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Response of Turf grass *Paspalum distichum* to different concentrations of seawater irrigation

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A B STRACT

The turf grass plays an important role in land stabilization, soil protection against water and wind erosion, sand dune fixation, air purification, temperature modification…etc. Turf grass species and cultivars differ in their responses to drought, water salt content and other environmental factors. This study was conducted to examine the effect of different sea water concentrations on development and growth of *Paspalum distichum.* Sea water was obtained from North eastern part of Benghazi city and concentrations of 0%, 1%, 2%, 5%, 10% and 20% (v/v) of seawater were used. The results of *Paspalum distichum* revealed that, there was no correlation between sea water concentration and leaf water content while the differences in the mean of leaf water content were not significant. Effect of treatment on fresh and dry weight of shoot system was significant. In contrast, fresh and dry weight of root system was not significant.

أستجابة نبات المسطحات الخضراء *Paspalum distichum* للري بتراكيز مختلفة من ماء البحر

سالم الشطشاط*، وفاء العوامي، محمد حمودة، ونجلة عبد السلام

تلعب نباتات المسطحات الخضراء دوراً مهماً في تثبيت التربة وحمايتها ضد الأنجراف المائي والهوائي وكذلك في تثبيت الكثبان الرملية وتنقية الهواء وتعديل درجات الحرارة....الخ. تختلف أنواع وأصناف هذه النباتات في أستجابتها للجفاف ومحتوي الماء من الأملاح وغيرها من العوامل البيئية. أجريت هذه الدراسة لأختبار تأثير تراكيز مختلفة من ماء البحر علي نمو وتطور نبات البسبيليوم *Paspalum distichum* . تم الحصول علي ماء بحر صافي ونظيف من شاطيء يقع بالجزء الشمالي الشرقي من مدينة بنغازي وأستخدت تراكيز 0%, 1%,2 %,5 %, 10% و 20% من ماء البحر في هذه التجربة. أوضحت النتائج بأنه لايوجد أرتباط بين التراكيز والمحتوي المائي للورقة. تأثر الوزن الطري والجاف للمجموع الخضري بشكل معنوي بينما وعلي عكسه لم يظهر الوزن الطري والجاف للمجموع الجذري أي تأثراً معنوياً.

INTRODUCTION

Libya is one of the driest countries in the world with significant changes recorded in temperature and precipitation during the last couple of decades (El shatshat and Abdosalam 2017), within which roughly 90.8% of the area is hyper-arid, 7.4% arid, 1.5% semi-arid and 0.3% is classified as sub-humid region located in northeast (Ben-Mahmoud, 1993). Libya as an arid nation accounts for 94.5% areas as desert with perpetually scarce freshwater except for a narrow strip along the northern coast, which has a Mediterranean climate. Barely five percent of the country receives more than 100 mm of rain each year (Bindra *et al.*, 2013).

It is well documented that the amount and quality of irrigation water available in many of the arid and semi-arid regions of the world are the main limiting factors to the extension of agriculture (Beck, 1984; Munns, 2002). High soil salinity level can be a major environmental constraint to crop productivity and negatively affects soil fertility and limits plant production. Most plants are susceptible to salt stress and either die or have a yield reduction (Scholberg and Loccascio, 1999). In many plants, seed germination and early seedling growth are most sensitive stages to environmental stresses (Jones, 1986). Most salinity problems in agriculture result directly from the salts carried in the irrigation water.

Turf grasses play an important role in land stabilization and animal nutrition due to their protein, carbohydrates, fats, fibers and mineral contents, soil protection against water and wind erosion, sand dune fixation, water purification, air purification, temperature modification, energy and cost saving, oxygen generation and carbon sequestration (Beard and Green (1994).

The turf grass industry is considered to be a billion dollars' industry which has an impact on the environment as well. Establishing and maintaining quality turf requires ensured supply of quality irrigation water which is the most important challenge worldwide. Turf grasses are among the most important plant groups that used extensively in the landscape of new cities, coastal resorts and touristic villages. Most of these communities are built in desert areas where irrigation depends primarily on relatively saline water from wells or desalination units (Sakr, 2009).

Due to shortage of irrigation water in arid and semi-arid regions, sea water was suggested to be a source of irrigation, but the damage of effect which caused be increasing salt concentration in sea water was take in account.

Turf grass species and cultivars differ in their responses to salinity and salt effect. A number of researches were conducted to determine the effect of salt on growth and development of turf grass, therefore, the aim of this study was to find out the effect of sea water concentration on *Paspalum distichum* turf grass under local conditions.

MATERIALS AND METHODS

The Plant material used in this study is described in table 1 and it was obtained from local market. This study was conducted at Benghazi city under normal environmental climatic conditions in an opened area.

Preparation of sea water concentrations:

Clean and clear seawater was obtained from Sedi khalifa area which located around 17 Km in North eastern of Benghazi. Five concentrations of seawater 1%, 2%, 5%, 10% and 20% (v/v) were prepared, while distilled water was used as a control treatment (0%).

Sea water effect on development of Knotgrass ***P. distichum*****:**

This experiment was conducted in an opened space, exposed to natural air and sunlight. Eighteen *P. distichum* transplants provided in ordinary condition were cultivated in plastic pots with diameter and deepness of 30 cm (3 pots for each concentration) filled with mixed agricultural soil (sand and clay 1:1). The pots were irrigated with different concentration of seawater for 2 weeks, then the shoot parts were harvested, the clipped shoots were measured by sensitive balance to obtain the fresh weight. Dry weight was obtained after drying of the clipped shoots in an oven of temperature of 65 ° C for 24 hours. *P. distichum* pots were treated with urea solution 0.4% as a fertilizer prepared by adding 40g of urea to 10 L of water. *P. distichum* pots were allowed to grow again after treated with 0.4% urea and harvest process was repeated 3 times and dry and fresh weights were measured every time.

Statistical analysis:

Data were analyzed using SPSS (version 18) and Anova test was used to determine the differences in the response to verities of seawater concentrations and significance was accepted at *P*-values below 0.05. the confidence interval was set at 95%.

Table (1): Plant species used in the study.

Common name	Scientific name	Family
Knotgrass	*Paspalum distichum* L.	Poaceae

RESULTS AND DISCUSSION

As described in table (2) and figure (4-6), there was very weak correlation between sea water concentration and leaf water content (Pearson correlation =0.111). Increasing the concentration level did not affect leaf water content, the differences in the means of leaf water content were not significant compared with the control (p-value= 0.063).

Effect of treatment on the means of *P. distichum* fresh and dry weights showed significant differences (P- value 0.008, 0.015) respectively. Compared with their control treatments, both fresh and dry weights of shoot system showed increasing at concentrations of (1 and 5%), then showed decreased value when concentration increased (figure 1 and 2). Maximum reduction in shoot dry and fresh weight was seen at higher concentrations (10% and 20%).

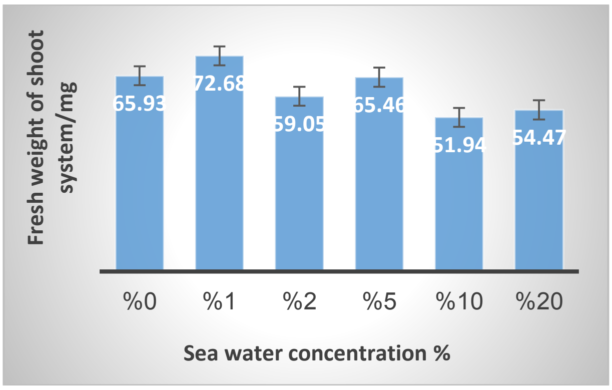

Figure 1; Effect of sea water on fresh weight of *P. distichum* shoot system. Data are means in (mg) and bars are standard deviations.

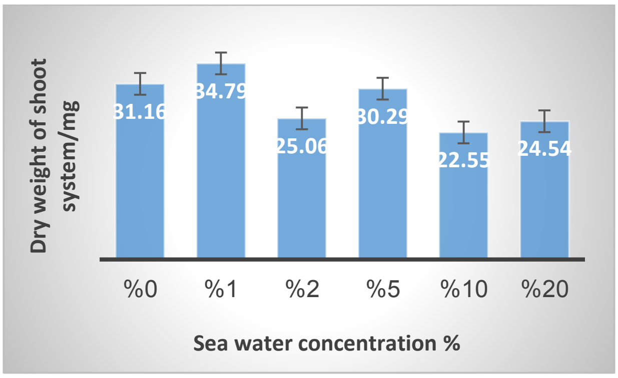

Figure 2; Effect of sea water on *P. distichum* shoot system dry weight. Data are means in (mg) and bars are standard deviations.

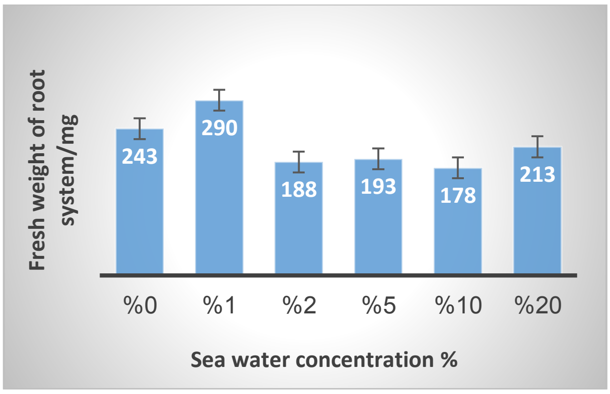

Figure 3; Effect of sea water on *P. distichum* root system fresh weight(mg). Data are means in (mg) and bars are standard deviations.

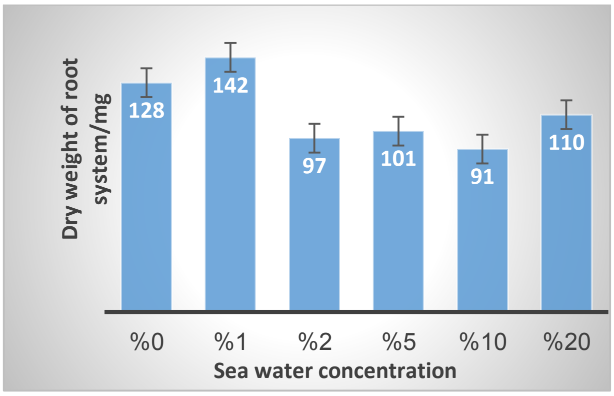

Figure 4; Effect of sea water on *P. distichum* root system dry weight(mg). Data are means in (mg) and bars are standard deviations.

Table (2): Effect of sea water concentration on *P. distichum* leaf water content.

Sea water	Mean	N	STD
0%	53.00	3.00	1.73
1%	52.33	3.00	2.08
2%	57.33	3.00	2.08
5%	54.00	3.00	1.73
10%	56.67	3.00	3.21
20%	55.00	3.00	0.00
Pearson correlation	0.11		
Anova	0.064		

Sea water effect on the means of *P. distichum* root fresh and dry weights showed no significant differences (P- value 0.083, 0.095) respectively. Compared with their control treatments, both fresh and dry weights of root system showed decreased value with increased the concentration, but this reduction in root system weight was not significant (figure 3 and 4).

The results of the study revealed that, there was very weak correlation between salinity and leaf water content (Pearson correlation =0.111). Sea water level did not affect leaf water content, the differences in the means of leaf water content were not significant compared with the control (p-value= 0.063). This indicating that salt concentration tolerance may, in part, be attributed to the ability of plants to maintain a desired tissue hydration level.

Both fresh and dry weights of *P. distichum* were decreased with increased concentration level, but this reduction was not significant compared with the control treatment. Such reduction in root fresh weight might be due to a decrease in water uptake and osmotic potential under salt stress, which directly affects the growth and development of plants (Terry and Waldron, 1984; Riaz *et al*., 2010). Similar trend was observed by (De Costa and Zoysa, 1995) in soybean and rice, but in contrast, (Hameed and Ashraf, 2008) in *Cyndon dactylon* and (Naz *et al*., 2009) in some arid zone grasses showed that high root dry weight is related to salinity tolerance.

The overall reduction in dry weight of root was attributed due to toxic effect of salt and reduced nutrient availability due to salt stress in growth medium (Qadir and Shams, 1997). Shoot dry weight decreased with increase in external NaCl concentration. This decrease in shoot dry weight could be due to shrinkage of cellular contents, reduced growth, development, and differentiation of tissues and disturbed avoidance mechanism as described earlier in different plant species under salt stress (Kent and Lauchli, 1985; Suplick-ploense *et al*., 2002; Munns and Tester, 2008). Salts effect the growth of plants, which reduces metabolite synthesis and ultimately decreases dry weight of shoot (Cheesman, 1988).

One of the most urgent problem in many of the arid and semi-arid countries is the scarcity of water and Libya is among these countries. Finding enough water to support the food needs and other demand is a priority to all governments. Availability of good quality irrigation water is always a constraint in the arid regions and the water desalination is an expensive alternative.

The need for salt tolerant turf grass has increased (Harivandi *et al*., 1992). Because of salt accumulation in soils (Hoos, 1981), increased restrictions on the use of potable water for landscape irrigation (Devitt *et al*., 2004; Lockett *et al*., 2008), and saltwater intrusion in the groundwater (McCarty and Dudeck, 1993; Murdoch, 1987).

CONCLUSION

According to the results of this study, seawater can be used as a source of irrigation in knot grass. It is clear that high concentrations were caused negative effect. Therefore, using low concentrations must take in account while at this concentrations, the turf grass revealed good results in both shoot and root parameters which measured. Continue further work using other plant turf grasses under different other conditions is highly recommended.

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