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STUDY ON SALT TOLERANCE OF TURF GRASSES

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Response of two Bermuda grass *(Cynodon dactylon)* varieties, Dacca and Khabal grass, to different levels was studied in a plot experiment. Salinity was developed artificially at levels of EC_e 0.6, 5.0, 10.0 and 15.0 dS m^{-1} using NaCl. Plant mortality, sodium and chloride concentration in plant increased with the increasing levels of salinity. However, plant fresh and dry weights, leaf area, leaf blade length, stolon diameter and potassium concentration decreased with an increase in salinity. Khabal grass was more tolerant than Dacca grass on the basis of different parameters studied.

INTRODUCTION

In Pakistan, increased use of saline water for irrigation of playing surfaces and home lawns is becoming a serious problem. The situation needs investigation to monitor the response of various lawn grasses to different salinity levels. It has been reported that the differential salinity tolerance based on growth responses do exist among the turf grass species (Dudeck *et al.,* 1983). In this context, Cordukes and Parups (1972) reported that Cl^- contents of leaf tissue increased in *Poa pratensis, Festuca rubra* and *Lolium perenne* receiving various rates of Cl^- and Ca^{2+}. Hughes *et al.* (1975) also observed that the addition of 30,000 ppm of NaCl to the soil completely inhibited the survival of seedlings of *Poa pratensis.* Leaf Na^+ concentration was also reported to increase with the addition of various grasses and amount of Na^+ concentration was also reported to increase with the addition of NaCl. However, there was no relationship between salt addition of NaCl. However, there was no relationship between salt tolerance of various grasses and amount of Na^+ in leaf tissue. Mostafa *et al.* (1984) indicated that plant height, number of shoots and fresh as well as dry weights of root, stem and leaves of *Datura innoxia* significantly decreased when salinity level was increased from 0 to 0.4% (air dry soil). They also observed a decrease in K^+ contents of stem and leaves after the stress onset.

MATERIALS AND METHODS

Two grass varieties, Dacca and Khabal, were studied for their salt tolerance at salinity levels of 0.6, 5.0, 10.0 and 15.0 dS m^{-1} developed artificially in the soil by using commercial grade NaCl salt. Plots measuring 66 x 66 x 16.5 cm in size were dug and lined with polythene sheet (0.2 mm thick) to protect leaching of salts. Fifty g of grass $plot^{-1}$ were planted at plug distance of 10 cm. Experiment was laid out in completely randomised design with three replications. The data on mortality percentage, shoot fresh and dry weights, leaf area, stolon diameter were recorded. The oven dry plant material was ground to powder form. The chemical analyses for Na^+ and K^+ were made according to the U.S. Salinity Lab. Staff (1954). The chloride in plant material was

determined following the method described by Johnson and Ulrich (1959).

by NaCl in the uptake of mineral nutrients and in water relations leading to harmoni-

Table 1. Effect of salinity on growth of two turf grasses

EC_e (dS m^{-1})	Plant mortality (%)	Fresh weight (g)	Dry weight (g)	Leaf blades length (cm)	Leaf area (cm^2)	Stolon diameter (cm)
0.6	2.67 d	3.65 a	2.14 a	5.66 a	8.45 a	0.074 a
5.0	12.11 c	3.31 a	1.71 b	5.20 b	7.67 ab	0.069 ab
10.0	21.30 b	2.74 b	1.40 c	4.78 c	6.67 bc	0.066 bc
15.0	28.22 a	2.40 b	1.26 c	4.42 c	6.14 c	0.062 c
Variety						
Dacca grass	16.50	2.53 b	1.41 b	3.45 b	4.91 b	0.056 b
Khabbal grass	15.67	3.52 a	1.85 a	6.58 a	9.56 a	0.079 a
S.E.	1.80	0.35	0.19	0.32	0.89	0.005

Figures in columns bearing same letter(s) are non-significantly different at 5% probability.

RESULTS AND DISCUSSION

Effect of salinity on growth: All the salinity levels differed from one another and increased mortality significantly which was the highest (28.27%) at EC_e 15 dS m^{-1} (Table 1). The difference in mortality between the two varieties of grass was, however, non-significant. The increased mortality at high salinity may be due to rapid uptake of toxic ions like Na^+ and Cl^- by plants at higher level of salinity (Cordukes and Parups, 1972) or physiological draught due to the osmotic effect of salt. Fresh and dry weights at EC_e 10 and 15 dS m^{-1} were statistically at par with each other but significantly lower than those at EC_e 5 dS m^{-1} or at control. Khabal grass yielded significantly more mean fresh and dry weights than the Dacca grass. Inhibition of dry matter accumulation at higher salinity could be due to the reasons similar to those described above or changes induced cally controlled changes in growth (Parrando *et al.*, 1978).

The leaf blade length was reduced from 5.67 cm at EC_e 0.6 dS m^{-1} to 4.42 cm at EC_e 15 dS m^{-1}. The differences in leaf area measured at EC_e 10 and 15 dS m^{-1} were non-significant but were significantly lower than the control. Khabal grass yielded almost double the mean leaf length (6.58 cm) and mean leaf area (9.56 cm^2) than Dacca grass with 3.45 cm length and 4.91 cm^2. Reduction in leaf area might be due to suppressed cell division and cell elongation caused by salinity. The mean stolon diameter of Khabal grass was significantly more than that of Dacca grass. It may be noted that mean plant mortality, dry weight and leaf blade length decreased significantly at EC_e 5 dS m^{-1} compared to the control while the other parameters showed significant differences at EC_e 10 dS m^{-1}.

Table 2. Effect of salinity on the concentration of Na^+, Cl^- and K^+ in plants

EC_e (dS m^{-1})	Sodium		Chloride		Potassium	
	Dacca grass	Khabbal grass	Dacca grass	Khabal grass	Dacca grass	Khabal grass
0.6	4.02 d	3.74 d	13.67 d	18.00 d	54.40 a	63.36 a
5.0	9.61 c	6.63 c	19.44 c	23.67 c	52.23 b	58.04 b
10.0	11.84 b	7.63 b	25.11 b	27.89 b	45.57 c	54.09 c
15.0	13.36 a	10.16 a	33.89 a	34.89 a	44.48 c	50.47 d
Mean	9.71	7.02	23.03	25.58	49.17	56.49
S.E.	0.51		0.9		2.07	

Figures in column bearing same letter(s) are non-significantly different at 5% probability.

Effect of salinity on chemical composition: As the concentration of salts in the medium increased, the grasses accumulated significantly more Na^+ and Cl^- (Table 2). At all the salinity levels Dacca grass accumulated more Na^+ than Khabal grass. Results are in line with Hughes *et al.* (1975) who observed that leaf Na^+ concentration of *Poa pratensis* increased with addition of NaCl to the soil. Increased Cl^- concentration of leaf tissue with increasing applied Cl^- was observed by Cordukes and Parups (1972). Maximum Cl^- concentration (34.89 and 33.89 me kg^{-1} in Khabal and Dacca grass, respectively) was measured at EC_e 15 dS m^{-1}. When NaCl concentration increased in soil, the potassium concentration in plant decreased. Maximum K concentration of 63.36 me kg^{-1} was found in Khabal grass at control while the lowest K concentration was found in both the varieties at EC_e 15 dS m^{-1}. Dudeck *et al.* (1983) also reported similar results.

On the basis of results obtained, it could be concluded that the variety Khabal grass was more tolerant to NaCl stress than variety Dacca grass.

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