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RESEARCH ARTICLE

EFFECTS OF SUPPLEMENTAL UV-B RADIATION ON PENNISETUM GLAUCUM (PEARL MILLET) CROP

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Abstract

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Pearl millet is one of the most important of the world, which is mostly cultivated in the arid and semi arid regions. It is member of genus Pennisetum of Poaceae family and was formerly known new line Pennisetum americanum. It has been considered under orphan crop because it has been reported for the improvement by the scientist community. The plant of interest for the study is specifically selected considering regional importance and agro-climatic suitability. The plant under consideration for the study is Pearl millet (Pennisetum glaucum (L.) R. Br.) which is a major cereal crop of tropicalregion.It has been considered as an orphan crop because of the negligence by the world scientists. It is ranked fourth after rice, wheat and sorghum in India and ranked fifth in world after rice, wheat, maize and sorghum. Only a few works have been carried out on P. glaucum for tolerance against fungalinfection.

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Introduction:-

At the beginning of the evolution of life on Earth UV influx rates clearly exceeded the present values. Terrestrial plant life had become possible after development of ozone layer in the stratosphere which had absorbed all the solar UV-C and part of the UV- B radiation [1]. Instrumental monitoring of the stratospheric ozone started only in 1926 using Dobson spectrometers.[2] A reduction of the stratospheric ozone layer has taken place over the last three decades in response to CFC emissions of anthropogenic origin.

UV rays come in the range between 200-400 nm. UV rays represent less than 5% of the total electromagnetic radiation reached on the earth surface. UV radiation can be categorized into three spectral regions.
UV-radiation has long been known to be damaging to life; indeed this quality is being employed increasingly for the disinfection of water and for the mutation of microorganisms for laboratory experiments. UV-B affects plants and animals by modifying both their biological and chemical environment.

Material and Methods:-

The composite seeds of Pennisetum glaucum (L.) R.Br. cv. WC-C75 was obtained from All India Coordinated Pearl Millet Improvement Project), Jammu & Kashmir, India.The effect of abiotic (salt and drought stress) and biotic stress (fungal infection) on P. glaucum seedling was studied. Andfor the study of post transformation stress effect the transgenic plantlets were subjected to stress treatment.

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For the study of effect of stress on morphological parameters the 20 sterilized seeds were placed on filter paper moistened with different concentrations of salt and mannitol solution in each petriplates and were allowed to grow for 7 days at 25 ºC under 16 hrs lightconditions.Morphologicalparameters, Germination percentage, Root/shootlength and Root/shootweight of Pennisetum glaucumwas observed.

Results:-

Morphologicalparameters:

The morphological symptoms are indicators of injurious effects of both abiotic and biotic stress. Adverse effect of both abiotic and biotic stress can only be known by making comparisons with control plant grown under comparable conditions.

Germinationpercentage:

The germination efficiency decreased as the salt (NaCl) concentration increased (Figure 4.1). The percentage of germination was recorded 36.66%, 27.33%, 6.66% and 3.66% at salt concentrations 50 mM (S1), 100 mM (S2), 150 mM (S3) and 200 mM (S4) respectively on 7^{th} day of stress treatment. The germination percentage under control condition was observed to be72%.

Germination percentage of P. glaucum cv.WC-C75was strongly affected by salinity levels and increase in NaCl concentration caused decrease in final germination percentage. Similar results were reported in Bread wheat and Fenugreek seeds.[3]

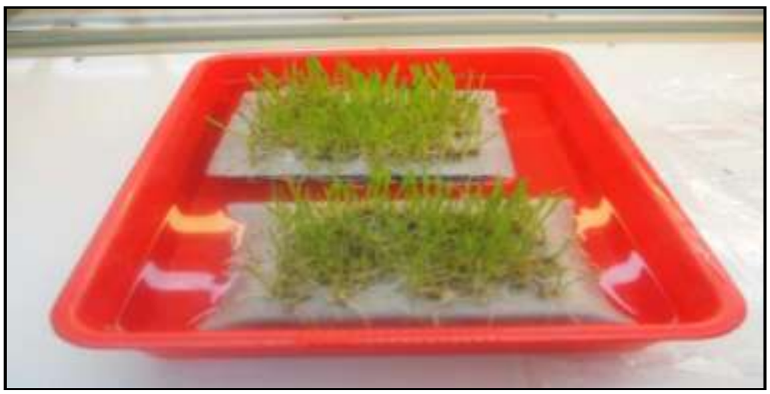
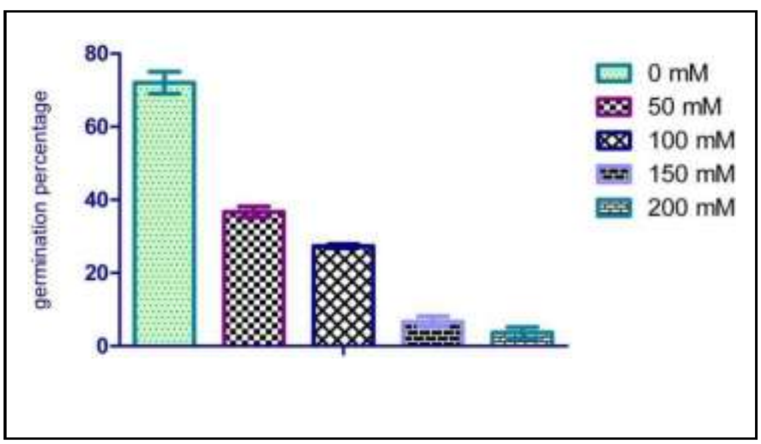


Photo plate 1:- P. glaucum seedlings subjected to salt treatment (Nacl).

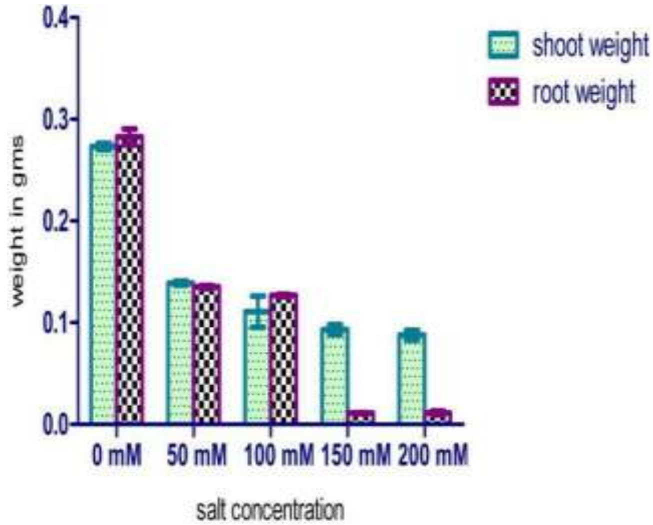


Graph -1:- showing germination efficiency in P. glaucum under salt stress and Control).

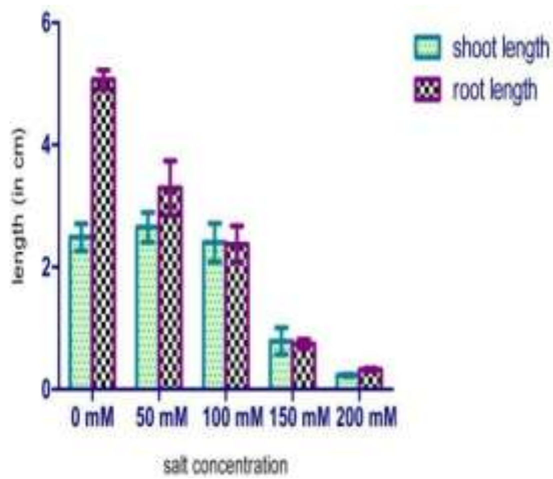
Root/shootlength:

Considerable decrease in root and shoot length was observed in P. glaucum with increasing salt concentration (Graph-2). The root/shoot length reduction is due to excessive accumulation of salt (NaCl) in the cell wall which affects the metabolic activities ultimately resulting in decreased cell enlargement. The shoot length decreased with increasing salt concentrations as compared to that ofcontrol.

Root/shootweight:
The fresh weight of shoots and roots were recorded and compared with control (Graph-3). Both root/shoot length decreased significantly with increasing salt concentration.



Graph-2:- Showing root/shoot mean length of P. glaucum seedlings after 7 days of salt treatment.



Graph-3:- Showing root/shoot mean weight of P. glaucum seedlings after 7 days of salt treatment.

Discussion and Conclusion:-

Both halophytes and glycophytes responses in similar manner to increased salt stress by reduction in percentage of seed germination and also delayed seed germination. [4] Moderate salt stress intensity delayed germination while higher intensities significantly decreased the germination, which is similar to as reported in wheat.[5] The germination percentage significantly decreased at 200 mM of NaCl in P. glaucum as compared to control(unstressed).

The root/shoot length reduction is due to excessive accumulation of salt (NaCl) in the cell wall which affects the metabolic activities ultimately resulting in decreased cell enlargement.[6] The reduction in growth parameters with increasing NaCl concentration is due to the limited supply of metabolites to growing tissue as the metabolic productivity is significantly reduced at higher salt which is either due to low water uptake or toxic effect of salt [7]

Our results showed reduction in root/shoot fresh weight in response to increasing NaCl concentration.[8]Reduction of root/shoot length as well as weight in sorghum. Wheat, spinach, Triticale and barley under salt stress showed similar results to ours.[9-10]

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