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Studies on the Effect of Salinity and Spraying of Microelements on Vegetative Growth of some Turfgrasses

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ABSTRACT

Two field experiments were located at the place of Abu Jerida of Faculty of Agric. Damietta Univ. during two seasons of 2015-2016 and 2016-2017. The research aims to test the effect of chemical fertilizer as microelements and salinity on two species of turfgrass (paspalum and seashore paspalum). 16 treatments were arranged in split block design with 3 replicates as follows: 4 levels of salinity (control, 1800, 3600 and 7200 ppm) as main plot and 4 sources of micronutrient in foliar way (without, Fe, Mn and Zn) as sub plot. The obtained results could be summarized as follows: fresh and dry weight g/plant, moisture%, chlorophyll content, Fe, Zn and Mn content as well as protein and carbohydrates content % decreased with increasing salinity levels. However, application of micro elements improved the previous traits by causing significant increases in the values with the corresponding controls. Foliar application of iron was the most effective one. Except protein was with zinc. As for, Paspalum, found that seashore paspalum recorded higher mean values of fresh weight than paspalum. Regarding to the interaction effect found that using iron as foliar application under low level of salinity recorded the highest mean values of parameters under study.

Keywords: salinity, micronutrient, turfgrass, paspalum

INTRODUCTION

Turf grass, as an important element to the landscape, serves the functions as beautification and its attractiveness are suitable for mental health, more specifically, the aesthetic effect of parks, gardens, and lawns. Turfgrass is also used to cover sports fields, such as golf, soccer and serve in the stabilization of slopes, among other purposes (Raven *et al*., 2001). Turfgrasses, especially sport turf, play an important role by providing cushioning effect that could help reduce injuries to participants and improve playability. Turfgrasses are monocot plants under the family Poaceae that act as vegetative ground cover. With its above-ground network of leaves, shoots, and stems and an extensive fibrous root system, turf grasses reduce soil erosion, remove dust and dirt fromthe air, release oxygen that provides a cooling effect, filter water by trapping potential groundwater pollutants, and produce safe playing surfaces for children and adults (Emmons, 2008).

There are a number of potential turfgrass species that may be appropriate at various salinity levels of seawater. The demand for salinity-tolerant turfgrasses is increasing due to augmented use of effluent or low-quality water (sea water) for turf irrigation. This need has been exacerbated by rapid urbanisation (and associated turfgrass acreage increase) in arid/semiarid regions having intense competition for limited potable water resources (Harivandi *et al.,* 1992) and in coastal areas where salt water intrusion into fresh water irrigation wells is common (Murdoch, 1987). A new generation of turf varieties allows landscape development in saline environments (Hester *et al.,* 2001 and Gulzar *et al*., 2003). Such type of several grasses has now been developed and selected to produce plant varieties that can be utilized as turf. These turfs are ideal in environments in which salinity is a problem or where limited or no fresh water is available for irrigation.

Paspalum vaginatum O. Swartz and seashore paspalum belongs to the family Poeceae. It grows along the coastline as strand vegetation in many tropical and subtropical areas of the world. It is a perennial creeping grass that is stoloniferous and rhizomatous. It forms a thick mat of growth and has dark- green leaves with shinny waxy leaf coat (Zinn, 2004). It is used in numerous golf courses greens, tees, fairways and roughs. It is salt-tolerant, which informs its increasingly use in coastal sites where flooding and salt water intrusion are prevalent. Breeding for cultivars with fine leaf texture and tolerance to drought and high-salinity irrigation have allowed frequent use of seashore paspalum in highly managed turfgrass sites (Dudeck and Peacock, 1984; Duncan and Carrow 2000).

Salinity causes a major environmental problem limiting plant growth and productivity of both irrigated and non-irrigated lands in many areas of the world and include imposition of ion toxicities (e.g., Na and Cl), ionic imbalances, osmotic stress, and soil permeability problems (Ashraf *et al*., 2008). In general, salt tolerance in plants is associated with low uptake and accumulation of Na, which is mediated through the control of influx and/or by active efflux from the cytoplasm to the vacuoles and also back to the growth medium (Jacoby, 1999).

In Egypt, salt-related problems have increased where turf-grass is managed, especially during the last 30 years as new urban communities are established. Tourism development in Egypt's north coast, specifically between Alexandria and Al-Alamein, is also growing rapidly, and extensive use of turfgrass is occurring while at the same time potable water is limited. Accordingly, the need for salt-tolerant turfgrasses has increased.

The objectives of this study were to compare growth responses of paspalum and seashore paspalum in terms of fresh, dry weights, chlorophyll content, protein, carbohydrates and micronutrient under different levels of sodium chloride (NaCl) salinity stress conditions in the culture medium and the effect of microelements on this species to avoid the stress of salinity.

MATERIALS AND METHODS

Two field experiments were located at the place of Abu Jerida of Faculty of Agric. Damietta Univ. during two seasons of 2015-2016 and 2016-2017. The research aims to test the effect of chemical fertilizer as microelements and salinity on two species of turfgrass (paspalum and seashore paspalum).

Two species under investigation were breed with the levels of micro elements (Fe, Mn and Zn) comparing with the untreated plants.

The grasses were imported from abroad and grown using uniform cutting from each species. Each cutting contained three nodes and transplanting into filed in the middle of December, which planted in composted sand medium with 20 cm depth in 4 slides, each of one (4m long and 50 cm wide) replicates 4 time preparing slide rolls for the second season.

After one week the plants were treated with fertilization of micronutrient (Fe, Mn and Zn) at the levels (1.66, 1.66 and 1.54 ml/L) in foliar way with 20 days intervals comparing with control for 6 month and irrigated with normal water.

During seasons of 2015-2016 and 2016-2017 two filed experiment were conducted to investigate the effect of microelements on two spices of turfgrass (paspalum and seashore paspalum) under salinity conditions.

16 treatments were arranged in split block design with 3 replicates as follows: 4 levels of salinity (control, 1800, 3600 and 7200 ppm) as main plot and 4 rates of micronutrient in foliar way (without, Fe, Mn and Zn) as sub plot.

Composted sand soil was prepared in 20 cm in depth and 4 slides, each of one (4m long and 50 cm wide). Date of planting was 15th June, slide roles were transplanting in to the sandy soil.

The salinity level was measured by EC meter. Untreated checks (0) were irrigated with tap water. Seawater was diluted by adding tap water (EC was 200 ppm) for treatments until levels under investigation (1800, 3600 and 7200 ppm). After the targeted salinity levels were achieved, the irrigation water was applied on daily basis for a period of summer season and less in winter one for 6 months.

Foliar application of microelements (Fe, Mn and Zn) at the levels (1.66, 1.66 and 1.54 ml/L) in foliar way with 20 days intervals comparing with control (tap water).

Plants were harvested after six months were taken randomly from each experimental plot for investigation plant fresh weight, then plant samples were oven dried at 700c tell constant weight was reached, and then dry weight in gm per plant was calculated.

Chemical parameters of fresh plant i.e. crude protein (%) according to (AOAC, 2000), total carbohydrates (%) as according by (Sadasivam and Manickam, 1996), chlorophyll a, b and total chlorophyll mg/g were determined on fresh weight basis as the method described by (Goodwine, 1965).

The dried plant samples were thoroughly ground and stored for chemical analysis as Fe, Zn and Mn ppm as described by (Kumpulainen *et al*., 1983).

All data were statistically analyzed according to the technique of analysis variance (ANOVA) and the least significant difference (L.S.D) method was used to compare the deference between the means of treatment values to the methods described by Gomez and Gomez, (1984). All statistical analyses were performed using analysis of variance technique by means of CoSTATE Computer Software.

RESULTS AND DISCUSSION

Fresh weight g/plant:

Data present in Table 1 show the effect of different concentration of NaCl; tap water, 1800, 3600 and 7200 ppm on fresh weight g/plant. Data reveal that increasing salinity levels significantly decreased fresh weight and this effect increased consistently and rapidly with increasing salinity levels both in paspalum and seashore paspalum. The reduction in these character were directly proportional to the concentration of NaCl. All data were compared with the control during three stages.

In the same Table found that, comparing two varieties of paspalum, found that seashore paspalum recorded higher mean values of fresh weight than paspalum.

The growth of fresh weight was decreased by (18.62, 46.89 & 60.01% for paspalum), (18.93, 32.54 & 48.52% for seashore paspalum), for plant treats with concentration of NaCl 1800, 3600 and 7200 ppm comparing with the untreated plants.

As regard the effect of different concentration of salinity on fresh weight g/plant, it is clear from data in Table 1 that fresh weight of varieties (paspalum and seashore paspalum) plants grown under salinity treatments were significantly increased over their controls. This was true at two varieties.

It is clear from the data in Table 1 that application of micro elements improved the fresh weight of plants by causing significant increases in the values with the corresponding controls. The highest mean values of fresh weight observed with adding iron fertilization, comparing with other treatments.

Verities of plants under microelements found that seashore paspalum was more affective tan paspalum only and gave highest values.

Data presented in Table (1) declare the interactive effect between salinity and micro elements on fresh weight. It is clearly observed fresh weight of paspalum and seashore paspalum plants grown under salinity and treated with micro elements were significantly increased over control. The highest effect of the interactions were recorded in general in the plant treated with iron as micro-elements and grown under 1800 ppm NaCl.

Dry weight g/plant:

Result in Table 1 show the effect of salinity on dry weight g/plant of paspalum and seashore paspalum plants. These data revealed that the dry weight was significantly decreased by adding any NaCl concentration to the soil in irrigation water. It could also concluded that increasing the concentration of NaCl gradually and consistently decreased the dry weight. The lowest values for the different characters were attained by adding the highest level of NaCl (7200 ppm).

The decrease percentage in dry weight g/plant was (7.56, 17.80, 85.27 & 32.31% respectively, for paspalum) and (16.16, 25.16 & 40.31%), respectively for seashore paspalum) grown under high NaCl concentration (1800, 3600 and 7200 ppm) as compared with control (tap water).

Data presented in Table (1) declare the effect of micro-elements concentration applied on dry weight of paspalum verity plants. It can be noted that pronounced increase in dry weight by using micro elements. Using iron fertilization caused the best increment in dry weight which represented as 20.25 & 27.68 g/plant for paspalum and seashore paspalum plants treated with (iron), respectively.

Iron fertilization treatment alleviate the harmful effect of salt stress on dry weight and improved the growth parameters due to its positive effect as shown in Table (1).

Results in Table (1) show the effect of interaction between tyeps of microelements and different concentration of salinity NaCl application on some dry weight of paspalum plants. The same Table show that dry weight increased significantly by adding microelements in plants grown under different concentration of NaCl. The highest values for such different dry weight was attained by application of iron fertilization under 1800 ppm NaCl.

Moisture%:

Data recorded in Table (1) show the effect of NaCl concentration in irrigation water on moisture content of papalum verity plant. Results reveal that moisture content significantly decreased by increasing NaCl concentration in the growth media. The highest mean values recorded with control (tap water) followed by 1800 ppm then decreased with increasing salinity levels.

Data presented in Table (1) show the effect of micro-elements treatments on the content of moisture in verity of paspalum plants. It is clearly showed that moisture content% of paspalum plant significantly increased due to microelements application in plants. The highest mean values realized with using iron fertilization.

The interaction effect between NaCl concentration and micro-elements application on moisture% at the same Table. It could be observed that using different type of micro-elements treatments leads to increase moisture% under saline conditions compared to untreated plants. The highest mean values was recorded with iron fertilization under low concentration of NaCl.

Generally moisture content in seashore paspalum was less than paspalum which loss water slowly.

The decrease in plant biomass production due to the high level of salinity which was found in the present study may be attributed to the low medium water potential, specific ion toxicity, or ion imbalance as reported by Greenway and Munns (1980). Na+ and Cl- ions accumulation as well as reduction in certain nutrients in the fresh and dry weight indicated that high concentrations of salinity water can influence ion distribution, so that they can contribute to the osmotic potential, and thereby increase the protection against osmotic stress (Touchette, 2009). This results agree with those reported by Pessarakli and McMillan (2014); Soody, (2015); Guo *et al.,* (2016) and Pompeiano *et al.,* (2016).

The increment in plant growth parameters may be brought about by the presence of the foliar spraying of the micronutrients which acts as constituents of cell wall and membranes (Kirkby and Römheld, 2004). The results of other investigators such as El-Maadawy *et al.,* (2006); Pourvi *et al.,* (2012) and Dergham *et al.*, (2017) they all recommended that irrigate seashore paspalum plants grown in sandy soil with saline water up to 12000 ppm NaCl up to 16000 ppm NaCl obtain the best growth, colour and higher covering density under salinity stress of NaCl.

Table 1. Average values of fresh, dry weight and moisture content of paspalum verity as affected by salinity levels and type of micro-elements during 2015-2016 and 2016-2017.

Treatments		Fresh weight g/plant		Dry weight g/plant		Moisture%	
		P	Pp	P	Pp	P	Pp
Effect of salinization							
Tap water		126.88	149.99	22.75	32.00	81.86	78.58
1800 ppm		103.25	121.59	21.03	26.83	79.47	77.94
3600 ppm		67.38	101.18	18.70	23.95	72.13	76.30
7200 ppm		50.75	77.21	15.40	19.10	69.60	75.01
LSD $_{at\ 5\%}$		2.73	1.26	0.22	0.29	0.64	0.20
Effect of micro-elements							
Control		77.00	98.51	19.78	23.30	72.92	75.82
Fe		95.38	124.25	20.25	27.68	77.77	77.69
Mn		90.13	116.26	19.30	26.00	76.88	77.15
Zn		85.75	110.94	18.55	24.90	75.49	77.17
LSD $_{at\ 5\%}$		1.71	2.33	0.34	0.43	0.79	0.71
Effect of interaction							
Tap water	Control	115.50	131.35	25.50	30.50	77.92	76.78
	Fe	140.00	170.40	19.20	35.60	86.26	79.68
	Mn	129.50	152.65	24.00	31.00	81.46	79.10
	Zn	122.50	145.55	22.30	30.90	81.79	78.76
1800 ppm	Control	87.50	113.60	21.10	25.00	75.84	77.99
	Fe	112.00	127.80	24.90	28.20	82.30	78.29
	Mn	108.50	124.25	19.20	27.90	81.99	77.55
	Zn	105.00	120.70	18.90	26.20	77.75	77.93
3600 ppm	Control	59.50	95.85	18.10	23.20	69.56	75.79
	Fe	73.50	106.50	19.80	24.90	73.05	76.61
	Mn	70.00	102.95	18.60	24.20	73.43	76.48
	Zn	66.50	99.40	18.30	23.50	72.47	76.31
7200 ppm	Control	45.50	53.25	14.40	14.50	68.34	72.73
	Fe	56.00	92.30	17.10	22.00	69.47	76.17
	Mn	52.50	85.20	15.40	20.90	70.63	75.45
	Zn	49.00	78.10	14.70	19.00	69.96	75.67
LSD $_{at\ 5\%}$		3.42	4.67	0.67	0.87	1.59	1.42

Chlorophyll content:

Results presented in Table (2) declare the effect of various concentration of salinity on photosynthetic pigments during experiment. Data showed generally, that there was a reduction in chlorophyll a, b and a+b with increasing NaCl concentration.

The reduction of change in pigments were significantly decreased by increasing salinity levels. The significant reduction during both stages were found in plants grown under high salinity levels i.e. 1800, 3600 and 7200 ppm of NaCl. At 1800 ppm of NaCl; Chla, Chl b and total decreased by about (23.33, 22.27%), at 3600 ppm (28.64, 30.50%) and at 7200 ppm (39.08, 36.51%), respectively for paspalum and seashoe paspalum comparing with control.

Data in Table (2) show the effect of micro-elements at various concentration on pigment. It was noticed that, micro-elements treatments markedly increased chlorophyll a, b and a+b, in papalum verity plants with adding different micro-elements concentration. In respect to pigments under micro-elements application, data in Table (2) show a significant increase with adding Fe fertilization for chlorophyll a, b and a+b.

At the same Table, show the interaction between NaCl concentration in irrigation water and application different concentration of micro-elements on pigments of two papalum verity samples. It can be found that chlorophyll a, b and a+b significantly increased in salinized plants treated with Fe fertilization under various concentration of NaCl compared to their control.

Table 2. Average values of chlorophyll content of paspalum verity as affected by salinity levels and type of micro-elements during 2015-2016 and 2016-2017.

Treatments		Chlorophyll a mg/g FW		Chlorophyll b mg/g FW		Total chlorophyll mg/g FW	
		P	Pp	P	Pp	P	Pp
Effect of salinization							
Tap water		0.562	0.597	0.441	0.485	1.003	1.082
1800 ppm		0.402	0.463	0.367	0.378	0.769	0.841
3600 ppm		0.367	0.401	0.342	0.351	0.708	0.752
7200 ppm		0.318	0.364	0.293	0.323	0.611	0.687
LSD $_{at\ 5\%}$		0.001	0.005	0.001	0.004	0.003	0.006
Effect of micro-elements							
Control		0.375	0.417	0.323	0.355	0.697	0.772
Fe		0.456	0.494	0.387	0.430	0.844	0.924
Mn		0.419	0.466	0.371	0.379	0.791	0.845
Zn		0.398	0.448	0.362	0.372	0.760	0.820
LSD $_{at\ 5\%}$		0.005	0.003	0.003	0.003	0.006	0.005
Effect of interaction							
Tap water	Control	0.503	0.498	0.380	0.405	0.883	0.903
	Fe	0.651	0.683	0.485	0.625	1.136	1.308
	Mn	0.558	0.631	0.445	0.461	1.003	1.092
	Zn	0.534	0.575	0.455	0.448	0.989	1.023
1800 ppm	Control	0.380	0.448	0.350	0.365	0.730	0.813
	Fe	0.442	0.475	0.388	0.399	0.830	0.874
	Mn	0.398	0.468	0.375	0.376	0.773	0.844
	Zn	0.388	0.461	0.356	0.371	0.744	0.832
3800 ppm	Control	0.358	0.381	0.335	0.340	0.693	0.721
	Fe	0.377	0.442	0.346	0.360	0.723	0.802
	Mn	0.371	0.392	0.345	0.355	0.716	0.747
	Zn	0.361	0.388	0.340	0.350	0.701	0.738
7200 ppm	Control	0.257	0.340	0.225	0.310	0.482	0.650
	Fe	0.355	0.377	0.330	0.335	0.685	0.712
	Mn	0.350	0.371	0.320	0.325	0.670	0.696
	Zn	0.310	0.368	0.296	0.320	0.606	0.688
LSD $_{at\ 5\%}$		0.010	0.008	0.007	0.006	0.012	0.011

Generally, seashore paspalum recorded large amount of chlorophyll a, b and total than paspalum.

Reduction in total leaf chlorophyll was largely due to damage induced by salt. It might be caused by Na+ and Cl- ions toxicity leading to necrosis on the leaf surface. Necrotic spots on leaf resulted in a decrease in total photosynthesis and carbohydrate stored in the plant (Touchette, 2009). Application of NaCl to plant foliage induced fragmented cuticles, disrupted stomata, collapsed cell walls, coarsely granulated cytoplasm, disintegrated chloroplasts and nuclei, and disorganized phloem (Touchette, 2009). Besides, certain elements are important for normal growth and are part of chlorophyll ultrastructure. When such nutrients are limited, chlorophyll formation will be inhibited (Touchette, 2009). Similar to the results obtained in this study Kekere (2014); Pompeiano *et al.,* (2014); Amareh *et al.,* (2015) and Soody, (2015).

Leaf chlorophyll preservation and photosynthesis durability in stress of fertilization are physiological tolerance indices (Pessarakli, 1993). Therefore, the using of nutrient containing with Fe which are the main component of Chlorophyll under this conditions can be prevented this organelle decreases. Amirani and Kasraei, (2015). These result were consistent with finding of El-Maadawy *et al.,* (2006); Pourvi *et al.,* (2012); Soody, (2015) and Dergham *et al.*, (2017).

Fe, Zn and Mn concentration:

Data recorded in Table (3) show the effect of NaCl concentration in irrigation water on Fe, Zn and Mn concentration of paspalum and seashore paspalum. Results reveal that Fe, Zn and Mn content of paspalum and seashore paspalum plant significantly decreased by increasing NaCl concentration. Comparing with untreated plant (control) the rate of decrease at the highest concentration of salinity (7200 ppm) recorded as (0.96, 0.69% for Fe mg/kg); (1.78, 1.68% for Zn mg/kg) and (2.93, 1.32% for Mn mg/kg), respectively for paspalum and seashore paspalum.

At the same Table, It is clearly showed that iron, zinc and manganese content of paspalum and seashore paspalum plant significantly increased due to using micro-elements application in plant.

Concentration of Fe in paspalum and seashore paspalum recorded the highest mean values with using iron fertilization, as for concentration of Zn mg/kg, the highest mean values was realized with for using Zn fertilization, while concentration of Mn recorded the highest values with using Mn fertilization during the experiment.

The interaction effect between NaCl concentration and micro-elements application on mineral content of paspalum and seashore paspalum, presented in Table (3).

It could be observed that, concentration of micro-elements in lant under investigation increased with using different type of micro-element fertilization under any salinity levels but decreased with increasing levels of salinity. The highest values of mineral concentration realized with tab water and iron, Zn and manganese, respectively for Fe, Zn and Mn mg/kg.

Table 3. Average values of micro nutrient mg/kg of paspalum verity as affected by salinity levels and type of micro-elements during 2015-2016 and 2016-2017.

Treatments		Fe mg/kg		Zn mg/kg		Mn mg/kg	
		P	Pp	P	Pp	P	Pp
Effect of salinization							
Tap water		24.04	25.95	11.26	12.48	16.38	16.67
1800 ppm		23.33	25.34	10.65	11.87	15.42	15.98
3600 ppm		23.55	25.55	10.84	12.07	15.65	16.23
7200 ppm		23.81	25.77	11.06	12.27	15.90	16.45
LSD at 5%		0.03	0.05	0.03	0.03	0.03	0.03
Effect of micro-elements							
Control		22.42	24.59	9.86	11.11	14.04	15.23
Fe		25.22	26.87	10.54	11.75	16.47	16.51
Mn		23.92	25.94	11.21	12.39	17.83	17.65
Zn		23.17	25.22	12.22	13.45	15.01	15.93
LSD at 5%		0.04	0.03	0.03	0.04	0.04	0.03
Effect of interaction							
Tap water	Control	22.71	24.81	10.08	11.35	14.30	15.49
	Fe	25.80	27.33	10.82	11.98	16.73	16.76
	Mn	24.21	26.21	11.43	12.63	18.45	18.22
	Zn	23.45	25.46	12.71	13.96	16.03	16.19
1800 ppm	Control	22.15	24.37	9.63	10.87	13.77	14.92
	Fe	24.66	26.39	10.25	11.51	16.21	16.27
	Mn	23.63	25.62	10.98	12.14	17.21	17.08
	Zn	22.88	24.98	11.75	12.95	14.48	15.66
3600 ppm	Control	22.32	24.50	9.78	11.03	13.95	15.18
	Fe	24.98	26.68	10.41	11.67	16.38	16.43
	Mn	23.82	25.88	11.13	12.30	17.62	17.46
	Zn	23.08	25.14	12.04	13.29	14.66	15.85
7200 ppm	Control	22.50	24.67	9.93	11.19	14.12	15.33
	Fe	25.43	27.06	10.66	11.82	16.57	16.59
	Mn	24.03	26.05	11.28	12.47	18.05	17.85
	Zn	23.27	25.30	12.37	13.61	14.85	16.03
LSD at 5%		0.08	0.06	0.06	0.08	0.07	0.06

It is difficult to suggest mechanistic explanations of salinity influence on microelement concentration due to relatively smaller differences between control and salinised tissues (Tozlu *et al.,* 2000). On other way this decrease in micronutrients may be due to the reduction in their uptake by the plants or to the inhibition of root growth under salinity stress conditions (Munns *et al*., 2010). In this regard, Soody, (2015) on turfgrass paspalum found that, salt water irrigation resulted in a decrease in iron, zinc, manganese and magnesium.

This result is accordance with the finding of Yilmaz *et al.* (1997) who reported that foliar application of Zn can greatly enhance plant increase Zn concentration in flag leaves. Also, in the same line (Zeidan *et al.* 2010; Gomaa *et al*., 2015), who reported that foliar application of micronutrients significantly increased concentration of micronutrients in flag leaves and grains. These result were consistent with finding of Soody, (2015).

Protein and carbohydrates content %:

Data recorded in Table 4 show the effect of salinity concentration on protein and carbohydrates contents in two verity of paspalum plants during the experiment. Results declare that there was a significant decrease in concentration of protein and carbohydrates by increasing NaCl concentration in growth medium. This result was true in two verities.

The lowest value of protein and carbohydrates was recorded at the highest level of salinity stress compared with control plants. In this regard, the 7200 ppm of NaCl resulted in a decrease of about (28.97, 29.75% for protein) and (3.70, 3.22 for total carbohydrates), respectively for glucose, paspalum and seashore paspalum.

Table (4) declare the effect of micro-element treatments on concentration of protein and carbohydrates. Both of protein and carbohydrates significantly affected with application of micro-element under all treatments. It can be also noticed that plants treated with zinc had the highest protein after control, while, using iron fertilization recorded the highest values of carbohydrates with the other treatments. This was true at two verities.

The effect of interaction between salinity levels and application of different type of micro-elements on protein and carbohydrates content is shown in Table (4). It could be observed that using the micro-elements treatments significantly increased carbohydrates and decreased protein of paspalum plants under any levels of salinity, comparing with tab water.

Our result indicated that protein decreased with increasing salinity may be due to the increasing activity of acid and alkaline proteases in order to keep osmotic stress during NaCl stress (Parida *et al*., 2002). Data recorded in the present study showed clearly that the magnitude of carbohydrate reduction was increased with increasing salinity stress level. The reduction in total carbohydrates in turf grass plants under high salt stress could be attributed to the nutritional imbalance and reduced photosynthesis as recorded by Ramezani *et al.* (2011). In a previous study by Jalal *et al*. (2012) they found that stress conditions decreased chl a, chl b, carotenoids and caused stomatal closure in P. tenuiflorus plants. Stomatal closure, in turne, restricts CO_2 entry into leaves thereby decreasing CO_2 assimilation and carbohydrate formation (Chaves, 2002). Kumari and Vishnuvardhan (2015); Soody, (2015) and Pompeiano *et al.,* (2016).

Marschner (1995) reported that Zn-deficient plants reduced the rate of protein synthesis and protein content drastically but increase the accumulation of amino acids. Zeidan (2001) indicated that Zn application significantly increased grain protein and enhanced grain Zn concentration. According to Farajzadeh *et al.* (2009) studies, favorable use of zinc and iron increased the amount of grain's protein in wheat. On the other hand total content of grain's carbohydrates, and protein will be increased by using zinc and iron which these are effective on grain weight of ear (Safyan *et al*., 2012). Also, (Rawashdeh and Florin, 2015) showed that total content of grain's carbohydrates, starch, Indole acetic acid and protein was increased by foliar application Fe and Zn.

Table 4. Average values of protein and carbohydrates % of paspalum verity as affected by salinity levels and type of micro-elements during 2015-2016 and 2016-2017.

Treatments		Protein %		T. carbohydraties %	
		P	Pp	P	Pp
Effect of salinization					
Tap water		13.36	11.56	29.69	31.05
1800 ppm		11.12	9.86	29.36	30.71
3600 ppm		7.95	6.77	28.98	30.38
7200 ppm		9.49	8.12	28.59	30.05
LSD at 5%		0.06	0.28	0.04	0.03
Effect of micro-elements					
Control		11.04	9.74	26.92	28.57
Fe		9.91	8.51	31.43	32.55
Mn		10.39	9.00	29.90	31.20
Zn		10.59	9.05	28.38	29.87
LSD at 5%		0.03	0.21	0.04	0.04
Effect of interaction					
Tap water	Control	13.85	12.26	27.41	29.05
	Fe	12.86	10.86	31.92	33.07
	Mn	13.18	11.26	30.47	31.71
	Zn	13.53	11.87	28.96	30.36
1800 ppm	Control	11.70	10.45	27.14	28.72
	Fe	10.48	9.29	31.65	32.70
	Mn	10.95	9.67	30.09	31.37
	Zn	11.34	10.04	28.57	30.04
3600 ppm	Control	8.48	7.35	26.75	28.41
	Fe	7.44	6.19	31.28	32.38
	Mn	8.13	6.96	29.71	31.03
	Zn	7.76	6.56	28.19	29.71
7200 ppm	Control	10.11	8.90	26.38	28.09
	Fe	8.86	7.71	30.85	32.04
	Mn	9.29	8.12	29.34	30.70
	Zn	9.71	7.73	27.79	29.38
LSD at 5%		0.06	0.44	0.09	0.09

CONCLUSION

The growth rates of the grasses were affected only with increasing levels of salinity stress. While both cultivars seemed to follow the same trends among most of the criteria screened for, overall the seashore paspalum cultivar showed slightly more tolerance to salinity stress than the paspalum cultivar. From the results of this study, it can be concluded that these halophytic plant cultivars are suitable for growth and production under arid, desert regions and Seashore paspalum can effectively be used for biological salinity control or reclamation of desert saline soils, sustainable production under harsh conditions of the desert regions with high soil salinity levels and drought conditions and effectively combat desertification processes. Due to the results obtained in this study, the use of seashore paspalum cultivar was more effective under salinity condition more than paspalum with foliar application with iron under low salinity levels

REFERENCES

Amareh, R.; H. R. Miri and M. S. Tadaion (2015). Investigate and feasibility of the Paspalum notatum lawngrass irrigation by sea water in coastline region. J. Bio. and Env. Sci., 7 (1): 88-96. (14)

Amirani, D. C. and P. Kasraei (2015). The effect of foliar application of microelements on phenological and physiological characteristics of Mung bean under drought stress. Int. J. Agri. and Agri. Res., 7 (3): 1-8.

AOAC, (2000). Association of Official Analytical Chemists, 17th ED. Of A.O.A.C. international published by A.O.A.C. international Maryland, U.S.A., 1250 pp.

Ashraf, M.; H. R. Athar, P. J. C. Harris, and T. R. Kwon (2008). Kwon, some prospective strategies for improving crop salt tolerance. Advances in Agronomy, 97: 45–110. (10)

Chaves, M. (2002). Water stress in the regulation of photosynthesis in the field. Annals of Botany, 89: 907-916.

Dergham, A. H.; S. S. Ahmed and S. M. Shahin (2017). The interactive effects of saline irrigation water and fertilization on growth and quality of seashore paspalum turf grown in some soils of Egypt. Middle East J. Agric. Res., 6 (3): 700- 711.

Dudeck, A. E. and C. H. Peacock (1984). Effects of Salinity on Seashore Paspalum Turfgrasses. American Society of Agronomy. Crop Science Society of America. Vol. 77 No. 1, p. 47-50. (12)

Duncan, R. R. and R. N. Carrow (2000). Soon on golf courses: New seashore paspalums. Golf Course Mgt. 68 (5): 65-67.

El-Maadawy, E. I.; H. A. Mansour, and M. H. Zaki (2006). Studies on the fertilization and irrigation of turfgrasses: I - Effect of NPK and Fe fertilization on the vegetative growth and chemical composition of *Paspalum vaginatum* turfgrass. Annals of Agricultural Science, Moshtohor; 44 (2): 663-684.

Emmons, R. D. (2008). Turfgrass Science and Management, Delmar Thompson Learning, New York, NY, USA, 4th edition. (10)

Farajzadeh, M. T. E.; M. B. Khorshidi and V. Ahmadzadeh (2009). Effect of micronutrients and their application method on yield, crop growth rate and net assimilation rate of corn (cv. Jeta). J. Food, Agric. and Enviro., 7 (2): 611-615.

Gomaa, M. A.; F. I. Radwan, E. E. Kandil and S. M. A. El-Zweek (2015). Effect of some macro and micronutrients application methods on productivity and quality of Wheat (*Triticum aestivum* L.). Middle East J. Agric. Res., 4(1): 1-11.

Gomez, K. A., and A. A. Gomez, (1984). "Statistical Procedures for Agricultural Research". John Wiley and Sons, Inc., New York.pp:680.

Goodwine, T. W. (1965). Quantitative analysis of the chloroplast pigments. Academic Press, London and New York.

Greenway, H. and R. Munns (1980). Mechanisms of salt tolerance in non-halophytes. Annual Review of Plant Physiology, 31: 149-190.

Gulzar, S.; M. A. Khan and I. A. Ungar (2003). Effects of salinity on growth, ionic content, and plant – water status of *Aeluropus lagopoides*. Communications in Soil Science and Plant Analysis. 34 (11 & 12): 1657–1668. (7)

Guo, H.; Y. Wang, D. Li, J. Chen, J. Zong, Z. Wang, X. Chen and J. Liu (2016). Growth response and ion regulation of seashore paspalum accessions to increasing salinity. Enviro. and Experimental Botany, 131: 137 -145.

Harivandi, M. A.; J. D. Butler and D. M. Soltanpour (1992). Salt influence on germination and seedling survival of six cool -season turfgrass species. Commun. Soil Sci. Plant Anal., 23(7): 519-529.

Hester, M. W.; I. A. Mendelssohn, and K. L. McKee (2001). Species and population variation to salinity stress in Panicum hemitomon, Spartina patens, and Spartina alterniflora: morphological and physiological constraints. Environ. and Experimental Botany, 46 (3): 277–297. (10)

Jacoby, B. (1999). "Mechanism involved in salt tolerance of plants," in Handbook of Plant and Crop Stress, M. Pessarakli, Ed., pp.97– 124, Marcel Dekker, New York, NY, USA. (10)

Jalal, R. S.; A. E. Moftah and S. O. Bafeel (2012). Effect of salicylic acid on soluble sugars, proline and protein patterns of shara (*Plectranthus tenuiflorus*) plants grown under water stress conditions Intel Res. J. Agric. Sci. and Soil Sci., 2 (9): 400-407.

Kekere, O. (2014). Influence of sea sprays on growth and visual quality of seashore paspalum (*Paspalum vaginatum* O. Swartz) use in beach landscaping. Intel. J. Horti., 4 (13): 64-71. (8)

Kirkby, E. A. and V. Römheld (2004). Micronutrients in plant physiology: functions, uptake and mobility. Proceedings No. 543, International Fertilizer Society.

Kumari R. P. and Z. Vishnuvardhan (2015). Effect of Salinity on Growth, Protein and Antioxidant Enzymes in Three Kodo Millet (*Paspalum scrobiculatum*) Germplasm. Int. J. Curr. Microbiol. App. Sci., 4(6): 475-483. (18)

Kumpulainen, I.; A. M. Raittila; I. Lehto, and P. Koiristoinen, (1983). Electro thermal Atomic Absorbtion spectrometric determination of heavy metals in foods and diets. J. Associ. Off. Anal. Chem., 66: 1129-1135.

Marschner, H. (1995). Mineral Nutrition of Higher Plants. 2 Ed. Academic Press.

Munns, R.; R. A. James, X. R. R. Sirault, R. T. Furbank and H. G. Jones (2010). New phenotyping methods for screening wheat and barley for beneficial responses to water deficit. Journal of Experimental Botany, 61: 3499-3507.

Murdoch, C. L. (1987). Water the limiting factor for golf course development in Hawaii. USGA Green Section Record, 25: 11–13. (10)

Parida A.; A. B Das and P. Das (2002). NaCl causes changes in photosynthetic pigments, proteins and other metabolic components in the leaves of a true mangrove, Bruguiera parviflora, in hydroponic cultures. J. Plant Biology 45: 28-36.

Pessarakli, M. (1993). Handbook of plant and Crop stress. Marcel Dekker, Inc. 693 p.

Pessarakli, M. and D. E. McMillan (2014). Seashore Paspalum, a high salinity stress tolerant halophytic plant species for sustainable agriculture in desert regions and combating desertification. Intel J. Water Resources and Arid Environ., 3(1): 35-42. (1)

Pompeiano, A., V. Giannini, M. Gaetani, F. Vita, L. Guglielminetti, E. Bonari and M. Volterrani (2014). Response of warm-season grasses to N fertilization and salinity. Scientia Hort., 177: 92

Pompeiano, A.; E. Di Patrizio, M. Volterrani, A. Scartazza and L. Guglielminetti (2016). Growth responses and physiological traits of Seashore paspalum subjected to short -term salinity stress and recovery. Agricultural Water Management, 163(1): 57-65.

Pourvi, J.; S. Kachhwaha and S. L. Kothari (2012). Optimization of micronutrient for the improvement of *in vitro* plant regeneration of *Stevia rebaudiana* (Bert.) Bertoni. Indian J. Biotech., 11: 486-490.

Ramezani, E.; M. G. Sepanlou and H. A. N. Badi (2011). The effect of salinity on the growth, morphology and physiology of Echium amoenum Fisch. and Mey. African J. Biotech., 10: 8765-8773.

Raven, P. H.; R. F. Evert, and S. E. Eichhoron (2001). Plant Biology, Translation by A. Salatino, Guanabara Koogan, Rio de Janeiro, Brazil, 6th edition. (10)

Rawashdeh, H. M. and S. Florin (2015). Foliar application with iron as a vital factor of wheat crop growth, yield quantity and quality: A Review. Int. J. Agric. Pol. Res., 3 (9): 368-376.

Sadasivam, S., and A. Manickam, (1996). Biochemical Methods, 2nd Ed. New age inter. India.

Safyan, N.; M. R. Naderidarbaghshahi and B. Bahari (2012). The effect of microelements spraying on growth, qualitative and quantitative grain corn in Iran. Intl. Res. J. Appl. Basic. Sci. 3 (S): 2780-2784.

Soody, Z. O. (2015). Effect of chemical fertilization and salinity on turfgrass (Paspalum). M.Sc Thesis, Thesis, Fac. of Agric. Fayoum Univ., Egypt.

Touchette, B. W.; K. L. Rhodes; G. A. Smith and M. Poole (2009). Salt spray induces osmotic adjustment and tissue rigidity in smooth cordgrass, *Spartina alterniflora* (Loisel), Estuaries and Coasts, 32 (5): 917-925. http://dx.doi.org/10.1007/s12237-009-9178-4.

Tozlu, I.; G. A. Moore and C. L. Guy (2000). Effect of increasing NaCl concentration on stem elongation, dry mass production, and macro- and micronutrient accumulation in Poncirus trifoliata. AUST. J. PLANT PHYSIOL. 27: 35-42.

Yilmaz, A., H. Ekiz, B. Torun, I. Gultekin,S. Karanlik, S.A. Bagci and I. Cakmak (1997). Effect of different zinc application methods on grain yield and zinc concentration in wheat cultivars grown on zinc deficient calcareous soils. J. Plant Nut., 20: 461-471.

Zeidan, M. S. (2001). Response of wheat plants (*Triticum aestivum* L) to different methods of Zinc fertilization in reclaimed soils of Egypt. Plant Nutrition - Food Security and Sustainability of Agro-ecosystems (Eds W.J. Horst, *et al.*), Kluwer Dordrecht, The Netherlands, pp: 1048-1049.

Zeidan, M. S.; F. Manal and H. A. Hamouda (2010). Effect of foliar fertilization of Fe, Mn and Zn on wheat yield and quality in low sandy soils fertility. World J. Agric. Scie., 6 (6): 696-699.

Zinn, S. (2004). Suggestions for the care of seashore paspalum. Environmental Turf, Inc., Fort Pierce, Fla.

دراسات على تأثير الملوحه والرش بالعناصر الصغرى على النمو الخضرى لبعض المسطحات الخضراء

على أبو الحمايل ، السيد عطيه البرعى و حسن عبد الله
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أجريت تجربتان حقليتان في منطقه أبو جريده، كليه الزراعه ، جامعه دمياط خلال موسمي ٢٠١٥-٢٠١٦، ٢٠١٦-٢٠١٧. تهدف التجربه الى اختبار تأثير إضافه العناصر الصغرى تحت مستويات الملوحه على نوعين من الحشائش(باسبليم و باسبليم الشواطئ). صممت ١٦ معامله في تجربه قطاعات منشقه بثلاث مكررات كالتالى وهى: ٤ مستويات من الملوحه (كنترول، ١٨٠٠، ٣٦٠٠ ، ٧٢٠٠ جزء في المليون) كقطاعات رئيسيه و ٤ صور رش من التسميد بالعناصر الصغرى (كنترول، حديد، منجنيز، زنك) كقطاعات تحت رئيسيه. يمكن تلخيص النتائج كالتالى: الوزن الطازج والجاف و الرطوبه و محتوى النبات من الكلوروفيل والحديد والمنجنيز و الزنك بالاضافه البروتين والكربوهيدرات انخفضت بزياده مستويات الملوحه. اما بالنسبه للرش بالعناصر الصغري أدت الى زياده معنويه في قيم الصفات السابقه مقارنه بمعامله الكنترول و افضل النتائج عند استخدام الرش بالحديد ماعدا البروتين افضل النتائج مع الزنك. بالاضافه الى زياده تحمل صنف باسبيليم الشواطئ عن الصنف باسبيليم. بالنسبه للاضافات المشتركه وجد ان الرش بالحديد عند المستويات المنخفضه من الملوحه سجلت اعلى القيم للصفات تحت الدراسه.