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Environmental Impacts of some Organic Extracts on Sugar Beet Yield under Saline-Sodic Soil Conditions

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ABSTRACT

The objective of this study is to evaluate the effects of different organic extracts (natural or synthetic) as stimulator substances on sugar beet yield and soil properties. Two field experiments were carried out during two successive seasons (2016 and 2017) in a private farm at Port-Said site, Egypt. Tomato and banana peels were used as natural organic extracts while citric acid and malic acid were used as synthetic organic extracts. Natural and synthetic extracts were applied to soil. The results showed that either synthetic or natural organic extract individual or combined led to significant increases in root and sugar yields/fed. The highest values of sugar yields were obtained using synthetic organic extracts application followed by natural organic extracts. The results revealed also that, natural peel extracts showed a significant increase in the sucrose% comparing with the synthetic organic acids. Sucrose% reached 22% for both peels extracts while it reached 17% for both organic acids treatments. The application of synthetic or natural organic extract improved nutritional values of sugar beet plant. There was excellent potential to obtain a purity% of sugar using natural peel extracts. Applying the combination of banana extract and citric acid showed the maximum reduction in soil salinity (18.5%), whereas applying Tomato extract individually showed the minimum reduction of soil salinity (7.9%) compared to control. The Soil pH decreased insignificantly in case of treatments relative to the control. Moreover, applying these extracts led to a decrease in both sodium and potassium cations content of the soil under this study. Adding organic extract (natural or synthetic) led to a pronounced decrease in both SAR and ESP values as compared with the control. So, these extracts can be used for reducing soil salinity and improve the long term productivity of this soil for sustainable agriculture.

Keywords: sugar beets, salt affected soil, salinity, organic extract, citric acid, maleic acid

INTRODUCTION

Currently, at least 20 % of the world's irrigated land is salt-affected soils. Among those affected by salt, about 60 % are sodic, (Qadir *et al*., 2006). Salt affected soils represent 9.1 % from the total area and 30 % from the total cultivated area in Egypt, (FAO, 2005). Therefore, improving salt affected soils in Egypt could be considered as an important issue in the agricultural security program (Abdel-Fattah, 2012). Salinity of soil is negatively affecting metabolic processes, growth and yield (Ashraf and Harris, 2004). Increase salts damage plants by confusing the uptake of water into roots and uptake of nutrients (David, 2007). The negatively effect of salinity on plant growth and yield has been attributed to osmotic effect on water availability, ion toxicity, nutritional imbalance, and reduction in enzymatic and photosynthetic efficiency and other physiological disorders (Khan *et al*., 1995). Sugar beet (Beta vulgaris L.) is the second important sugar crop after sugar cane; it produces about 30 % of total world production and have readily adaptable to different environmental factors including salinity. 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). To overcome the problem of sugar production shortage in Egypt, the challenge must be inevitable for relieving 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. Plant biostimulants are diverse substances and microorganisms used to enhance plant growth. Plant biostimulants contain substance(s) and/or micro-organisms whose function when applied to plants or the rhizosphere is to stimulate natural processes to enhance/ benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, and crop quality (Pamela *et al*., 2014). Plant extracts derived from their parts (roots, stems, leaves, fruits) are now increasingly used in research due to their widespread, immediate availability and cheaper cost, besides having potential medicinal properties and ability to manage certain health conditions which have been growing in recognition (Sherif *et al*., 2012). Fruits and vegetable processing in Egypt generates substantial quantities of waste. These fruits peels are a source of minerals and chemical components as sugars, and organic acids, dietary fibers and phenolics which acts an antioxidants, and antibacterial (Adams *et al*., 2006). Use of waste as a source of polyphenols and antioxidants may have considerable economic benefit to food processors. Therefore a cheap, efficient and environmentally sound utilization of these wastes is needed. Citric acid which was used in carry study is one of the organic acids commonly used as chelating agents and neutralization (Johansson., 2002), citric acid form square planer complex with heavy metals through binding to citrate anions with cations. Phytoremediation is a novel clean up technology for removal of contaminants from polluted water and soils. In phytoremediation the plant uptake capability and the availability of the pollutant in the medium are important (Lopez *et al*., 2005) so, adding chelating agent (Hornburg and Brümmer 1993) enhance phytoremediation by increasing the bioavailability of heavy metals. The study aims to estimate the effects of applying several organic extract (natural or synthetic) as stimulator substances on sugar beet yield cultivated under saline-sodic soil conditions and also on soil properties.

MATERIALS AND METHODS

1. Preparation of different aqueous extracts from tomato and banana peels:

Tomato and banana peels were taken as an agricultural waste to prepare aqueous extracts. These agricultural wastes were collected and air dried. The well-dried agricultural wastes were chopped into small pieces. Each of the dried agricultural waste was prepared as a tea bag form then each bag was individually soaked in one liter of tap water for 24 hr at room temperature with a ratio of 100 g agriculture wastes /Liter water. The peel water extract was obtained by filtration. These aqueous extracts were used as stimulators substances for sugar beet plants cultivated in saline-sodic soil. The chemical compositions of the two different extracts are shown in Table (1).

2. Field experiment and treatments:

Two field experiments were carried out during two successive seasons (2016 and 2017) in a private farm at Port-Said location, Egypt, to evaluate the effects of different organic extracts (natural or synthetic) on sugar beet yield in case of saline-sodic soil conditions. The field experiment designed of 10.5 m^2 (3x3.5m) area / plot with three replicates. The experimental layout was a randomized complete blocks. Some chemical characteristics of well irrigation water are given in Table (2) and physiochemical properties of the initial soil are presented in Table (3). In case of the two seasons all plots were fertilized with N, P and K as recommended and the natural and synthetic organic extracts were applied to soil at a rate of 2 L / plot for three different periods at 30, 45 and 60 days from sowing. On harvest, plants from each group were harvested to determine growth and biochemical changes in sugar beet. The experiment consisted of the following nine treatments in case of the two seasons (2016 and 2017).

Table 1. Chemical composition of the natural extracts applied in the study.

Component	Tomato extract	Banana extract
Citric acid (mg Kg^{-1})	295	665
Malic acid (mg Kg^{-1})	186	317
protein%	1.00	0.89
Carbohydrates%	2.60	4.10
Amino acids of protein%	0.83	0.47
Proline%	0.256	0.095
IAA (mg Kg^{-1})	112	96
GA3 (mg Kg^{-1})	256	156
N%	0.40	0.30
P%	0.07	0.02
K%	0.30	0.50

Table 2. Irrigation water properties

pH	EC dS/m	Cations (meq/L)				Anions (meq/L)			
		Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Cl^{-}	CO_3^{2-}	HCO_3^{-}	SO_4^{2-}
7.83	1.95	5.4	3.2	10.2	0.7	14.5	-	1.3	3.7

Analytical methods:

The initial soil sample and those taken after harvest were prepared for chemical and physical determinations. i.e., ECe, pH, SAR, ESP, Na, K, Ca, Mg. according to the standard methods described by Richard's (1954), Page *et al.* (1982) and Gee and Bauder (1986). Total soluble solids (TSS) were measured in juice of fresh roots by using a Hand Refractometer. Phosphorus and Potassium contents were measured by flame photometer according to Jackson (1973), also Nitrogen% was determined according to AOAC., (1970) for the collected plant samples. Total sugars was extracted and determined according to Smith, *et al.* (1964) and Murphy (1958). Concentration of free proline was colorimetrically measured in sugar beet using ninhydrin reagent by spectrophotometer. Catalase activity was determined by monitoring the disappearance of H_2O_2 at 240 nm (ε = 40mM^{-1} cm^{-1}) according to the method of Aebi, (1984). The reaction mixture contained 50mM K-phosphate buffer (pH 7.0), 33 mM H_2O_2 and enzyme extract. Peroxidase activity was determined at 436 nm by its ability to convert guaiacol to tetraguaiacol (ε = 26.6mM^{-1} cm^{-1}) according to the method of Polle *et al.* (1994). The reaction mixture contained 100mM K-phosphate buffer (pH 7.0), 20.1mM guaiacol, 10 mM H_2O_2 and enzyme extract. The increase in absorbance was recorded by the addition of H_2O_2 at 436 nm for 5 min. All plants were harvested at the end of experiment and yield per feddan is estimated. According to Snedecor and cochran (1979) all data were statistically analyzed for least significant difference.

Table 3. Physical and chemical properties of the soil

Physical	Value
Coarse sand (%)	4.2
Fine sand (%)	15.2
Silt (%)	35.3
Clay (%)	45.3
Texture soil	Clay
Chemical	
pH (1: 2.5, soil suspension)	8.34
Organic matter (%)	0.58
ECe dS m^{-1}, soil paste	12.50
Soluble cations (me/L)	
Ca^{++}	19.2
Mg^{++}	39.2
Na^{+}	65.0
K^{++}	1.6
Soluble anions (me/L)	
$CO_3^{=}$	-
HCO_3^{-}	2.28
Cl^{-}	83.60
$SO_4^{=}$	39.12

T1: control (recommended N, P and K dose only)
T2: Tomato extract (T) **T3: Banana extract (B)**
T4: citric acid at 300 mg/l (C) **T5: malic acid at 300 mg/L (M)**
T6: Tomato extract + Citric acid (T+C)
T7: Tomato extract + Malic acid (T+M)
T8: Banana extract + Citric acid (B+C)
T9: Banana extract + Malic acid (B+M)

RESULTS AND DISCUSSION

1. Root and sugar yields of sugar beets:

Data presented in Table (4) showed that applying synthetic and natural organic extracts individual or combined led to significant differences in root and sugar yields/fed. Data showed significant increase in root and sugar yields compared with untreated plants. Applying either natural or synthetic extracts as individual or combined showed a pronounced increase in root and sugar yields in the first and second season of the study. The highest values of sugar yields were obtained by synthetic organic extract followed by natural organic extract.

Table 4. Effect of synthetic organic acids and natural agricultural peel extracts on root and sugar yields (ton/fed) of sugar beet grown under salinity stress

Treatment	Root yields		Sugar yields	
	First season	Second season	First season	Second season
Control	4.64 E	4.85 E	0.57 G	0.57 G
Tomato extract (T)	7.53 CD	7.90 C	1.30 E	1.33 E
Banana extract (B)	7.36 D	7.70 C	1.20 F	1.20 F
Citric acid (C)	11.32 A	11.60 A	2.13 A	2.20 A
Malic acid (M)	10.29 AB	11.60 A	2.11 A	2.17 A
T+C	11.86 A	11.40 A	2.07 B	2.10 B
T+M	10.55 AB	10.96 AB	1.90 C	1.90 C
B+C	11.21 AB	11.40 A	1.90 C	2.10 B
B+M	9.27 BC	10.37 B	1.63 D	1.83 D
L.S.D at 0.05	1.800	0.6704	0.05474	0.05474

Applying citric and malic acids (synthetic extracts) in the second season showed the maximum increase in both root and sugar yields .The obtained increase as compared to the control treatment was 2.4 and 2.4-fold for root yield and 3.7 and 3.6-fold for sugar yield in case of applying citric acid and malic acid, respectively.

Tomato or banana peel extracts has been reported to induce significant effects on various biological aspects in plants. Chemical analysis of tomato or banana peel extract shows that, it has high contents of valuable compounds which are necessary for plants growth Lee *et al*., (2010). Banana peel is rich in nutritional components such as essential amino acids, unsaturated fatty acids, proteins and potassium Emaga *et al*. (2007). Also, it contains common growth promoting substances which increased plant growth.

2 Effect of organic acid and agricultural peel extracts on the quality of sugar under salinity stress:

The main important factors which affect the yield and quality of sugar beet roots are the ratio of refineable sugar, purity and total soluble solids (TSS) of root juice as shown in Table (5). Regarding the (TSS) of sugar beet roots, the data showed significant increase under salinity stress, where the highest value of TSS was recorded in control treatment while the lowest value was recorded in case of applying peel extracts (natural organic extract) followed by natural organic extract combined with synthetic organic extract. Also the application of synthetic organic acid and agriculture peel extracts as individual or combined led to significant differences in sucrose content, where the natural peel extracts showed a significant increase in the sucrose% comparing with the synthetic organic acids. Sucrose% reached about 22% for both peels extract while it reached about 17% for both synthetic organic acids treatments.

Concerning the purity% of sugar comparing with the control, there exists a remarkable increase according to the following order: B+M > natural peel extracts > organic acids.

The increase in TSS may be attributed to more salt absorption by plants under soil salinity, which in turn decreases purity and negatively affects the refineable sugar. These results are in agreement with the obtained results of citric acid or oxalic acid and are in harmony with El-Badawy (2013) and Mansour *et al*., (2008). They reported that percentages of total carbohydrates were positively responded to spraying with oxalic acid or citric acid as antioxidant. These simulative effects of oxalic acid or citric acid might be due to the fact that, organic acids are very important for osmotic adjustment under stress and regulation of pH of plant cells.

Table 5. Effect of organic acid and agricultural peel extracts on some quality of sugar under salinity stresses

Treatment	First season			Second season		
	Sucrose%	TSS%	Purity%	Sucrose%	TSS%	Purity%
Control	14.13 F	22.40 B	63.04 I	15.33 E	24.60A	62.67 I
Tomato extract (T)	21.40 B	22.40 B	95.28 B	22.17 A	23.60ABC	93.62 B
B extract (B)	22.20 A	23.80 A	93.19 C	22.63 A	24.47AB	92.31 C
Citric acid (C)	17.53 D	23.80 A	73.48 H	17.03 D	21.00 C	81.08 G
Malic acid (M)	15.10 E	20.20 C	74.45 G	16.70 D	23.50ABC	71.14 H
T+C	19.50 C	22.47 B	86.52 F	19.83 B	22.60ABC	87.37 F
T+M	18.73 C	20.77 C	90.17 D	19.27 C	21.50 BC	89.30 D
B+C	19.40 C	21.93 B	88.42 E	19.83 B	22.40ABC	88.27 E
B+M	19.23 C	19.90 C	96.58 A	19.67 BC	20.70 C	95.09 A
L.S.D at 0.05	0.7262	0.8792	0.2508	0.4926	2.749	0.3792

TSS means total soluble solids

3 Chemical composition of sugar beet roots

Data presented in figures 1, 2 and 3 revealed that there was slight difference in N, P and K percentages as a result of all extract treatments and control. The highest value of N and P was recorded by (T+C) treatment while the highest value of N was recorded by banana extract. These results may be due to the fact that the banana peel extract contains high amounts of K while tomato extract contain high amount of N, P and amino acids as shown in Table (1). 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 that 0.025% of nitrogen content in beet reduced the sugar percentage by 1% (Singh, 1971). It is worth mentioning that, soil application of peel extracts and organic acid (citric or malic acid) individual or combined caused significant increase in the proline and antioxidant enzyme (catalase or peroxidase) of plant compared with control treatment (Figures 4, 5 and 6). Data of Sugar beet grown under saline-sodic soil conditions showed a change in the chemical components of plant leaves. Catalase and peroxidase activities increased in response to soil application of different organic acids or different peels extract on sugar beet plants as compared to those of untreated control plants grown under salinity stress. The most effective treatment was detected with soil application with peels extract followed by tomato and banana peel extracts combined with synthetic organic acid. Application of peels extract individual or combined with synthetic organic acids mitigated the adverse effects of salinity stress on growth parameters. Peels extract, citric acid and malic acid as antioxidants have important function in metabolism of plant Singh *et* *al* (2010). At environmental stress, organic acids due to their molecules properties, act as cofactors for some specific enzymes, those catalyzed breakdown of the toxic free radicals. Organic acids (citric acid or oxalic) as non enzymatic antioxidant in chelating these free radicals and protecting plant from injury could result in prolonging the shelf life of plant cells and improving growth characters (Aono *et al*., 1993). Citrate is the most strong organic anion, followed by oxalate and malate, to mobilize phosphorous in the soil (Bolan *et al*., 1994). Superoxide dismutase, catalase and peroxidase are enzymes responsible for ROS-scavenging. At stress conditions higher content of hydrogen peroxide is detoxified by catalase and glutathione peroxidase (Mansour *et al*., 2008).

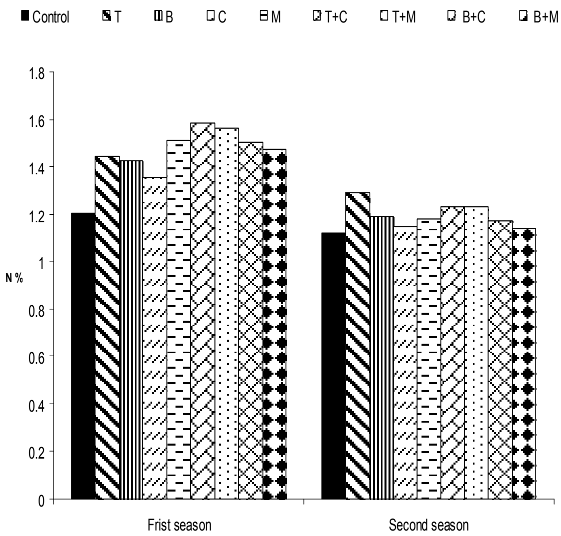

Fig (1): Effect of organic acid and different agricultural peel extracts on nitrogen contents of sugar beet plant under salinity stresses

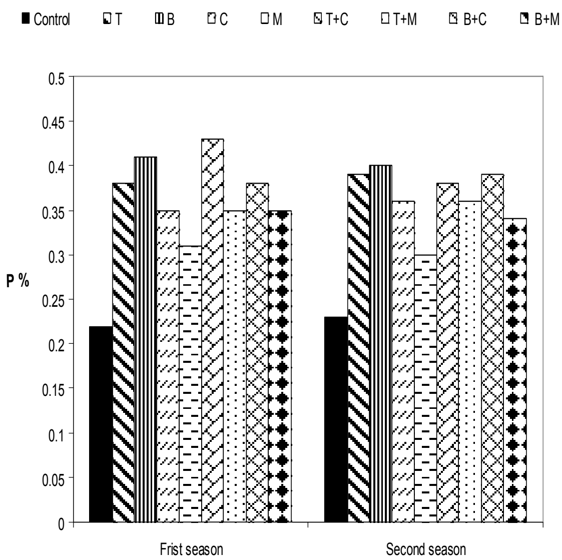

Fig (2): Effect of organic acid and different agricultural peel extracts on phosphorus contents of sugar beet plant under salinity stresses

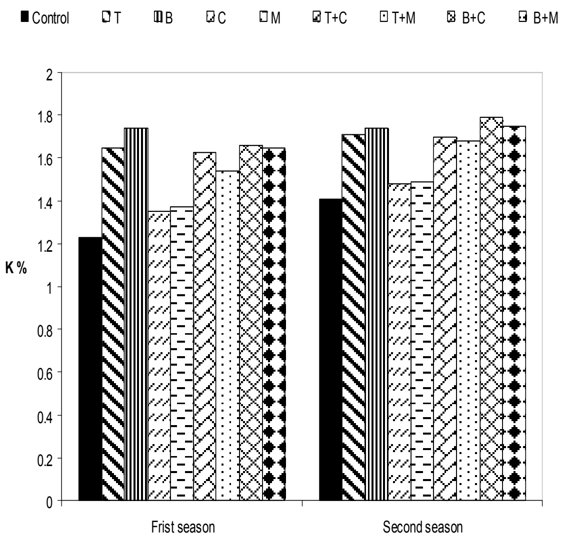

Fig (3: Effect of organic acid and different agricultural peel extracts on potassium contents of sugar beet plant under salinity stresses

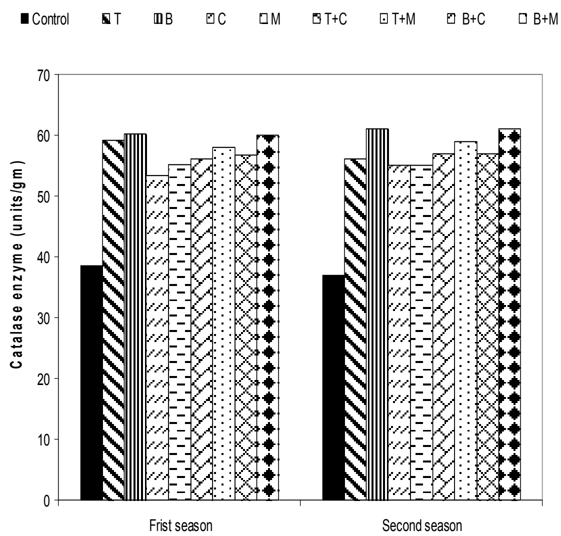

Fig (5): Effect of organic acid and different agricultural peel extracts on catalase activity of sugar beet plant under salinity stresses

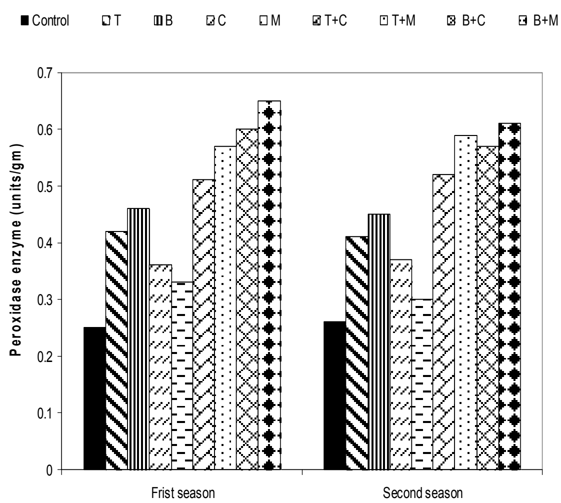

Fig (6): Effect of organic acid and different agricultural peel extracts on peroxidase activity of sugar beet plant under salinity stresses

The obtained results from this study emphasized also that, application of peel extracts and organic acid (citric or malic acid) individual or combined to sugar beet roots results in improvement of sugar roots yield (Fig. 7) especially in peel extract treatments followed by organic acid treatment compared to mineral fertilizer only as a control.

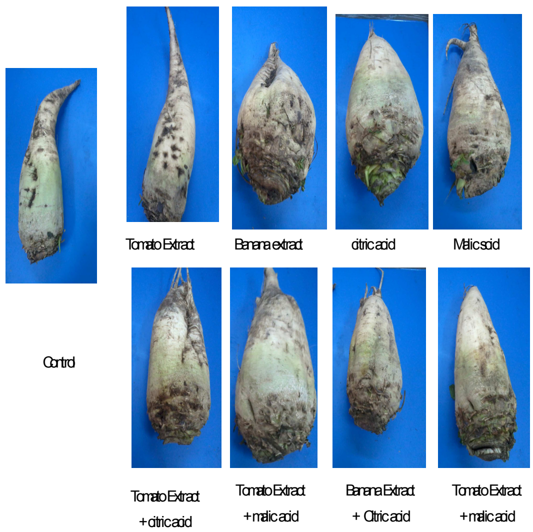

Fig. 7. Effect of peel extracts and organic acids on sugar beet roots grown on saline–sodic soil

4. Effect of applying organic acids and agricultural peel extracts on soil properties after sugar beet harvesting

1. Chemical soil properties

All the treatments had significantly reduced soil EC values relative to the initial soil (Fig. 8). Applying the combination of banana extract and citric acid (B+C)) showed the maximum reduction in soil salinity expressed as EC in saturated soil extract (26.4%). Whereas, applying tomato extract individually (T) showed the minimum reduction of soil salinity (9.6%) compared to the control treatment.

Soil pH directly affects on growth and vigorous of plants because its affects on soil nutrients availability. The Soil pH decreased insignificant by in case of all treatments relative to the control (Table 6).

Moreover, applying these treatments led to a decrease in both sodium and potassium cations content of the soil under this study.

Data presented in Table (6) showed that, adding organic extracts led to a pronounced decrease in both SAR and ESP values as compared with the control. The SAR value decreased from 20.37% for control to 18.0-18.7% for the different organic extract treatments applied in this study. Regarding the ESP values, it decreased from 22.35% for control to 20.19-20.92% for the different organic extract treatments.

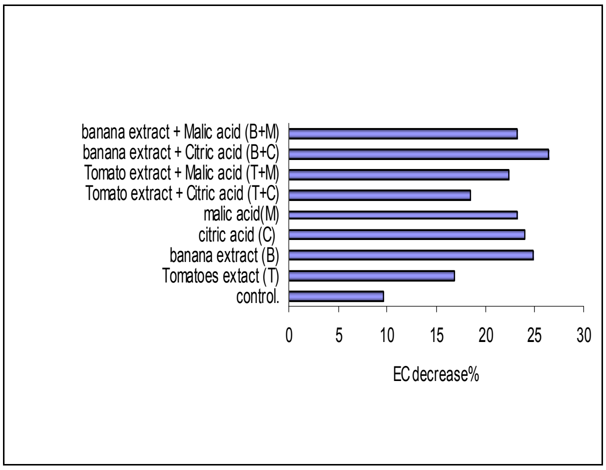

Fig. 8. The reduction% in soil EC of treatments related to the initial soil EC after growing two seasons

The results of both SAR and ESP values presented in Table (6) showed that the soil under this study is suffering from alkalinity problem. To overcome this problem gypsum requirements (G.R.) should be estimated and added to soil to overcome the alkalinity problem.

Table 6. Effect of applying natural and synthetic extracts on soil properties

Treatment	EC (dS/m)	pH	SAR%	ESP%
Control	11.3	8.2	20.4	22.4
T	10.4	8.0	18.0	20.2
B	9.4	8.0	18.7	20.8
C	9.5	8.0	18.7	20.8
M	9.6	7.9	18.7	20.8
T+C	10.2	8.0	18.1	20.3
T+M	9.7	7.9	18.7	20.8
B+C	9.2	8.4	18.8	20.9
B +M	9.6	7.9	18.7	20.8

Soluble cations in soil as affected by applying organic acids and agricultural peel extracts.

Fig. (9 and10) shows the concentration of soluble cations in soil at the end of the experiment, after treatment application. The concentration ratio of Na^{+}/Ca^{++} was the highest in control, (B+C) treatments; intermediate in case of (B, C, M, T+M and B+M) treatments; whereas, the lowest value exists in (T and T+C) treatments (Fig.9). Ca^{2+} and Mg^{2+} concentrations ratio tended to be slightly decreased at all treatments compared with initial soil (Fig. 10).

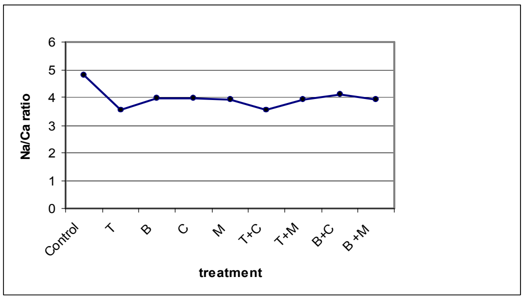

Fig. 9.The ratio of Na^{+} and Ca^{++} in saline soil

Fig. 10. The ratio of Ca^{++} and Mg^{++} in saline soil

The application of organic extracts would probably increase the amount of Ca^{2+}derived from $CaCO_3$ because of the formation of organic acids (Wong *et al*., 2009). Furthermore, potassium and sodium ions on the soil colloids would be replaced by calcium ions and leached from the soil. The results revealed that, by the end of the experiment, the dominant ions changed from Na^+ and K^+ to Ca^{2+} in soil by peel extracts and organic acids. David and Dimitrios, (2002) demonstrated that Mg^{2+}content tended to decrease in all treatments over time. Previous studies have reported that Ca^{2+} could improve soil structure by forming cationic bridges between clay particles and soil organic matter. In addition, Ca^{2+} can inhibit clay dispersion and the associated disruption of aggregates by replacing Na^+ and Mg^{2+} in clay and aggregates, thereby promoting aggregate stability (Zhang and Norton, 2002). These results indicate that peel extracts and organic acid (citric or malic acid) individual or combined could help in reducing the salt content and improve saline soil.

CONCLUSION

It can be concluded that the application of peel extracts and organic acids (citric or malic acid) individual or combined to sugar beet results in improving sugar roots yield especially in case of peel extract treatments followed by organic acid treatment compared to mineral fertilizer only as a control. Regarding the total soluble solids of sugar beet roots, the results showed that the highest value of TSS was recorded in control treatment while the lowest resulted by applying peel extracts (natural organic extract) followed by natural organic extract combined with the synthetic organic acids. The results revealed also that natural peel extracts showed significant increase in the sucrose% comparing with the synthetic organic acids. Sucrose% reached about 22% for both peels extract while it reached about 17% for both synthetic organic acids treatments. Concerning the purity% of sugar comparing with the control, an increase exists according to the following order: B+M > natural peel extracts > organic acids. Moreover applying the combination of banana extract and citric acid (B+C)) showed the maximum reduction in soil salinity expressed as EC in saturated soil extract (26.4%), whereas, applying tomato extract individually (T) showed the minimum reduction of soil salinity among all treatments applied in this study (16.8%). So, these extracts can be used for reducing salt affected soil damage and maintain its long term productivity for sustainable agriculture. The results of both SAR and ESP values showed that the soil under this study is suffering also from alkalinity problem where gypsum requirement should be added. Ca^{2+}/Mg^{2+} ratio tended to be slightly decreased in case of all treatment compared with the initial soil.These results indicate that peel extracts and organic acid (citric or malic acid) individual or combined could help in reducing the salt content and improve saline soil.

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الآثار البيئية لبعض المستخلصات العضوية على بنجر السكر تحت ظروف التربة المتأثرة بالاملاح

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الهدف من هذه الدراسة هو تقييم استخدام بعض المستخلصات العضوية (الطبيعية أو المخلقة) كمواد مشجعة لنمو محصول بنجر السكر تحت ظروف الأراضى المتأثرة بالأملاح. أجريت تجربتان خلال موسمين متتاليين (2016 و 2017) في محطة تجارب بورسعيد،التابعة لمركز البحوث الزراعية- مصر. حيث تم استخدام قشور الطماطم والموز كمستخلص عضوي طبيعي في حين تم استخدام حمض الستريك وحمض الماليك كمستخلص عضوي صناعى. واستخدمت المستخلصات الطبيعية أو الصناعية كمعاملة أرضية فى ظروف الأراضى المتأثرة بالاملاح . وأظهرت نتائج التجربة أن استخدام المستخلصات العضوية الطبيعية أو الصناعيه سواء بصورة منفردة او مختلطين أدى إلى زيادات كبيرة في محصول جذور بنجر السكر او لمحصول السكر ولوحظ ان اعلى قيم لهذه الزيادات فى المحصول عند استخدام المستخلص العضوي الصناعى يليها المستخلص العضوي الطبيعي. وقد اظهرت النتائج ان استخدام مستخلصات القشور الطبيعية أدت الى زيادة معنوية في نسبة السكروز مقارنة باستخدام الاحماض العضوية الصناعية. وقد بلغت نسبة السكروز 22٪ عند استخدام مستخلصات القشورالطبيعية بينما بلغت 17٪ عند أستخدام الأحماض العضوية الصناعية. وقد أدى استخدام المستخلصات العضوية الصناعية أو الطبيعية الى تحسين القيم الغذائية فى المحصول و كانت هناك امكانات ممتازة للحصول على نسبة نقاء للسكر فى جذور البنجر باستخدام مستخلصات القشور الطبيعية. كما بينت نتائج الدراسة مدى تأثير اضافة مثل هذه المستخلصات الطبيعية او الصناعية على التربة ، حيث أوضحت النتائج ان اضافة مخلوط مستخلص الموز مع حمض الستريك ادى الى خفض ملوحة التربة بنسبة 18.5% بينما استخدام مستخلص الموز بمفرده ادى الى خفض ملوحة التربة بنسبة 7.9% وذلك مقارنة بمعاملة الكنترول. أظهرت النتائج أيضا انخفاض غير معنوى للرقم الهيدروجيني للتربة عند استخدام المستخلصات الطبيعية والصناعية. وعلاوة على ذلك، أدى تطبيق هذه المستخلصات إلى انخفاض محتوى التربة من كاتيونات الصوديوم والبوتاسيوم تحت هذه الدراسة. أدت إضافة المستخلص العضوي (الطبيعي أو الصناعي) إلى انخفاض واضح في قيمتي نسبة الصوديوم المدمص و نسبة الصوديوم المتبادل مقارنة مع عنصر البوتاسيوم. لذلك، يمكن استخدام هذه المستخلصات للحد من أضرار التربة المتأثرة بالاملاح والحفاظ على انتاجية هذة الأراضى على المدى الطويل للزراعة المستدامة. وبينت الدراسة ان التربة تعانى ايضا من مشكلة القلوية بجانب مشكلة الملوحة ، لذلك تم تقدير الاحتياجات الجبسية لهذه الاراضى تحت الدراسة ويوصى باضافة 5 طن/ فدان جبس زراعى بجانب غسيل التربة للتخلص من الاملاح.