International Journal of Water Resources and Environmental Sciences 1(4): 98-101, 2012
ISSN 2311-2492

DOI: 10.5829/idosi.ijwres.2012.1.4.11116

Effect of NaCl on the Morphological Attributes of the Pearl Millet (*Pennisetum glaucum)*

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Abstract: Salinity cause the changing in morphology, physiology and the biochemical process of plants. When plants are exposed to salt stress different changes takes place in their metabolism to deal with problems that taking place in their environment. This research was conducted to see effect of concentration of salt on morphology of pearl millet. The three treatments of NaCl was given to 3 replicates of each group. The treatments were given after 10 days of germination and plants were harvested after 10 days of treatment. Then calculations and readings were taken.Data was analyzed by ANOVA using Costat Statistical computer package. Results obtained indicated that the difference in growth between these two lines it is due to differences in ion transfer rates to the shoot and accumulation of salts in the shoot results suggest that tolerance to salt stress, in pearl millet lines studied may be related to ability of plant to prevent accumulation of toxic ions like Na^+ and Cl^{2+} and to maintain the shoot and large concentration of salts in soil causes to significant change in morphology of pearl millet.

Key words: Salinity・Growth・Ions・Pearl millet・Salt・NaCl・Pearl millet・Salinity

INTRODUCTION

Many species of higher plants, mostly crops, in this growth inhibited by high NaCl concentration. The salt-induced inhibition of plant growth is caused by osmotic effects on water uptake but also by variable effects on plant cell metabolism. While the first component can bring about water deficiency, toxicity and nutritional disorders caused by the excess of ions [1]. Salinity is the process to which saline soils are produced by addition of soluble salts. These salts present in large amounts are calcium, sodium, magnesium and chloride and sulphate ions and in small amounts are potassium, carbonates and bicarbonates [2]. The osmotic pressure of the increases by the accumulation of these salts to which water intake by plants is decreased. Cramer *et al*. [3]. Many reports appearing in the literature shows that salinity causes many adverse effects on the morphology, anatomy and physiology of pearl millet [4]. For instance, with increasing concentration of salinity percent germination, height, grain and straw yield of pearl millet is decreased [5]. Alam and Naqvi [6] observed that with increase in salinity theplant height and dry matter yield decreased. The selective uptake of K^+ over Na^+ can be shown by computing the K^+: Na^+ ratio within the tissues as related to that of the external medium. As a general rule actual K^+:Na^+ ratio in the tissue decreases but the selectivity ratio increases with salinity [7]. This criterion has been used as an index for salt tolerance in various crops by different workers [8, 9]. Plants, whether glycophyte or halophyte, cannot tolerate large amounts of salt in the cytoplasm, so, they develop a plethora of mechanisms to cope with salt stress and to facilitate their metabolic functions [10]. In fact, salt stress affects all the major processes such as growth, photosynthesis, protein synthesis and energy and lipid metabolism [11]. Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is rated to be fairly tolerant to salinity [12]. Moreover, availability of high levels of tolerance in other species of *Pennisetum* [13] and within the *P. glaucum* [12] offers a scope for understanding the traits related to tolerance and to integrate these tolerant crop species/genotypes into appropriate management programs to improve the productivity of the saline soils [14].

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The aim of this study was to assess the effects of NaCl concentration on the plant growth, solutes transfer from root to shoot accumulation and distribution of inorganic solutes (Cl^-, Na^+, K^+, Ca^{2+} and Mg^{2+}) in order to better understand the ion transfer mechanism in pearl millet.

MATERIAL AND METHODS

The work under consideration was conducted outdoor within pots experiments at Hafiz Hayat Campus in University of Gujrat (UOG).Seeds of pearl millet (*Pennisetum glaucum)*were obtained from the Jalalpur Jattan, Gujrat Pakistan. CRD design was applied in this experiment.12 pots of good condition were selected and filled with fertile soil having organic manure. Pots were arranged in 4 rows, 3 pots in each row. Seeds were sown about 1.5-2cm deep with the help of finger. Seeds were sown at the date of 20-04-2012. Seeds were germinated after 5 days at the date of 25-04-2012.The treatments were given after 10 days of germination at 5-05-2012. The plants were watered with distilled water daily.

Treatments:

- T0= Control (Distilled water)
- T1= 25mM (NaCl)
- T2= 50mM (NaCl)
- T3=75mM (NaCl)

Plants were uprooted carefully and washed in distilled water. Shoot and root length was measured with the help of scale meter in cm and root dry weight, shoot dry weight, root fresh weight and shoot fresh weight in gram with the help of electrical balance.

RESULTS AND DISCUSSION

The root and shoot length of the pearl millet was decreases with the increase in the salinity level. The maximum growth was shown in the control of both parameters and the minimum reduction was observed in the T2 of the root length and the in the case of shoot length the minimum reduction was noted in T3 which the higher level of salinity applied to the pearl millet. The germination was also affected and these results was also observed by Greenway and Munns [1] that seed germination in distilled water is maximum and Greenway and Munns [1] reported the low germination in the salt treatments. There was little bit increase in the growth of pearl millet at mild conditions of sodium chloride(25mM). Generally, salinity stress results in a clear stunting of plants[15]. Slower growth is a general adaptive feature for plant survival under stress, allowing redirecting cell resources (e.g., energy and metabolic precursors) towards the defense reactions against stress [16]. There was also change in the leaf length and no. of leaves with the increase in the salinity and these results were related to the Muscolo *et al*. [13] that *Panicum clandestinum* growth and leaf length decreased with increase in salinity. The decreased rate of leaf growth after an increase in soil salinity is primarily due to the osmotic effect of the salt around the roots [17]. Salt stress initially inhibits leaf expansion through reduced turgor and may in fact eventually result in increased cell wall extensibility, which counteracts the negative effects of low turgor. In the presence of salt, cell wall extensibility of the growing region may decrease [18].

The root, shoot fresh and dry weight was also decreased in the higher salt concentration, the minimum weight was noted in T2 of fresh and dry weight of the root and shoot which was the 50mM level of the NaCl. But in the case of T3 the plant weight was increased which show that plant develop and intensive system to survive in the higher saline level. As compared with the control, no significant reduction in FW (Fresh weight) and DW (dry weight) of plants was observed after treatment. [19].Although pearl millet is salt tolerant crop but growth is reduced with the increase of salt treatment.

Table 1: Effect of NaCl on Root length, Shoot length, No. of Leaves, Leaf Area. Shoot fresh wt., Root fresh wt., Root dry wt., Shoot dry wt. of pearl millet

Source	df	M.s of Root length (cm)	M.s of Shoot length (cm)	M.s of No. of Leaf	M.s of Leaf Area (cm^2)	M.s of Shoot fresh wt. (gm.)	M.s of Root fresh wt. (gm.)
NaCl	3	7.47ns	9.09ns	0.31ns	3.50ns	0.04ns	5.50ns
Error	8	4.68	4.34	0.5	12.7	0.05	5.46
Total	11						

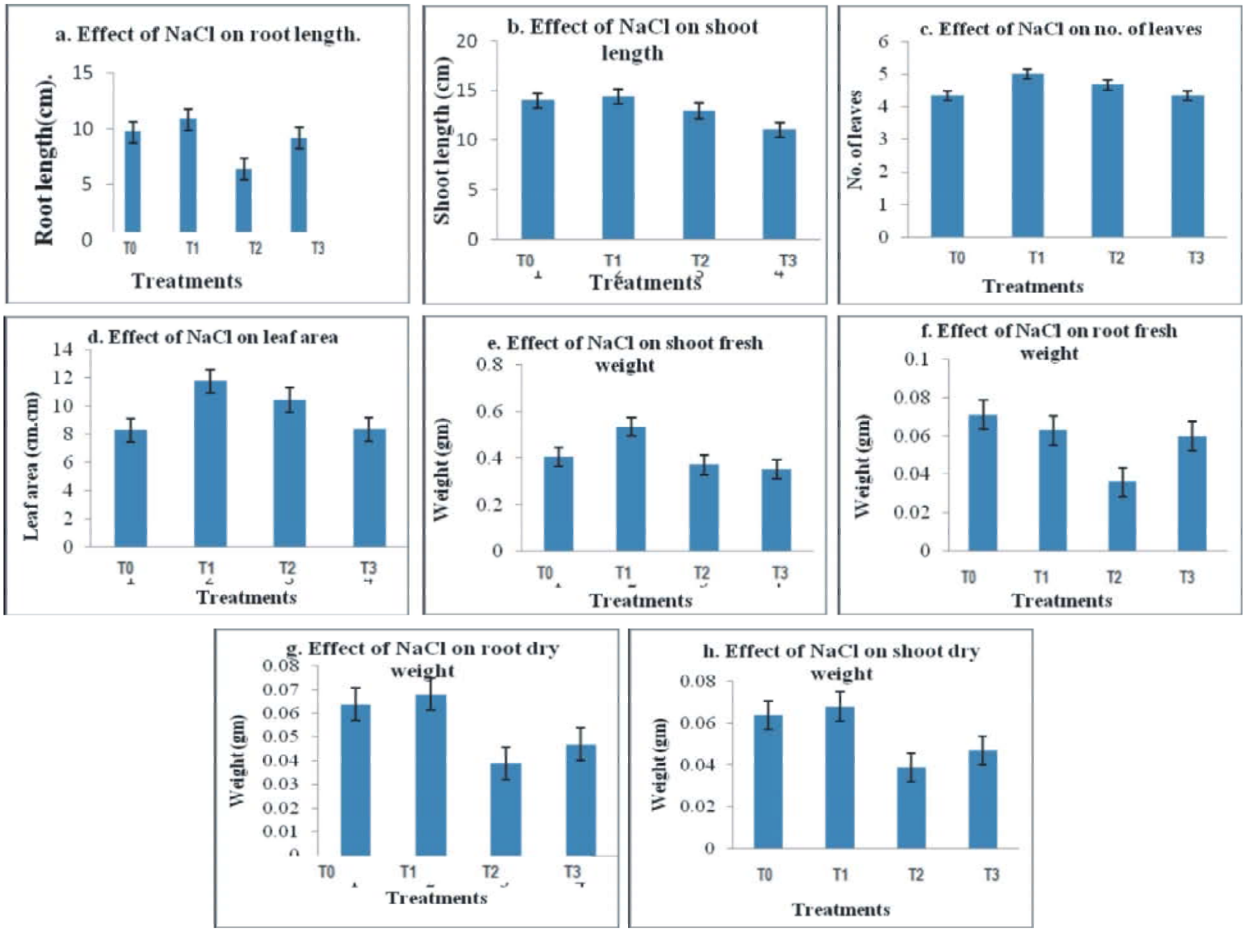

Fig. 1: Shows effect of NaCl on pearl millet on root length (a), shoot length (b), No. of leaves (c). Leaf area (d), shoot fresh weight (e), root fresh weight (f), root dry weight (g), shoot dry weight (h).

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