http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences, 1 (3): 226-227, 1998 Research Article

Effect of salinity on germination and seedling growth of wheat (*Triticum aestivum* L.)

N. Iqbal, H.Y. Ashraf*, F. Javed, Z. Iqbal* and G.H. Shah
*Department of Botany, University of Agriculture, Faisalabad, *Nuclear Institute for Agriculture and Biology, P.O. Box No. 128, Jhang Road, Faisalabad, Pakistan*

Abstract
Studies to test the salinity effect on germination and seedling growth of three wheat varieties were conducted in controlled temperature room (C.T. room) and results showed that germination percentage, shoot and root lengths and fresh and dry weights drecreased due to salinity in all the wheat varieties. Among the varieties LU-26S showed better response for all these parameters followed by Pasban and Sarsabz.

Key words: Salinity, germination, seedling growth, wheat varieties

Introduction
Salinity is a world wide problem. This problem is particularly serious in arid and semi-arid regions of the world where most of the developing and under developed countries happen to Fall. The problem of salinity is very serious in Pakistan. About 6.3 million hectares area of Pakistan is affected to various degrees by soil salinity (Khan, 1993).
Two approaches have been followed to cope with soil salinity. The first is to modify the soil conditions to suit the crop plants. The second approach is to exploit the genetic potential of plants for their adaptability to adverse soil conditions. The former is a long term process and very little success has been achieved in our country even after spending Rs. 21 billion upto 1988 (Aslam *et al*., 1993). However the later is a short term strategy and includes the crop cultivation on the salt affected fields. To employ this approach the screening of salt tolerant genotypes is necessary. Germination and seedling growth under saline environment are the screening criteria which are widely used to select the salt tolerant genotype (Ashraf *et al*., 1990; Khan *et al*., 1993). As for better croping highest plant population is required, which is only possible if seed germination is satisfactory under saline conditions.
The present investigation was, therefore, conducted to determine salt tolerance capacity of three wheat varieties and look into the possibility of growing them on saline soils.

Materials and Methods
The experiment consisted of five salinity levels with three replications. Wheat *(Triticum aestivum* L.) cultivars, Pasban, LU-26S and Sarsabaz were tested for germination and seedling growth. Lots of healthy caryopesis were surface sterilized by 10 percent sodium hypochlorite for five minutes, then washed three times with distilled water. After this caryopesis were placed on moistened filter paper in petri-dishes (diameter 11.5 cm, depth 2 cm) with solutions of various salinity levels (0, 5, 10, 15 and 20 dS m^{-1}). Salinity was created by the addition of Na_2SO_4, $CaCl_2$, $MgCl_2$ and NaCl in a ratio of 70:35:10:23 respectively. Electrical conductivity of the solution was measured by using digital conductivity meter (Model F 538, WTW, Germany). The constituents of different salinity levels are given in the Table 1. The petri dishes were placed in growth chamber maintained at $28 \pm 2°C$ day/night temperature in complete darkness. The filter paper were moistened at regular intervals with the respective solution. Caryopsis having 2.5 mm radical, at the time of observation, were considered germinated. At the end of experiment, germination percentage, shoot and root length, fresh and dry weights of germinated seedlings were measured. This experiment was repeated three times. Data was statistical analysed using Analysis of varience and the means were compared according to DMRT test (Steel and Torrie, 1984).

Results and Discussion
The germination percentage was decreased as the salinity level increased from 0 to 20 dS m^{-1} (Fig. 1a). The highest percentage (96%) was recorded under control and lowest (72%) under 20 dS m^{-1}. All the three varieties showed significant differences regarding germination percentage. LU-26S had highest germination percentage (90%) followed by Pasban (87%) and Sarsabaz (81%). However, LU-26S performed better at all the treatments as compared with others.
Under salinity stress germination and early seedling growth are considered critical. Establishment of seedling and early vigour plays an important role in the subsequent capability of crop to withstand saline conditions and indirectly they determine crop stand density and consequently the yield of the resultant crop The rate of germination and the percentage of germination both decreased with increasing salinity levels. Ashraf *et al*. (1991) and Raghav and Pal (1994) had also reported similar results.
Highly significant decrease in root length and shoot length as the salinity levels increased were recorded (Fig 1b). The maximum root length (10.43 cm) was observed under control and minimum (3.171 cm) under 20 dS m^{-1}. Similarly maximum shoot length (6.97 cm) was obtained under control and minimum (2.463 cm) under 20 dS m^{-1} (Fig. 1c). There were highly significant differences among varieties. LU-26S showed highest shoot length (5.46 cm) followed by Pasban (4.85 cm) and Sarsabaz (4.22 cm). The maximum fresh and dry weight per plant were obtained under control and minimum under 20 dS m^{-1}. In this regard highly significant differences among the varieties were observed. Maximum fresh and dry weight were recorded in LU-26S followed by Pasban and Sarsabaz.
Reduction in growth due to salinity is a common observation. This reduction is due to water shortage and ionic toxicity created by salinity. The increase in plant

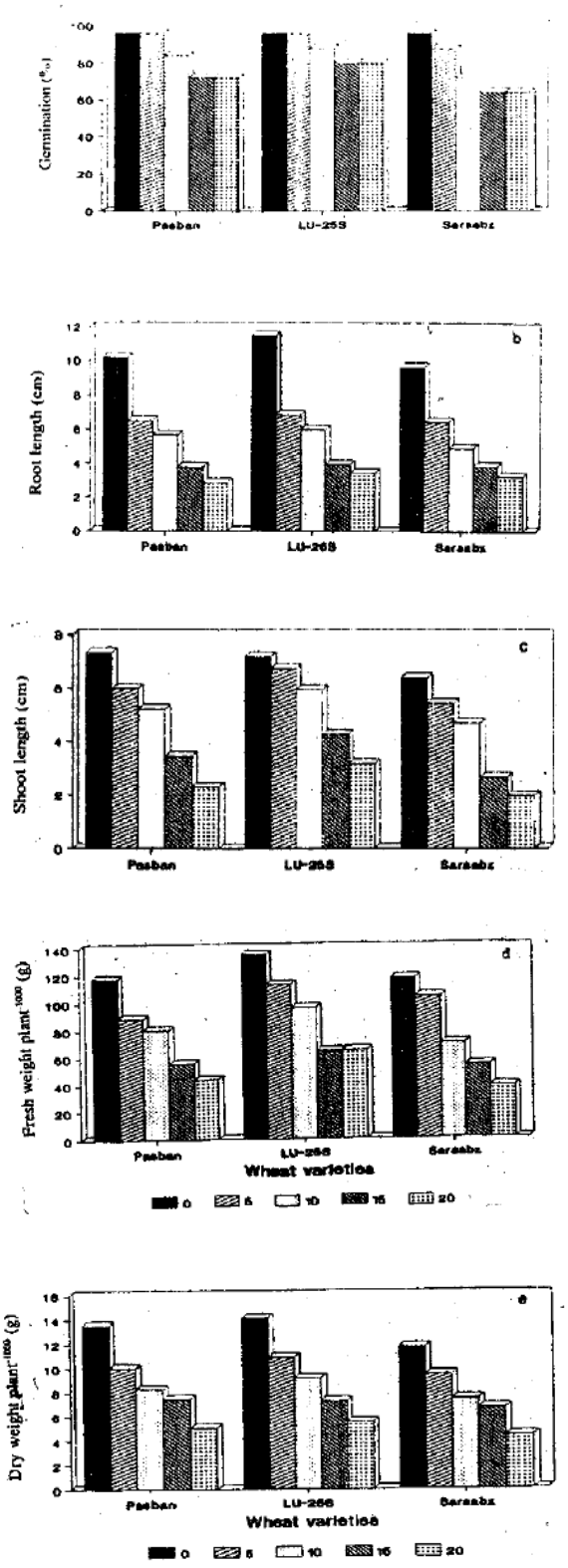

Fig. 1: Variations in (a) Germination (%), (b) Root length, (c) Shoot length, (d) Fresh weight and (e) Dry weight of three wheat varieties grown under different salinity levels

growth is due to turgor potential which deceased by water deficit produced by high concentration of the salts in the soil. Similar results were quoted by Ashraf and Naqvi (1996), Ashraf and Khan (1993), Parasher and Varmer (1992), Reggiani *et al*. (1994) and Huang and Redmann (1995).

Table 1: Constituents of different salinity levels

Name of constituent	Stock Sol.conc. (gm/l)	5	10	15	20
Na_2SO_4	200	10.00	20.00	30.00	40.00
$CaCl_2$	400	2.50	5.00	7.50	10.00
$MgCl_2$	400	0.67	1.34	2.01	2.68
NaC1	200	3.10	6.20	9.30	12.40

References

Ashraf, M.Y. and A.H. Khan, 1993. Effect of NAD on Nitrogen Status of Sorghum. In: Current Development in Salinity and drought Tolerance of Plants, Naqvi, S.S.M., M.R. Ansari, T.J. Flower and A.R. Azmi (Eds.). AEARC., Tando Jam, Pakistan, pp: 84-88.

Ashraf, M.Y. and M.H. Naqvi, 1996. Effect of salinity on germination, seedling growth and mineral nutrition of mungbean (*Vigna radiata* L. Wileck). Pak. J. Agric. Agric. Eng. Vet. Sci., 1: 96-98.

Ashraf, M.Y., M.A. Khan and S.A. Ahsan, 1990. Effect of salinity (NaCl) and polyethylene glycol (PEG) on germination, seedling growth and water uptake of sorghum. Pak. J. Agric. Eng. Vet. Sci., 6: 33-36.

Ashraf, M.Y., M.A. Khan and S.S.M. Naqvi, 1991. Effect of salinity on seedling growth and solutes accumulation in two wheat genotypes. Rachis, 10: 30-31.

Aslam, M., R.H. Qureshi and N. Ahmed, 1993. A rapid screening technique for salt tolerance in rice (*Oryza sativa* L.). Plant Soil, 150: 99-107.

Huang, J. and R.E. Redmann, 1995. Responses of growth, morphology and anatomy to salinity and calcium supply in cultivated and wild barley. Can. J. Bot., 73: 1859-1866.

Khan, G.S., 1993. Characterization and genesis of saline sodic soils in Indus plains of Pakistan. Ph.D. Thesis, Department of Soil Science University of Agriculture, Faisalabad, Pakistan.

Khan, M.A., M.Y. Ashraf and S.S.M. Naqvi, 1993. Influence of Salinity on Protein, RNA and Alpha Amino Nitrogen of Wheat Seedling. In: Current Development in Salinity and drought Tolerance of Plants, Naqvi, S.S.M., M.R. Ansari, T.J. Flower and A.R. Azmi (Eds.). AEARC., Tando Jam, Pakistan, pp: 89-93.

Parasher, A. and S.K. Varmer, 1992. Effect of different levels of soil salinity on germination, growth and yield of wheat (*Triticum aestivum* L.) md. J. Agric. Res., 26: 100-106.

Raghav, C.S. and B. Pal, 1994. Effect of saline water on growth, yield and yield contributory characters of various wheat (*Triticum aestivum* L.) cultivars. Ann. Agric. Res., 15: 351-356.

Reggiani, R., S. Bozo and A. Bertani, 1994. Changes in polyamine metabolism in seedlings of three wheat (*Triticum aestivum* L.) cultivars differing in salt sensitivity. Plant Sci., 102: 121-126.

Steel, R.G.D. and J.H. Torrie, 1984. Principals and Procedures of Statistics: A Biometrical Approach. McGraw Hill Book Co., New York, USA.