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Optimizing Management Practices for Increasing the Efficiency of Using Seawater as Alternating Methods of Irrigation

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TWO POT experiments were conducted in the halophytic green house of the National Research Centre, Dokki, Giza to study the effect of foliar application with zinc (300 ppm Zn-EDTA), potassium (2.0% KNO_3) or ascorbic acid (200 ppm) on productivity, salt tolerance and some physiological aspects of *leptochloa fusca* plants grown under different levels of seawater irrigation (Tap water, 12.5, 25.0, 37.5 and 50.0%). Increasing salinity of water irrigation level generally increased the content of soluble carbohydrates, proline, sodium, calcium and the value of succulence and osmotic potential (OP) as well as salinity tolerance index (STI) particularly under 50.0% seawater concentration. On the other hand, raising the level of seawater used for irrigation adversely affected the content of potassium as well as K/Na and Ca/Na ratio. However, moderate concentration of seawater increased biomass production, crop growth rate (CGR) and the content of chlorophyll a+b and crude protein. Foliar application with either potassium, zinc or ascorbic acid positively affected all the growth and physiological criteria as well as salt tolerance of the tested plants compared with unsprayed plants (control). Foliar application with potassium surpasses the other foliar application treatments especially under high levels of saline irrigation.

Keywards: Seawater irrigation, *Leptochloa fusca*, Foliar fertilizers, Salt tolerance.

Throughout the developing world, there are extensive coastal deserts where seawater is the only water available. Although growing crops in sandy soil and salty water is not a benign prospect for most farmers, for saline agriculture they can complement each other. The disadvantages of sandy soil for conventional crops become advantages when saline water and salt tolerant plants are used.

Salt tolerant plants (halophytes) are highly evolved and specialized organisms with well-adapted morphological, phonological and physiological characteristics allowing them to proliferate in the high salinity conditions and offers a low-cost approach to reclaiming and rehabilitating saline habitats. This approach would lead to the domestication of wild, salt tolerant plants for use as forage crops (González *et al.*, 2005). Whereas, *Leptochloa fusca* is a highly salt tolerant C4 perennial halophytic forage plants grown well in coastal salt marsh. It has a special place in newly emerging farming systems, especially in coastal areas and where freshwater resources are not available or in short supply. However, few forage halophytes have been domesticated and hence special management practices for their cultivation, adaptation and new agronomic traits must be developed and tested (Akhter *et al.,* 2004).

Currently, foliar-applied nutrients have limited direct use for enhancement of stress resistance mechanisms in field crops. Nevertheless, the interactions between plant nutrient levels and stress repair mechanisms are now being studied (Lavon *et al.,* 1999). Foliar application of potassium during vegetative growth is one of these precautions. Potassium is essential in maintenance of osmotic potential and water uptake and had a positive impact on stomatal closure which increase tolerance to water stress (Epstein,1972). Moreover, it is involved in activating a wide range of enzyme systems which regulate photosynthesis, water use efficiency and movement, nitrogen uptake and protein building (Nguyen *et al.,* 2002). While, zinc is an component of a number of dehydrogenases, proteinases and peptidases, thus Zn influences electron transfer reactions including those of the Krebs cycle and hence affecting the plant's energy production, also, zinc binding tightly to Zn-containing essential metabolites in vegetative tissues, such as in Zn-activated enzymes, e.g., carbonic anhydrase, which plays a role in photosynthesis, is localized in the cytoplasm and chloroplasts and may facilitate the transfer of CO /HCO G for photosynthetic CO fixation (Srivastava, 2006) .

Applying growth regulators especially ascorpic acid can modify morphological and physiological characteristic of plant and may also induce better adaptation of plant to environment which improve the growth and yield. It plays a major role in cell division and cell differentiation and affect many other physiological and developmental processes in plants including apical dominance, nutrient mobilization, chloroplast development, senescence and improve yield and chemical constituents of many crops and increasing the photosynthetic pigments content

Therefore, this investigation was undertaken to evaluate the efficiency of foliar application of zinc, potassium or ascorbic acid to reduce the harmful effect of salt stress on biomass production, biochemical composition and salt tolerance of *Leptochloa fusca* plants, and develop a management technique for productive use of halophytes grown under high levels of sweater irrigation.

Material and Methods

Two pot experiments were conducted in the halophytic green house of the National Research Centre, Dokki, Giza during the two successive summer seasons of 2006 and 2007 to study the effect of foliar application with potassium, zinc or ascorbic acid on biomass production, biochemical composition and salt tolerance of *Leptochloa fusca* plants grown under different levels of seawater irrigation. Pots were arranged in complete randomize design with 3 replicates and included 20 treatments which were the combination of four foliar treatments (tap water (control), 100 ppm Zn-EDTA, 2.0 % KNO_3 and 200 ppm Ascorbic acid) X five levels of seawater irrigation (Tap water, 12.5%, 25.0%, 37.5% and 50.0 % seawater concentration). Rhizomes of *Leptochloa fusca* were collected from the wetland of Lake Qaron coast. Fayum, Egypt. Rhizomes were transplanted on May 7th and 11th in the first and second seasons, respectively in plastic pots 40 cm in diameter filled with mixture of peat-moss and sand (1:3).The mechanical and chemical analysis of the soil was carried out by using the standard method described by Klute (1986), Table 1.

TABLE 1. Mechanical and chemical analysis of the soil (combined data of 2006 and 2007 seasons).

Mechanical analysis		Chemical analysis			
Sand	98.36	P^H	8.45	Mg (mg/100g)	22.85
Silt	0.91	$CaCo_3$	1.15	Na (mg/100g)	8.39
Clay	0.73	Organic matter	0.24	Fe (ppm)	2.49
Texture class	Sandy soil	N (mg/100g)	38.12	Mn (ppm)	4.22
		P (mg/100g)	1.12	Zn (ppm)	1.28
		K (mg/100g)	9.05	Cu (ppm)	1.11

Each pot was fertilized with 6.2 g calcium superphosphate (15.5% P_2O_5) and 1.5 g potassium sulphate (48.0 % K_2O) and 6.75 g urea (46.5% N) at the rate of 32 kg P_2O_5/fed., 24 kg K_2O/fed. and 105 kg N/fed., respectively. Foliar application was carried out 21 days after each cutting. Each pot was irrigated three times per week with the specified seawater concentration. The chemical analysis of the irrigation water is given in Table2.

Data recorded

Three cuttings were taken at 42 days intervals. Three replicates were taken for each seawater treatment to determine biomass production(g), total productivity of the three cuttings(g) and crop growth rate CGR=[(W2-W1)/(T2-T1) g/week], where W_1 and W_2 refer to dry weight of the whole plant at time T_1 and T_2 in week, respectively. Salt tolerance index was calculated as total plant dry weight obtained from different seawater concentration compared to total plant dry weight obtained from plants irrigated with tap water, STI=[(TDW at Sx/TDW at S1)x100], whereas STI=salt tolerance index, TDW=total dry weight, S1=control treatment, Sx= x treatment (Seydi *et al.*, 2003).

The following physiochemical measurements were determined in the fresh harvested shoot of the second cutting: chlorophyll a+b (mg/g fresh weight) according to Von Wettstein (1957), proline (µg/g) according to Bates *et al.* (1979), osmotic potential were obtained from the corresponding values of cell sap concentration tables given by Gusev (1960). Then the harvested shoots were dried to constant weight at 70 C° to determined values of succulence (ratio of fresh weight/dry weight) according to Tiku (1979), total nitrogen percentage according to A.O.A.C. (1975) and the crude protein content was calculated by multiplying total nitrogen concentration by 6.25. Soluble carbohydrates content determined by the method described by Dubois *et al.*, (1956). The contents of sodium and potassium were determined in the digested material using Jenway flame photometer as described by Eppendrof and Hing (1970). While, calcium was determined by Versinte method according to Jackson (1967). K/Na and Ca/Na ratio were also calculated for each treatment. The obtained results were subjected to statistical analysis of variance according to Snedecor and Cochran (1982) and the combined analysis of the two seasons was calculated according to the method of Steel and Torrie (1980).

TABLE 2. Chemical analysis of diluted seawater irrigation (combined data of 2006 and 2007 seasons).

Characters	Tap water	12.50 %	25.00 %	37.50 %	50.00 %
p^H	7.56	8.02	8.06	8.26	8.36
EC (ds/m)	0.88	10.36	12.36	18.25	23.58
Na (mg/L)	76.36	1869.00	3136.25	5864.36	6589.26
K (mg/L)	3.24	65.36	115.25	151.35	181.65
Cl (mg/L)	561.02	3659.25	6555.48	7842.36	8947.26
Ca (mg/L)	94.36	98.36	111.36	122.36	131.36
Mg (mg/L)	11.03	33.35	66.58	81.56	974.25

Results and Discussion

A- 1-Effect of diluted seawater irrigation on dry weight, crop growth rate and total productivity

Data presented in Table 3 show that increasing seawater concentration in the irrigation water to 12.5 % increased dry weight, crop growth rate and total productivity compared to tap water and there is no significant differences between them while, increasing seawater concentration in the irrigation water up to 25.00 % significantly increased dry weight and crop growth rate (CGR) in the three cuttings and consequently the total productivity. However, higher saline irrigation levels adversely affect the previous characters. Such stimulatory effect of moderate salinity on growth of some halophytic plants may be attributed to improved shoot osmotic status as a result of increased ions uptake metabolism (Naidoo *et al.*, 1995).

On the other hand, the reduction in growth and yield under high salinity levels could be due to reduction in photosynthesis, disturbance in mineral uptake, protein synthesis or carbohydrate metabolism (Al-Garni, 2006). He added that in most halophytic species growth decreases gradually with the increase of salt rate in the culture medium above a critical threshold specific to each species. In addition, Ashour *et al.* (2004) attributed the reduction in growth at higher salinity level to reduced turgor and high energy cost of massive salt secretion and osmoregulation. Similar results were obtained by Tawfik *et al.*, (2006) who reported that low NaCl concentrations stimulate growth of some halophytic species.

TABLE 3. Effect of diluted seawater irrigation on some growth characters of *Leptochloa fusca* (combined data of 2006 and 2007seasons).

Seawater concentration	First cutting		Second cutting		Third cutting		Total productivity	
	Dry wt. (g)	CGR	Dry wt. (g)	CGR	Dry wt. (g)	CGR	Dry wt. (g)	CGR
Tap water	26.19	4.37	27.18	4.53	32.26	5.38	85.63	4.76
12.5 %	27.26	4.54	27.76	4.63	33.16	5.53	88.18	4.90
25.00%	31.93	5.32	32.56	5.43	33.63	5.61	98.13	5.45
37.5 %	20.65	3.44	21.69	3.62	22.93	3.82	65.27	3.63
50.00%	14.98	2.50	15.67	2.61	17.50	2.92	48.15	2.67
LSD 5%	1.74	.35	1.53	.38	1.58	.40	3.94	0.40

A-2-Effect of foliar application on on dry weight, crop growth rate and total productivity

Data presented in Table 4 cleared that, all foliar spraying treatments significantly increased dry weight and crop growth rate (CGR) in the three cuttings and consequently the total productivity. Moreover, potassium surpassed the other treatments with no significant differences between foliar application treatments except the effect of foliar application with zinc on dry weight at the third cutting and total productivity. However, the increment percentages of the total productivity were 8.72, 3.34 and 11.12 % for ascorbic acid, zinc and potassium, respectively compared with control treatment plants. In this concern, Michael *et al.*, (2004) attributed such enhancement effect of spraying plants with Zn and K on growth

TABLE 4. Effect of foliar application on some growth characters of*Leptochloa fusca* (combined data of 2006 and 2007seasons).

Foliar application	First cutting		Second cutting		Third cutting		Total productivity	
	Dry wt. (g)	CGR	Dry wt. (g)	CGR	Dry wt. (g)	CGR	Dry wt. (g)	CGR
Tap water	22.63	3.77	23.79	3.97	26.44	4.41	72.85	4.05
Ascorbic acid	25.01	4.17	25.35	4.23	28.84	4.81	79.20	4.40
Zinc	23.78	3.96	24.51	4.09	26.99	4.50	75.29	4.18
Potassium	25.40	4.23	26.24	4.37	29.31	4.88	80.95	4.50
LSD 5%	2.05	0.41	1.74	0.43	1.88	0.47	4.52	0.44

might be attributed to the favorable influence of these nutrients on metabolism and biological activity and its stimulating effect on photosynthetic pigments and enzyme activity which in turn encourage vegetative growth of plants. Moreover, Foyer *et al.* (1994) stated that, the stimulatory effect of ascorbic acid may be due to its substantial role in many metabolic and physiological processes. They added that antioxidant defense system, rather than a single antioxidant, is responsible for protection in stressed plant Our results are in agreement with those obtained by Thalooth *et al.* (2006) and Khan *et al.* (2006).

A-3-Effect of interaction between diluted seawater irrigation and foliar application on dry weight, crop growth rate and total productivity

Data in Table 5 revealed that, the interaction between diluted saline irrigation water treatment and foliar spraying of the different nutrients significantly affected dry weight and crop growth rate (CGR) in the three cuttings and consequently the total productivity. However, foliar application of K recorded the highest values for both parameter under 25.0% dilution seawater concentration. On the other hand, the lowest values were recorded in unsprayed plants (control) at the level of 50.0% seawater irrigation. These results coincide with those obtained by Khan *et al.* (2006) who stated that, Ascorbic acid alleviated the sea salt effects in some halophytic plants.

B-1-Effect of diluted seawater irrigation on biochemical composition and some physiological aspects

Diluted seawater irrigation affects the studied parameters in different ways. Data presented in Table 6 show that raising irrigation salinity levels up to 50 % significantly increase the content of soluble carbohydrates, proline, calcium and sodium contents as well as succulence and osmotic potential values. On the other hand, the same treatment decreased the content of potassium and the values of STI as well as the ratio of K/Na and Ca/Na. However moderate saline irrigation up to 25.0 % generally increased chlorophyll a+b and crude protein content. Regarding to the effect of diluted seawater irrigation and foliar application on salt tolerance index (STI) of *Leptochloa fusca* plants. It is evident that irrigating *Leptochloa fusca* plants with high levels of seawater (37.5 and 50.0%) has the most deleterious effect on (STI). In other wards, the deleterious effect of salinity on its productivity increase with increasing the level of salinity. In this respect, Murphy *et al.*, (2003) suggested that both proline and soluble carbohydrates act as compatible solutes under high salinity levels. Kusaka *et al.*, (2005) added that, the observed increase in the osmotic potential might be due to the accumulation of inorganic solutes, several organic components such as sucrose, glucose, quaternary ammonium compounds, and amino acids including proline. Furthermore, the greatest accumulation of sodium by plants at high salt concentration may be attributed to the damage of the protoplasm of plant cells and as a result of the selective salt absorption is replaced by passive absorption which causes abnormal accumulation of salts in plant organs (Kader and Lindberg, 2005). They added that under saline conditions sodium influx across the plasmalemma to the vacuole might play a major role in permitting turgor maintenance. He *et al.* (2005) added that the accumulation of sodium ions inside the vacuoles reduce the toxic levels of sodium in cytosol and increase the vacuolar osmotic potential with the concomitant generation of a more negative water potential that favors water uptake by the cell and better tissue water retention under high salinity levels. Similar results were obtained by Tawfik *et al.* (2006). On the other hand, the depressing effect of salinity on potassium could be attributed to the difficulty of its uptake due to competition with the high concentration of the sodium in the root medium. Lacerda *et al.* (2005) reported that the greatest salinity tolerance observed in plants under saline conditions was associated with lower of Na/K ratio and greater capacity for osmotic adjustment. Lycoskoufis (2005) stated that the inhibition of photosynthesis under high salinity levels predominantly due to reduced stomatal conductance.

TABLE 5. Effect of interaction between diluted seawater irrigation and foliar application on some growth characters of *Leptochloa fusca* (combined data of 2006 and 2007 seasons).

Seawater concentration	Foliar application	First cutting		Second cutting		Third cutting		Total productivity	
		Dry wt. (g)	CGR	Dry wt. (g)	CGR	Dry wt. (g)	CGR	Dry wt. (g)	CGR
Tap water	Tap water	25.27	4.21	26.84	4.47	30.72	5.12	82.84	4.60
	Ascorbic acid	26.82	4.47	27.33	4.55	33.42	5.57	87.57	4.86
	Zinc	25.43	4.24	26.34	4.39	31.98	5.33	83.74	4.65
	Potassium	27.26	4.54	28.22	4.70	32.91	5.49	88.39	4.91
12.5 %	Tap water	25.45	4.24	27.63	4.60	30.64	5.11	83.72	4.65
	Ascorbic acid	28.29	4.71	26.83	4.47	34.13	5.69	89.24	4.96
	Zinc	27.30	4.55	27.94	4.66	32.54	5.42	87.78	4.88
	Potassium	28.02	4.67	28.63	4.77	35.32	5.89	91.97	5.11
25.00%	Tap water	30.28	5.05	30.61	5.10	33.59	5.60	94.48	5.25
	Ascorbic acid	32.23	5.37	33.28	5.55	34.58	5.76	100.09	5.56
	Zinc	31.60	5.27	31.35	5.22	30.39	5.07	93.34	5.19
	Potassium	33.62	5.60	35.02	5.84	35.97	6.00	104.62	5.81
37.5 %	Tap water	18.53	3.09	20.25	3.37	22.46	3.74	61.23	3.40
	Ascorbic acid	22.33	3.72	23.00	3.83	23.39	3.90	68.72	3.82
	Zinc	19.43	3.24	21.06	3.51	22.42	3.74	62.91	3.50
	Potassium	22.33	3.72	22.47	3.74	23.44	3.91	68.24	3.79
50.00%	Tap water	13.59	2.27	13.63	2.27	14.78	2.46	42.00	2.33
	Ascorbic acid	15.40	2.57	16.32	2.72	18.67	3.11	50.39	2.80
	Zinc	15.15	2.53	15.86	2.64	17.64	2.94	48.66	2.70
	Potassium	15.79	2.63	16.87	2.81	18.89	3.15	51.55	2.86
LSD 5%		3.74	.74	3.19	0.80	3.28	0.82	7.14	0.81

TABLE 6. Effect of diluted seawater irrigation on chemical constituents and some physiological aspects of *Leptochloa fusca* (combined data of 2006 and 2007 seasons).

Characters	Seawater concentration					LSD 5%
	Tap water	12.5%	25.00%	37.50%	50.00%	
Chlorophyll a+b (mg/g dry we.)	2.60	2.75	3.17	2.94	2.49	0.16
Solublecarbohydrates %	41.12	43.37	44.93	46.81	48.13	3.41
Crude protein %	8.46	8.71	9.98	9.32	7.87	0.71
Proline (ug/g dry we.)	269.15	310.69	400.03	463.30	543.87	26.51
Potassium content (mg/g dry wt.)	11.23	10.86	9.87	9.48	8.78	0.70
Sodium content (mg/g dry wt.)	7.08	8.95	12.01	13.85	14.85	0.98
Calcium content (mg/g dry wt.)	2.76	2.81	3.31	3.88	4.03	0.32
K/Na ratio	1.59	1.22	0.82	0.69	0.59	0.09
Ca / Na ratio	0.35	0.31	0.28	0.28	0.27	0.03
Succulence(fresh wt./dry wt.)	2.01	2.19	2.31	2.38	2.57	0.18
Osmotic potential	6.59	7.35	9.50	10.46	12.50	1.04
Salinity tolerance index (STI)	103.37	106.45	118.46	78.80	58.12	6.24

The stimulating effect of moderate salinity on protein accumulation of some halophytic plants may be due to the increased synthesis of certain new sorts of proteins (Dubey and Rani, 1989). On the other hand, the reduction in protein content under high salinity level may be due to the disturbance in nitrogen metabolism, inhibition of nitrate absorption or the decrease of the availability of amino acids and denaturation of the enzymes involved in amino acid and protein synthesis (Sher Mohamed *et al.*, 1994).

B-2-Effect of foliar application on biochemical composition and some physiological aspects

As for the foliar spraying treatments Table 7 cleared that foliar spraying with either Ascorbic acid, Zn or K generally increased the content of chlorophyll a+b, crude protein, potassium and calcium contents as will as the ratio of K/Na and Ca/Na as compared with control plants.

On the other hand, the previous treatments decrease the content of soluble carbohydrates, proline and sodium content as well as the values of succulence and osmotic potential. These results are coincide with those obtained by Khan *et al.* (2006). It is clear that all potassium foliar treatments improved all the tolerance feature of *Leptochloa fusca* plants and increase plant adaptation to saline irrigation. These results coincide with the results obtained by Thalooth *et al.* (2006) and Abd El Aziz *et al.* (2006). On the other hand, it can be noticed that all foliar spraying treatment increase plant tolerant to salinity stress by increasing STI values. Similar results were obtained by Seydi (2003).

TABLE 7. Effect of foliar application on chemical constituents and some physiological aspects of *Leptochloa fusca* (combined data of 2006 and 2007 seasons).

Characters	Foliar application				LSD 5 %
	Tap water	A. acid	Zinc	Potassium	
Chlorophyll a+b (mg/g dry we.)	2.71	2.99	2.79	2.66	0.19
Soluble carbohydrates%	46.32	44.52	45.38	43.26	4.02
Crude protein %	8.40	8.91	8.75	9.41	0.84
Proline (ug/g dry we.)	481.3	352.9	391.1	364.3	31.25
Potassium content (mg/g dry wt.)	9.60	10.21	10.00	10.35	0.82
Sodium content (mg/g dry wt.)	12.23	11.29	11.08	10.79	1.15
Calcium content (mg/g dry wt.)	3.63	3.23	3.19	3.14	0.38
K/Na ratio	0.86	1.00	1.00	1.06	0.11
Ca / Na ratio	0.30	0.29	0.30	0.30	0.03
Succulence (fresh wt./dry wt.)	2.46	2.23	2.34	2.14	0.21
Osmotic potential	9.93	9.11	9.46	8.62	1.23
Salinity tolerance index (STI)	87.94	95.61	90.88	97.72	7.36

B-3-Effect of interaction between diluted seawater irrigation and foliar application on biochemical composition and some physiological aspects

As for the interaction effect of between saline irrigation and foliar application treatments, Fig. (1–12) show that the highest content of photosynthetic pigments content were recorded in *Leptochloa fusca* plants sprayed with Ascorbic acid and irrigated with 25.0% seawater, meanwhile plants sprayed with potassium produced the highest crude protein content under 25.0% seawater irrigation. Furthermore, unsprayed plants irrigated with 50.0% seawater gave the highest content of soluble carbohydrates, proline, sodium and calcium contents as well as succulence and osmotic potential values. On the other hand, the treatment foliar potassium X tap water gave the highest content of potassium, K/Na and Ca/Na ratio. Similar results were obtained by Khan *et al.* (2006) and Thalooth *et al.*,(2006) who found that, foliar application of nutrients has been reported to decrease fertilizers needed, improve the crude protein content and counteract the effects of stress. Concerning the interaction effect of saline irrigation and foliar spraying treatments. It is clear from Fig. 12, that the highest (STI) value was recorded under 25.0% seawater and foliar application of potassium, while the least value was recorded under 50.0% and unsprayed plants (control).

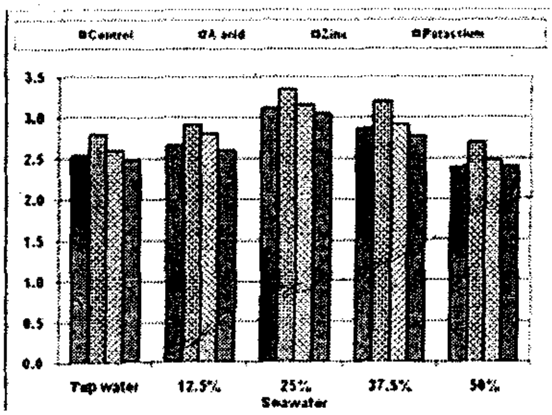

Fig. 1. Interaction effect of sewater irrigation and foliar application on Chl.a+b content.
LSD 5% = 0.35

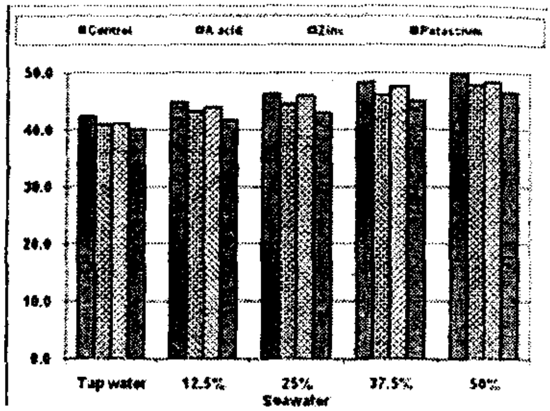

Fig. 2. Interaction effect of sewater irrigation and foliar application soluble carbohydrates %.
LSD 5% = 7.35

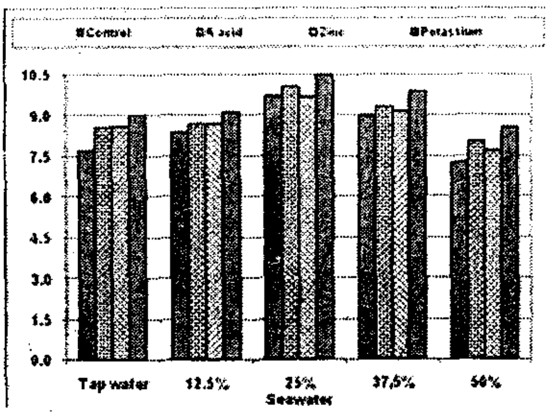

Fig. 3. Interaction effect of sewater irrigation and foliar application on crude protein %.
LSD 5% = 1.45

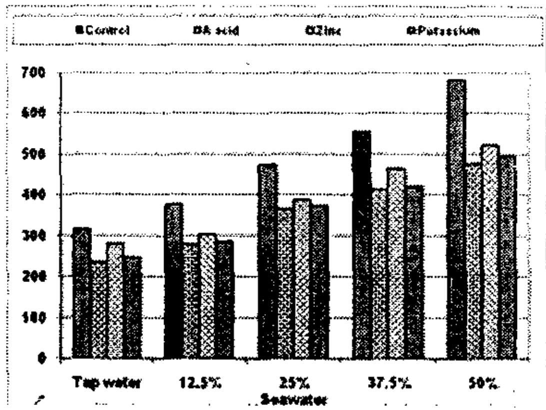

Fig. 4. Interaction effect of sewater irrigation and foliar application on proline content.
LSD 5% = 57.11

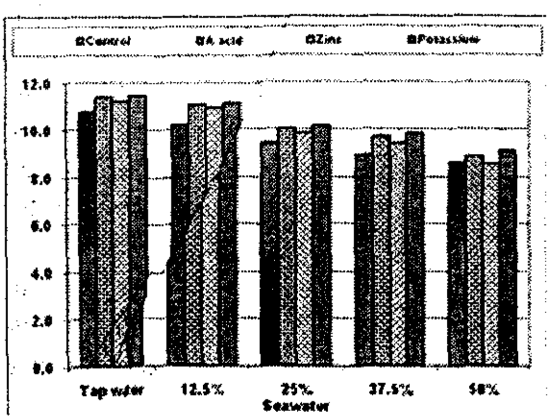

Fig. 5. hteraction effect of sewater irrigation and foliar application on potassium content.
LSD 5% = 1.49

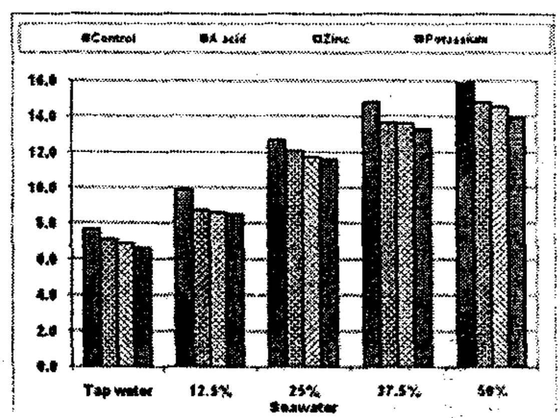

Fig. 6. Interaction effect of sewater irrigation and foliar application on sodium content.
LSD 5% = 2.11

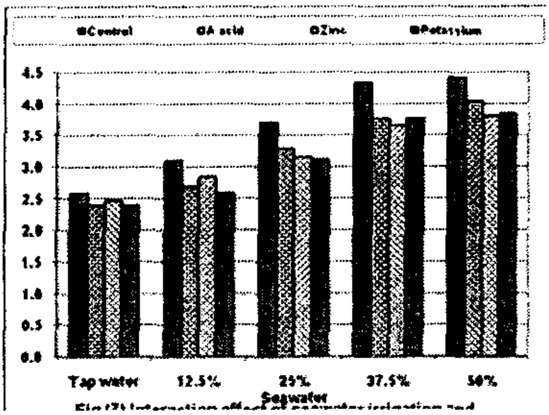

Fig. 7. Interaction effect of sewater irrigation and foliar application on calcium content.
LSD 5% = 0.69

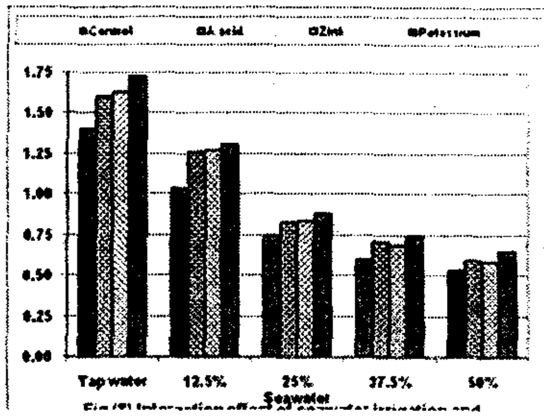

Fig. 8. Interaction effect of sewater irrigation and foliar application on K/Na ratio.
LSD 5% = 0.20

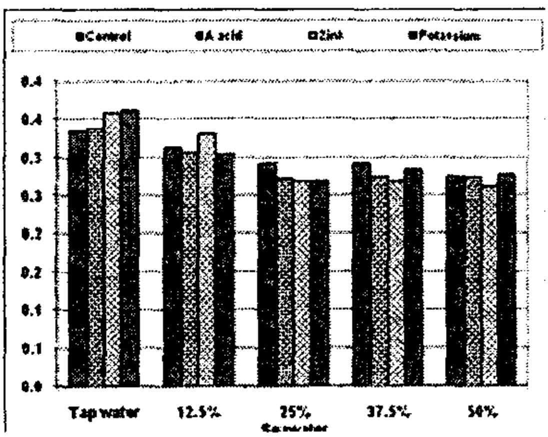

Fig. 9. Interaction effect of sewater irrigation and foliar application on Ca/Na ratio.
LSD 5% = 0.05

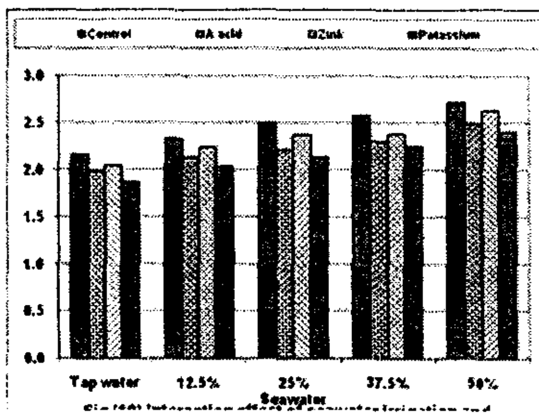

Fig. 10. Interaction effect of sewater irrigation and foliar application on succulence.
LSD 5% = 0.38

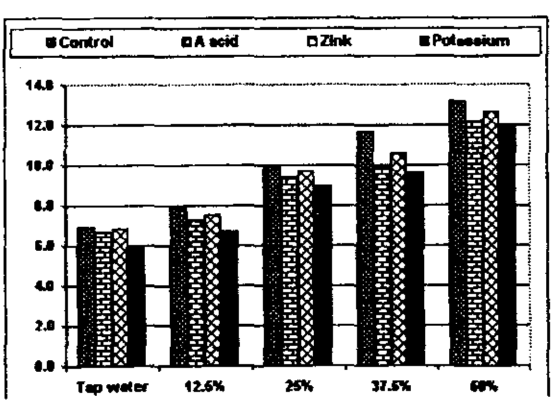

Fig. 11. Interaction effect of sewater irrigation and foliar application on osmotic potential.
LSD 5% = 2.25

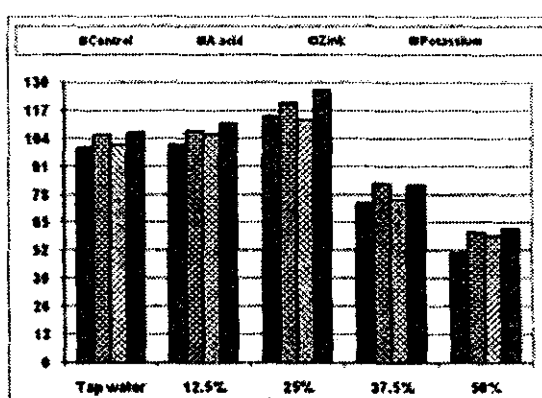

Fig. 12. Interaction effect of sewater irrigation and foliar application on (STI).
LSD 5% = 13.45

Conclusion

Halophytes irrigated with seawater represent a considerable potential as crop plants. Their growth may be stimulated by the presence of salts in the growth medium. At high salinity their growth is presumably limited by many factors but mainly because an imbalance in nutrient uptake, essentially potassium and calcium. Studies of salinity tolerance of plants irrigated with seawater in a quick check system under greenhouse conditions is the first step for the development of cash crops. Increased research on the selection of halophytic species which have an economic utilization may enable the rehabilitation and revegetation of salt-affected lands given that the appropriate soil and irrigation management is applied.

Foliar application with potassium, zinc or ascorbic acid positively affected all the growth and physiological criteria as well as salt tolerance of the tested plants compared with unsprayed plants (control). Foliar application with potassium surpasses the other treatment especially at high levels of saline irrigation. However, additional research to identify the agronomic treatment for these plant species is important in developing strategies for their use in agro-forestry.

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زيادة كفاءة استخدام مياه البحر فى الرى

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أجريت تجربتى أصص فى صوبة الهالوفيت بالمركز القومى للبحوث، الدقى، الجيزة لدراسة تأثير الرش الورقى بكل من الزنك أوالبوتاسيوم أو حمض الأسكوربيك على الأنتاجية و التركيب الكيميائى و بعض العمليات الفسيولوجية لنبات السيفون تحت المستويات المختلفة للرى بمياة البحر المخففة (ماء الصنبور ، ١٢,٥٪ ، ٢٥٪ ، ٣٧,٥٪ ، ٥٠٪).

زيادة تركيز الملوحة أدى الى زيادة محتو ى النبات من السكريات الذائبة والبرولين و الصوديوم والكالسيوم و قيمة كل من العصيرية و الضغط الأسموزى ومعامل مقاومة الملوحة خصوصا تحت ظروف الرى بالتركيزات العالية من مياه البحر. على العكس من ذلك أدت زيادة تركيز مياة البحر فى الرى إلى نقص محتوى النبات من البوتاسيوم و الفوسفور و كذلك نسبة البوتاسيوم / الصوديوم والكالسيوم / الصوديوم.

أدى استخدام التركيزات المتوسطة من مياه البحر فى الرى الى زيادة الانتاجية ومعدل النمو ومحتوى النبات من الصبغات و البروتين الخام .