the soil, deficiency in nitrogen, phosphorus, potassium, zinc, iron, manganese have been identified as some major constraints in sugar beet crop production, should be added to the soil accordingly (Armin and Asgharipour, 2011). To overcome the problem of sugar production shortage in Egypt, the challenge must be inevitable for reliving salinity conditions.

Nowadays, a great attention has been focused on the possibility of using natural and safe agents for promoting growth and yield of sugar beet under saline stress.

The use of organics and microbial systems for nutrients mobilization, or as biofertilizers are getting popular in recent years and being introduced to cater for different cropping systems.

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Amino acids are well known as biostimulants which have positive effects on plant growth, yield and significantly mitigates the injuries caused by abiotic stresses (Kowalczyk and Zielony, 2008). Commercially, it is extracted from natural materials such as soybean seeds.

The role played by accumulated amino acids in plants subjected to stress varies from acting as osmolytes, regulation of ion transport, modulating stomatal opening, and detoxification of heavy metals. Amino acids also affect synthesis and activity of some enzymes and gene expression (Rai, 2002). Recently, several studies have shown that plants can take up amino acids directly; by-passing the need for microbial mineralization to produce simpler inorganic N forms (Weigelt *et al.* 2005).

Compost tea is a highly concentrated microbial solution produced by extracting beneficial microbes from compost .It is a source of foliar and soil organic nutrients, contain chelated micronutrients for easy plant absorption and the nutrients is in a biologically available form for both plant and microbial uptake. Compost teas are gaining importance as an alternative to chemical fertilizers and pesticides. The microbial population in the compost tea contributes toward its effectiveness. It has beneficial effects on plant growth and considered as a valuable soil amendment (Gharib *et al.,* 2008).

Olive Mill Waste Water (OMWW) is the main waste product generated in olive oil extraction industry; about $5.4*10^6$ m^3 OMWW annually produced worldwide (Baccar *et al.,* 1996 and Benitez *et al.,* 1997). It is rich in organic materials as polysaccharides, lipids, proteins and aromatic molecules (Ethaliotis *et al.,* 1999) minerals such as N, P, K, Ca, Mg and micronutrients. The extract can be utilized in agricultural practices as soil amendment, (Aqeel and Hameed, 2007). The extract can be used as a safe agronomic amendment after chemical or biological phenols removing. Foliar fertilization using olive mill wastewaters is also revealed to be a promising way to manage this effluent (Hanafi and El Hadarmi, 2007). But little information exists on the utilization under saline conditions.

The yeast (*Saccharomyces cerevisiae*) is a byproduct obtained from the recovery, processing and drying of the yeast surplus generated during the alcoholic fermentation from sugar can must. It is a natural bio- product rich in proteins, carbohydrates, minerals and vitamins (Brown *et al.,*1996), beside, hormones and other growth regulating substances (Nagodawithana, 1991).

This study aimed to using some environmental friendly products such as amino acids, compost tea, olive mill waste water and yeasts to alleviate the negative effects of salinity conditions and improve sugar beet yield.

MATERIAL AND METHODS

Field Experiment:

A field experiment was carried out in winter season during 2010/11 at Ras Sudr Experimental Station, South Sinai on sandy loam soil. The effects of different organic extracts on the yield production of sugar beet (*Beta vulgaris* L.) Var. Soltan in saline calcareous soil irrigated with saline water were studied.Some physical and chemical properties of the soil are presented in Table (1) and the average characteristics of chemical analysis of well irrigation water are given in Table (2).

Table 1: Some physical and chemical properties of the studied soil.

(A) Chemical analysis of soils.

pH	E.C dS/m	Available nutrients, mg Kg^{-1}						
Paste extraction		N	P	K	Fe	Mn	Zn	Cu
7.76	12.71	39.0	4.18	117	3.1	4.5	0.45	0.33

(B) Physical analysis of soils.

Particle size distribution %				Texture class	Ca CO_3 %	O.M %
Coarse sand	Fine sand	Silt	Clay			
12.3	58.7	19.7	9.3	S.L	46.1	0.43

Table 2: Chemical analysis of irrigation water.

pH	E.C dS/m	T.D.S ppm	Soluble ions ($mmol_c$ / L)								SAR	Class
			Cations				Anions					
			Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	CO_3^{-2}	HCO_3^{-}	Cl^{-}	SO_4^{-2}		
7.89	4.32	3096	6.18	4.54	32.6	0.57	-	2.84	26.4	15.2	14.0	$C_4S_2^*$

*: According to U.S. Salinity laboratory classification (1954).

Three organic extracts were used in the proposed experiment of this study; they originally obtained from different sources, amino acids, compost tea and olive mill waste water.

Amino Acids (A.A) Preparation:

It is a commercial compound of Amino Green, which contains (w/v) total amino acids plus organic acids

20%, Fe 2.9%, Zn 1.4%, Mn 0.7%, amino acids, proline, hydroxy proline, glycine, alanine, valine, methionine, lysine, cycteine, phenylalanine, serine, glutamic, arginine, histidine, lysine and hystiden. The A.A was applied at a rate of 2ml/L.

Compost Tea (C.T) Preparation:

Aerated compost tea was produced by mixing mature compost made by El-Arabeya-For-Organic-Fertilizer Factory (Table, 3), with tap water in the ratio of 1:5(w/v) in 20 liter container, supplemented with 2% molasses to stimulate microbial growth. The entire contents were continuously aerated at room temperature with air fish tank pump. For application, the tea was poured through a sieve.

Table 3: Some chemical properties of the used compost.

pH	E.C dS/m	C/N	Total nutrients N P K	Total nutrients Fe Mn Zn Cu
1:5			%	mg Kg^{-1}
8.1	6.8	16.8	1.46 0.78 1.12	325 146 78.5 35.4

Fermented Olive Mill Waste Water (OMWW) Preparation:

The olive mill waste water (OMWW) was collected from an olive mill in Siwa Oases Experimental Station of Desert Research Center (DRC). Batch aerobic fermentation of OMWW was performed for phenol biodegradation. Olive mill wastewater were diluted 2 folds and inoculated with three highly active phenol degrading bacteria : *Azotobacter vinelandii, Pseudomonas putida* and *Pseudomonas flouresence* isolated from olive mill waste water by the method described by (Ramsay *et al.,* 1983).The fermentation was conducted under the following standard conditions: Effluent 20 liter, temperature 30^{o} C and treatment time 20 days. Under these conditions, the phenol reduction reached 71.9 % compared to that in raw OMWW (From 1200 ppm phenol to 270 ppm).

Yeast Preparation:

Yeast culture used in this study was prepared by inoculating 1L of nutrient broth with 10g of active commercial dry yeast and incubated for 48h, after that the one liter inoculum added to 10L nutrient broth for yeast treatment.

Chemical and Microbiological Analysis of the Organic Extracts:

The final chemical analysis of A.A, C.T and OMWW extracts are shown in Table (4). The microbiological analysis of C.T and OMWW extracts are shown in Table (5). For microbiological analysis, total microbial counts on Nutrient medium ,*Pseudomonas* counts on King B medium, fungi and yeasts counts on Potato Dextrose Agar medium *E.coli* counts on MacConkey medium were determined. For yeasts, Potato Dextrose Agar medium was acidified to pH 4.5.

Table 4: Soluble nutrient contents of the final organic extracts.

Organic extract	Soluble nutrients, mg.L^{-1}								
	N	P	K	Ca	Mg	Fe	Mn	Zn	B
A.A	100	1.2	1.61	1.03	1.27	72.5	17.5	32.5	0.02
OMWW	175	120	3206	169	135	5.22	0.67	2.34	11.4
C.T	2025	289	1725	484	132	1.36	1.95	0.86	1.56

A.A: Amino acids OMWW: olive mill waste water C.T: Compost tea

Table 5: The microbiological analysis of C.T and OMWW.

Organic extract	Total bacteria X10^{6}CFU/ml	*Pseudomonas spp.* X10^{4}CFU/ml	Fungi X10^{3} CFU/ml	Yeast X10^{3} CFU/ml	Enterobactereacea X10^{3} CFU/ml	*Streptococcus* X10 ^{3}CFU/ml
OMWW	3000	2.7	5	18	20	12
C.T	U.C.	2.1	11.5	0	0	0
Pathogenic bacteria						
Organic extract	Coliform group	Faecal coli form	*E.coli*		*Sallmonela*	*Shigella*
OMWW	0	0	0		0	0
C.T	0	0	0		0	0

A factorial field experiment was undertaken using the following treatments: a) in the main plots: With and without yeast, applied on soil only b) in sub plots: with one of the three organic extracts and c) in sub-subplots: three application methods; foliar spray, soil drench, and soil drench with foliar spray. Each one of the three organic extracts was applied as one dose at the rate of 20 liter/ 72m^2 after month from planting and repeated with the same dose for two other successive months. All treatments were replicated three times. The half recommended rates of NPK as 45, 20 and 25 kg N, P_2O_5 and K_2O respectively were added per feddan as ammonium nitrate (33.5 % N), superphosphate (15.5 % P_2O_5) and potassium sulphate (50 % K_2O).

Soil samples were collected at the depth of 0- 30 cm in root zone at mid-season stage. Roots and leaves yields / feddan were estimated, total sugar content % was determined in the juice of the sugar beet roots using a Saccharometer apparatus on a lead acetate extract of fresh macerated roots according to procedures of Supernova *et al.* (1979). Sugar yield was calculated as total yield (ton / fed.) X sugar percentage. Available nitrogen was extracted by 2M potassium chloride (KCl) solution, according to Dahnke and Johnson (1990). Available phosphorus, potassium and micronutrients, Fe, Mn, Zn and Cu, were extracted by ammonium bicarbonate – DTPA solution according to Soltanpour (1985).

Statistical Analysis:

The statistical analysis was performed as factorial split - split plot design, according to Steel and Torrie (1968). The least significant difference (LSD) at 5% level, using Costat program separated the means.

RESULT AND DISCUSSION

Data presented in Table (6) revealed that fresh yield of sugar beet roots and leaves as well as sugar yield were significantly affected by different factors; organic extracts, application method and yeast. While, least significant difference (L.S.D) at probability level of < 0.05 for the interaction effect between the yeast and organic extracts factors and also among the three factors showed no significance with roots, leaves and sugar yields. Statistical analyses of yield components, as affected by the individual factors are shown in Fig. 1, 2, 3 and 4. The interaction effect between the organic extracts and application methods on root yields was statistically significant and shown in Fig.(5).

Table 6: Sugar beet yield (ton / fed.) as affected by different organic extract, application method and yeast under saline conditions.

Method of application (M)	Source of extract (S)	Yeasts (Y)					
		Without			With		
		Leaves	Roots	Sugar	Leaves	Roots	Sugar
Foliar	Without	2.0	10.3	1.97	3.1	13.1	2.54
	A.A	3.2	14.1	2.84	4.4	18.0	3.86
	OMWW	3.3	16.5	3.25	4.3	19.8	4.05
	C.T	3.8	12.7	2.42	4.9	16.5	3.28
soil drench	Without	2.1	10.4	2.00	3.2	13.2	2.59
	A.A	3.5	16.6	3.30	4.3	19.2	4.11
	OMWW	3.2	18.8	3.61	4.4	20.6	4.24
	C.T	4.4	13.2	2.45	5.1	15.4	3.20
Foliar and soil drench	Without	1.9	10.2	1.96	3.0	13.0	2.53
	A.A	3.7	16.3	3.19	4.2	20.9	4.24
	OMWW	3.1	17.1	3.20	4.4	19.3	3.91
	C.T	4.6	12.8	2.43	5.0	16.3	3.21

A.A: Amino acids, OMWW: Olive mill waste water , C.T: Compost Tea

Variance analysis		Y	S	Y X S	M	M X Y	M X S	MXSXY
Roots	P < 0.05	0.004**	0.000***	0.7199	0.0492*	0.2289	0.0210*	0.9027
Leaves	P < 0.05	0.0366*	0.000***	0.3081	0.3343	0.3136	0.6104	0.5333
Sugar	P < 0.05	0.0022**	0.000***	0.0859	0.0445*	0.6391	0.0550	0.9894

P: Probability *, ** and ***: Significant levels

Effect of Adding Yeast on Yield Components:

Irrespective of the other factors, the mean effects of yeast on yield components are shown in Fig. 1(a, b) . The plots treated with the yeast showed significant increase in root, leaves, sugar as well as sucrose % as comparing with untreated plots, recording increments by about 22.1%, 30.4%, 28.4% and 5%, respectively. This result was in agreement with the data obtained by Shalaby and El-nady (2008) who found that the greatest sucrose values of sugar beet were obtained via soil inoculation with yeast. Amprayn *et al.* (2011) found that soil application of yeast on rice seedlings increased root growth by 16–35%.

The enhancing effect of yeast application might be due to secretion of cytokinins enhancing the accumulation of soluble metabolites (Entian and Fröhlich, 1984) ,increasing levels of endogenous hormones in treated plants which could be interpreted by cell division and cell elongation (Khedr and Farid, 2002) , increasing the metabolic processes role and levels of hormones, i.e. IAA and GA3 due to the physiological roles of vitamins and amino acids in the yeast extract (Chaliakhyan, 1957).The effective of growth regulators activates plant defense mechanisms in response to salinity stresses (Wasternack and Parthier, 1997).

Effect of Organic Extracts on Yield Components:

Regardless of the other factors, the mean effects of organic extracts on yield components are shown in Fig.2 (a, b). The plots treated with the extracts; A.A, OMWW or compost tea C.T showed significant increase in the yields of roots, leaves, sugar comparing with the control. The corresponding increment values were by about

49.5%, 59.8% and 23.9%, respectively for roots, 50.5%, 47.0% and 79.7% respectively for leaves, and 58.8%, 63.7% and 25.2%, respectively for sugar yield. While both of OMWW and A.A. treatments significantly increased the yields of roots and sugar comparing with C.T., there was no significant differences between the OMWW and A.A. treatments. Fig (2a).

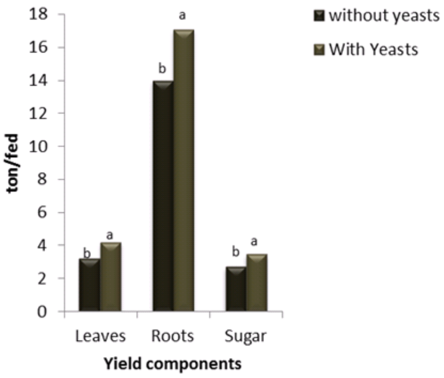

Fig. 1a: Effect of adding yeasts on yield components.

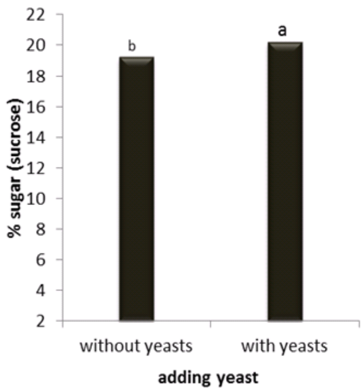

Fig. 1b: Effect of adding yeast on % sucrose of sugar beet.

The OMWW treatment was the superior organic source for increasing roots and sugar yields. These results may be attributed to high organic materials , minerals such as N, P, K, Ca, Mg and micro nutrients of OMWW (Aqeel and Hameed, 2007). That treatment contains amino acids resulted from microbiological remediation against phenols compound, also contains the highest potassium content comparing with the other organic sources (Table 4). Kochl (1987) showed that sugar content of beet was positively correlated with soil K content. K fertilizers increased sugar yield more than roots yield. Fathy *et al.* (2009) found that increasing N and K rates significantly increased roots and sugar yield in sandy calcareous soil. Nelson (1978) found that potassium has a positive effect in plant growth under saline conditions, because it plays an essential role in stomata movement, photosynthesis and regulation of osmotic pressure for plant.

With regard to the role of A.A. treatment, this result was in harmony with the finding by Fawzy *et al.*, (2010) who attributed the result to the physiological roles of amino acids in the Amino Green which increased the metabolic processes rate, and in the same time each micronutrient in the Amino Green compound has a role in improving plant growth, Zn directly involved in the synthesis of Indole acetic acid (IAA), Mn is directly involved in the catalytic rates in plants being the enzyme activator on some respiratory enzymes and in reaction of nitrogen metabolism and photosynthesis.

On the other hand, regardless of application method or adding yeasts, C.T treatments significantly increased the leaves yield comparing with all other treatments and control. This result may be due to that C.T has the highest content of nitrogen (Table 4), which increased the vegetative growth rather than root enlargement. In this respect, Mengel and Kikby (1987) demonstrated that the reduction in N supply resulted in a considerable increase in sugar content of sugar beet roots. Similar trend was found by Abd El-Hadi *et al*. (2002) who detected a negative relation between nitrogen concentration and sugar content in sugar beet roots, but inversely proportion to K concentration during vegetative growth. The reduction of sugar percentage was an approximate linear function of nitrate nitrogen in beet at harvest, and that0.025% each nitrogen in beet reduced the sugar percentage 1% (Singh, 1971).

The (A.A) treatment significantly increased the sucrose % as compared to the other sources and untreated plots. This may be due to the negative effect of amino acids on nitrate content. LiuXing-quan *et al.* (2008) revealed that foliar application with the mixture of amino acids increased N content of shoots whereas, NO_3 content reduced by 24-38%. Abo Sedera et al. (2010) revealed that the spraying with amino acids significantly increased total sugars content of fruits compared to control treatment.

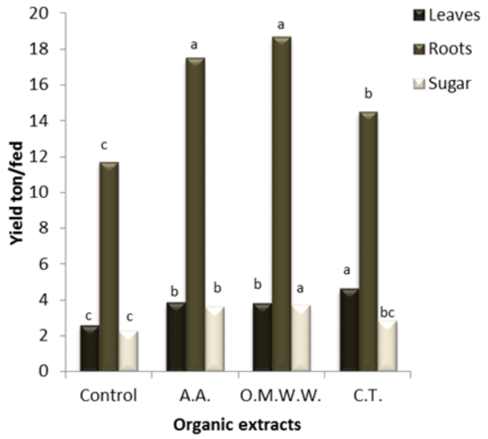

Fig. 2a: Effect of organic extracts on yield components.

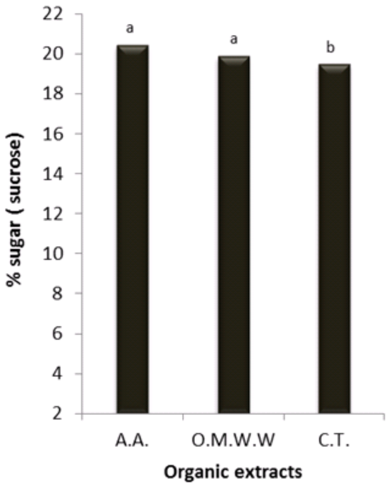

Fig. 2b: Effect of organic extracts on % sucrose of sugar beet.

Effect of Application Methods:

The mean effect of application methods of organic extract on yield components are shown in Fig.3 (a ,b). Different application methods had no effect on leaves yield, while soil drench alone or with foliar spray increased roots and sugar yields comparing with the only foliar spray, Fig. (3). These results were in accordance with that findings by Mohiti *et al.* (2011) under salinity stress. Yuncai *et al*. (2008) found that the application of foliar fertilization did not improve plant growth under salt stress. Significant difference was not observed between the method treatments of application in soil and (soil application + foliar spray).

The interactive effects between the organic sources and application method on root yields are shown in (Fig. 4). Apparently, that OMWW applied in soil, gave the highest value of roots yield comparing with other treatments and application methods, while, foliar spray with soil drench of A.A. gave the highest roots yield comparing with other methods. The application methods for C.T. did not significantly affect roots yield. It was clear that each organic preparation had different character when applied with different methods either on soil, leaves or both. These were due to the mineral composition and status of microbiological content of the final extracts.

Nutrient Availability in Soil:

Data presented in (Table 7) depict nutrient availability in the soil as influenced by the individual factors of yeast, organic preparation and application method. Regardless of the other factors, the mean effects of yeast on nutrients availability in soil showed that, the nutrients N, P and K were not affected by yeast application comparing with the control. While, both Fe and Zn availability significantly increased in plots treated with yeast, Mn availability in the soil significantly decreased comparing with untreated plots. This may be attributed to Mn uptake and accumulation in yeast cells. Yeast cells retain manganese up to a concentration as high as 15 mM without any deleterious effect on cell growth (Galiazzo *et al.,* 1989).

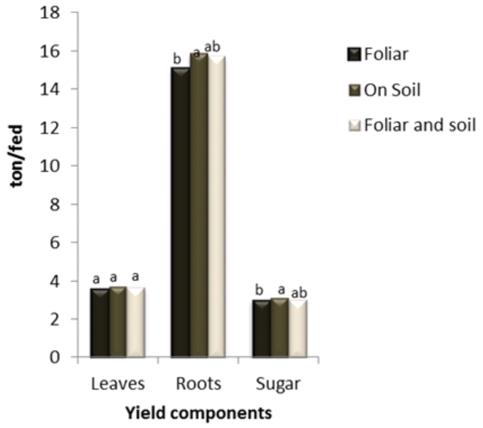

Fig. 3a: Effect of application methods on yield components.

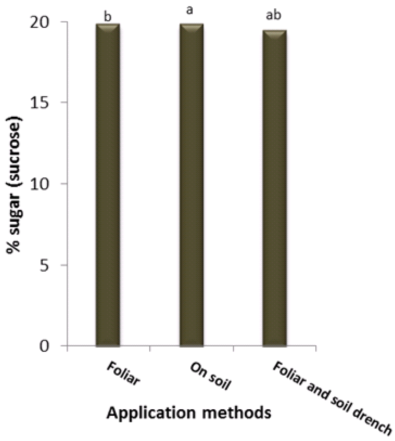

Fig. 3b: Effect of application methods on % sucrose of sugar beet.

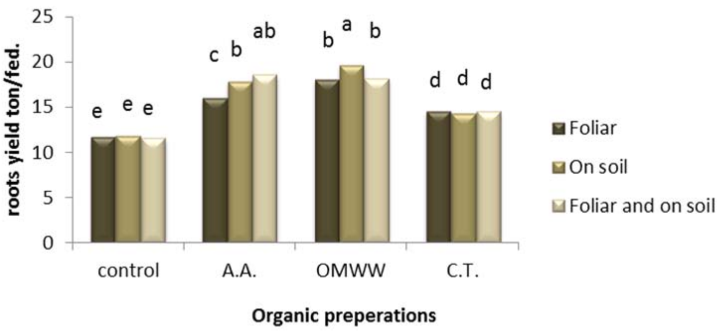

Fig. 4: The interaction effect between the source of organic preparations and application methods on roots yield of sugar beet (ton/fed) under saline conditions.

In respect to the mean effects of organic preparations factor, all these preparations significantly increased the availability of N, P, K, Fe, Mn and Zn in soil as compared with control. These results may be due to formation of nutrient chelated with the organic components of the organic preparations as well as the nutrients contents of these preparations. The C.T treatment significantly increased the availability of N and P comparing with other organic preparations. Compost tea are reported as an alternative to agrochemicals for enhancing plant growth by improving the physico-chemical properties of the soil and their nutritive effects, nutrients content and hormone-like compounds (Siddiqui *et al.,* 2008).

The A.A treatments increased Fe, Mn and Zn, comparing with other treatments. While, the OMWW treatments gave significant value of available K in soil over than the other preparations. The available residual for soil NPK after peanut and sesame harvesting show increases by foliar spray of humic and amino acids (Salwa 2011). An increase of total organic C, extractable N and C, available P, K, extractable Mn and Fe contents were measured when soils amended with OMWW (Anna, 2006).

The mean effects of application methods of organic preparations factor were shown in Table (7). Application of the organic preparations on soil as soil drench achieved significant increase of N, P, K, Fe, Mn and Zn availabilty comparing with other application methods.

Table 7: Effect of factors; organic extracts sources, application method and yeast on nutrient availability in the soil at the mid-season growth:

Treatment	Available of nutrient, $mg.kg^{-1}$					
	N	P	K	Fe	Mn	Zn
Yeast						
Without	118.6	6.86	175.7	9.11^{b}	9.65^{a}	3.98^{b}
With	121.0	7.40	142.7	12.63^{a}	7.95^{b}	4.70^{a}
$L.S.D_{0.05}$	N.S	N.S	N.S	1.43	0.771	0.388
Organic extract source						
Without	78.0^{d}	3.89^{d}	126.4^{c}	5.80^{d}	4.41^{d}	1.60^{c}
A.A	113.9^{c}	5.33^{c}	159.6^{b}	17.5^{a}	14.8^{a}	5.66^{a}
OMWW	125.1^{b}	8.64^{b}	189.1^{a}	10.6^{b}	9.56^{b}	5.22^{ab}
C.T	162.4^{a}	10.65^{a}	161.9^{b}	9.48^{c}	6.41^{c}	4.89^{b}
$L.S.D_{0.05}$	8.86	0.598	6.92	0.971	0.907	0.450
Method of application						
Foliar spray	118.2^{b}	6.81^{b}	150.8^{b}	9.22^{c}	8.75^{b}	4.21^{b}
Soil drench	125.0^{a}	7.83^{a}	170.1^{a}	12.2^{a}	9.29^{a}	4.66^{a}
Foliar and soil	116.3^{b}	6.73^{b}	156.8^{b}	11.1^{b}	8.36^{b}	4.16^{b}
$L.S.D_{0.05}$	4.21	0.333	7.52	0.783	0.437	0.409

A.A: Amino acids, OMWW:Olive mill waste water, C.T: Compost Tea , N.S: Not significant

Soil Microbial Activity:

Adding amino acids increased the soil total microbial count, and the count got higher with combined amino acids and yeast, but there was no change by adding OMWW or CT with yeasts comparing with the control. However the total count decreased by adding OMWW or CT alone comparing with the control (Table 8). There were non-significant effects of application methods. It was suggested that within the highly active rhizosphere, bacteria and soil microbes are equipped with the necessary breakdown tools to out-compete plant roots for the free amino acids; it is likely that most free amino acids in soils are taken up by microorganisms or become hidden in soil micropore (Ge, 2009).

Table 8: Effect of yeast, organic extracts sources and application methods at the mid-season growth on the microbial densities in the rhizosphere.

Treatments		Total count $x10^{5}$CFU		Yeast $x10^{3}$ CFU		Fungi $x10^{3}$ CFU		Actinomycetes $x10^{4}$ CFU	
		With yeast	without yeast	With yeast	without yeast	With yeast	without yeast	With yeast	without yeast
Control		70	60	2	1	2	1	3	3
A.A	Foliar	120	97	2	1.5	3	1	5	2
	Soil	125	95	2.5	2	3.5	2.5	8	5
	F.+S.	115	110	2.5	1.5	4.5	2.5	7	4
OMWW	Foliar	68	40	3	2	2.5	1	6	4
	Soil	65	42	4	1	2	1	7	3
	F.+S.	77	48	3	1	2	2	6	3
C.T.	Foliar	70	80	2.5	2	3	3	6.5	2
	Soil	75	55	3	1	4	2	5	5.5
	F.+S.	70	57	3	2	3	1	5	4

F. : Foliar, S. : Soil

Yeast counts in soil increased with the combinations of OMWW or C.T. with the yeast inoculum, however there was no effect with the combination with amino acids comparing with the control, also adding foliar OMWW or C.T. and soil drench amino acids solution alone without yeasts doubled the yeast cells number in soil comparing with the control. The best yield of Thymus vulgaris ,the essential soil and microbial activities were obtained by using combinations of both amino acid tryptophan and yeast applied as soil drench plus foliar spraying methods (El-Azim and El-Gawad, 2008). Adding C.T. alone as a foliar treatment increased fungi number in soil dramatically, and there was no effect by adding yeast to the C.T. in foliar treatment, while adding yeast in soil treatment or soil and foliar treatment increased the fungi number in soil comparing with C.T. treatments alone. Adding the amino acids solution and yeast together increased the enhancement of fungi growth in soil greater than each one alone ,while no effect was recorded by using OMWW .No significant differences were found for fungal community in the soil treated up to 50% OMWW while a decrease in 50% was found when 100% OMW was applied (Giuffrida, 2010).Adding amino acid solution or C.T. alone in soil increased the actinomycetes number in soil comparing with the control or the control with yeast; while no effect was recorded by using OMWW. However in all adding methods for the three treatments with yeast, the actinomycetes number in soil significantly increased. The actinomycetes counts decreased gradually up to a maximum of 38% when OMWW dose increased (Giuffrida, 2010).

Conclusions:

The results from this work indicated that individual factor of organic extracts, application method and yeast achieved significant positive effects on yields, the interaction effect between the yeast (*Saccharomyces cerevisiae*) and the three organic preparations on sugar beet productivity was not significant. So, the effects on crop yield which attributed to yeast with organic preparations treatments took the form of an integrative. The highest significant increases in roots and sugar yields were obtained by soil yeast with the treatments of (soil + foliar application of A.A.) or (soil application of OMWW). It is clear that each organic extract in this study was characterized by the behavior of its own when applied with different methods either as soil drench , foliar spray or together. These are due to the mineral composition and status of microbiological content of the final extracts. It could be concluded the fact that these organic and bio-organic fertilizers successfully reduced the hazard effect of soil salinity conditions.

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