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Effect of Salts along with Moisture Stress on Osmoprotectant in *Cenchrus setigerus*-76 Plants grown *in vivo.*

Reena Bora and S.P. Bohra
Stress Physiology Laboratory
Department of Botany
J.N.V. University, Jodhpur, (Rajasthan), India

Abstract : Changes in proline content in *C. setigerus*-76 grown *in vivo* in the presence of salts under normal and moisrure stress were studied. Three week old plants were treated with different concentrations of different salts. For moisture stress, plants were kept for 24 hours and 48 hours before the analysis of proline content. A decrease in proline content was observed in normal grown *C. setigerus* plants treated with NaCl, Na_2SO_4, NaF and $CaCl_2$. However, an increase was observed at pre-flowering stage of normally grown plants treated with NaCl. Moisture stress increased the proline content in NaCl and Na_2SO_4 salts imposed plants for 48 hours, where as, decreased in plants kept for 24 hours. In contrast, NaF and $CaCl_2$ recorded a decreased amount of proline content in both the conditions. Maximum accumulation of proline contents were recorded in 10^{-2}M NaCl treated and moisture stressed plants kept for 48 hours.

Key words : Osmoprotectant, Proline, Moisture stress, *Cenchrus setigerus*-76, NaCl, Na_2SO_4, NaF and $CaCl_2$.

Introduction :

Deserts plants are exposed simultaneously to both salt as well as evaporative water stress. The two osmotic quantities, salt and water are independent since addition of a salt to water lowers its osmotic potential (Levitt, 1980). Salinity is one of the important constrains in improving crop productivity. Salt stress affects the growth and water relations of pearl millet callus (Rangam and Vasil, 1984). Decreased protein synthesis in pearl millet seedlings in response to salinity could lead to an increased amino acids (Eder *et al.*, 1977). Detrimental effects of saline conditions, in general, can be attributed to the decrease in osmotic potential of the medium and disturbances in mineral nutrition of the plant or direct toxic effect on plant growth and metabolism. Moisture stress results in a loss of turgor leading to decrease in stomatal conductivity and photosynthesis (Sullivan and Ross, 1979).

Proline is an important imino acid which is found in free pool as well as protein fraction of plant tissues. Proline primarily functions as a solute for intracellular osmotic adjustment of water potential or as a protectant of metabolic machinery (Raghavendra and Reddy, 1987). Proline which accumulates during water and salt stress, plays a pivotal role in regulating the internal osmotic adjustment of the cell. (Stewart and Lee 1974).

Keeping this in view the present investigation was aimed to study the effect of salts along with moisture stress on proline in *Cenchrus setigerus*-76 plants grown *in vivo.*

Material and methods :

For *in vivo* studies seeds were sown in earthenware pots; pots were filled with a mixture of garden soil and goat manure in the ratio of 3:1. After two weeks of seedlings growth, thinning was done and five to six plants of uniform size were selected in each pot.

Experiments were designed to observe the following :

(a) Normal field condition : Different concentrations of salts were given to 3 week old plants. Pots treated with water served as controls. For pre-flowering stage subsequent three treatments were given at an interval of 4 days. After the emergence of inflorescences the spikes, plants were given fourth treatment (post-flowering stage) in the same manner as that of the pre-flowering stage. Leaf samples were collected after 4 days of the third treatment for biochemical analysis of pre-flowering stage and similarly leaves were collected after four days of the fourth treatment for biochemical analysis of post-flowering stage.

(b) Moisture stress condition : Before the analysis of proline content, plants were subjected to 24 hours and 48 hours of moisture stress. Plant material (leaves) were homogenised using appropriate buffers in pre-chilled pestle-mortar and centrifuged at 10,000 rpm for 20 minutes. The supernatent was dialysed and used for the estimation of proline content (Bates *et al.*, 1973).

Result and Discussion :

The observations are presented in Table-1. A decrease in proline content was observed in normal as well as moisture stressed. *C.setigerus* plants treated with NaCl, Na_2SO_4, NaF and $CaCl_2$. However, an increase was reported at pre-flowering stage of normally grown plants treated with NaCl and Na_2SO_4 treated moisture stressed plants subjected to 24 hours. Results are in accordance with Singh (1994) who reported proline content decreased in moisture stressed *Vigna* seedlings treated in different salts.

A drastic increase in proline content appears due to striking metabolic consequence of salt, osmotic stress, moisture stress, cold and thermal stress has been described over the years (Chu *et al.*, 1976a-b; Greenway and Munns, 1980; Stewart and Larher,1980; Paleg and Aspinall, 1981; Stewart and Ahmed, 1983). Accumulation of proline under water and salinity occurs as a consequence of a reduction in cell osmotic potential.

Proline content decreased with respect to control as well as increasing concentration of NaCl, Na_2SO_4 at post-flowering stages and NaF at pre-flowering stages. In cotrast, plants treated with $CaCl_2$ showed reverse effect at post-flowering stages in normal grown plants. In *Phaseolus aconitifolius*, NaCl treatment increased the proline content which was observed only up to 8.5×10^{-3} M (Huber *et al.*, 1977). Proline content increased in pearl millet callus with increasing concentration of NaCl (Rangan and Vasil, 1984). Fluoride increased proline content in *Eruca sativa* seedlings (Mathur and Purohit, 1992).

Moisture stress increased the proline content in NaCl and Na_2SO_4 salts when plants imposed for 48 hours, whereas, decreased in plants kept for 24 hours. In contrast, NaF and $CaCl_2$ recorded decreased amount of proline content in both the conditions. Proline accumulated only at severe water stress in sunflower (Lawlor and Fock, 1977). Proline accumulation under moisture stress was also observed in bermuda grass (Barnett and Naylor, 1966) and cotton (Elmore and McMichael, 1981). Wheat accumulated large amount of proline when subjected to moisture stress (Sairam and Dube, 1984).

Thus, the present study reveals an increase in proline contents, when treated

Table 1 : Effect of Salts along with Moisture Stress on Proline in *Cenchrus setigerus*-76 Plants Grown *in vivo*.

Treatments	Proline (mM / g Fwt)		Proline (mM / gFwt)	
	Pre Flow.	Post Flow.	24 Hrs. M.S.	48 Hrs. M.S.
Control	0.065 ± 0.816	0.047 ± 0.843	0.028 ± 0.256	0.046 ± 0.814
NaCl				
10^{-3} M	0.089 ± 1.24	0.012 ± 0.896	0.007 ± 0.124	0.115 ± 0.942
10^{-2} M	0.073 ± 0.816*	0.015 ± 2.16	0.009 ± 0.153	0.315 ± 1.67
10^{-1} M	0.093 ± 0.942	0.035 ± 0.942	0.028 ± 0.197 NS	0.224 ± 1.26
Na_2SO_4				
10^{-3} M	0.038 ± 0.471	0.010 ± 0.588	0.008 ± 0.172	0.202 ± 0.962
10^{-2} M	0.060 ± 0.816NS	0.029 ± ?1.67	0.011 ± 0.643*	0.018 ± 0.247
10^{-1} M	0.023 ± 0.972	0.026 ± 0.247	0.017 ± 0.471	0.031 ± 0.816
NaF				
10^{-3} M	0.059 ± 0.726 *	0.017 ± 0.789	0.013 ± 0.267	0.058 ± 0.647
10^{-2} M	0.040 ± 1.24	0.020 ± 0.247	0.009 ± 0.169	0.055 ± 0.594 NS
10^{-1} M	0.039 ± 0.642	0.026 ± 0.364	0.007 ± 0.126	0.053 ± 0.764*
$CaCl_2$				
10^{-3} M	0.103 ± 0.792	0.020 ± 0.196	0.020 ± 0.247	0.032 ± 0.942
10^{-2} M	0.029 ± 1.24	0.024 ± 0.187	0.018 ± 0.156	0.022 ± 0.464
10^{-1} M	0.029 ± 1.63	0.038 ± 0.471	0.017 ± 0.196	0.020 ± 0.764

± Values × 10□³ represent SD,
NS – Not significant
MS – Moisture Stress

* – Significant at 5% P. only,
All other values significant at 1 % P.

with different concentrations of salts. This may furthur be proved to be a useful step in using these techniques for further studies.

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Department of Zoology

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