PROLINE CONTENT IN LEAVES AND ROOT IN AFRICAN MAHOGANY SUBMITTED TO SALINITY

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ABSTRACT: African mahogany (*Khaya Senegalensis*) has gained prominence on the national scene. Tolerance mechanisms against abiotic adversity has been the objective of study in this sector. In this context, this study aimed to verify proline accumulation in young African mahogany plants under different concentrations of sodium chloride (NaCl). The experiment was conducted in greenhouse and the salinity established by the addition of NaCl to the nutrient solution, whose concentrations corresponded to the following levels of electrical conductivity (0.0; 3.3; 15.1; 29.9; 42.6; 53.6 dS m^{-1}) in a completely randomized design. At 120 days after treatment the leaves and roots were oven dried at 65 °C, homogenates and shreds and samples of this material were collected for the determination of proline contents. It was verified that the proline levels of the treatments differed significantly ($p < 0.05$) from the control plant for both leaves and roots. The increment of this organic osmolyte in plants under stress the importance of this for vegetables on abiotic stress, indicating that these solutes play a fundamental role in the osmoprotection and osmoregulation processes.

KEYWORDS: abiotic stress, amino acid, *Khaya Senegalensis*

TEOR DE PROLINA EM FOLHAS E RAIZ DE MOGNO AFRICANO SUBMETIDAS A SALINIDADE

RESUMO: O Mogno africano (*Khaya Senegalensis***)** tem ganhado destaque no cenário nacional. Mecanismos de tolerância frente a adversidade abióticas tem sido objetivo de estudo

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nesse setor. Neste contexto, este trabalho objetivou verificar o acumulo de prolina em plantas jovens de Mogno africano sob diferentes concentrações de cloreto de sódio (NaCl). O experimento foi conduzido em casa de vegetação e a salinidade estabelecida pela adição de NaCl à solução nutritiva, cujas concentrações equivaleram aos seguintes níveis de condutividade elétrica (0,0; 3,3; 15,1; 29,9; 42,6; 53,6 dS m^{-1}) em delineamento inteiramente casualizado. Aos 120 dias após o tratamento as folhas e raízes foram secas em estufa a 65 °C, homogeneizadas e trituras. Amostras desse material foram coletadas para a determinação dos teores de prolina. Verifica-se que os teores de prolina dos tratamentos diferiu significativamente ($p<0.05$) da planta controle tanto para as folhas quanto para as raízes. O incremento desse osmólito orgânico nas plantas submetidas ao estresse evidencia a importância deste para os vegetais sobre estresse abióticos, indicando que esses solutos têm papel fundamental nos processos de osmoproteção e osmorregulação.
PALAVRAS-CHAVE: estresse abiótico, aminoácido, *Khaya Senegalensis*

INTRODUCTION

He Brazilian forestry sector is one of the segments that is increasing prominence, being of great importance in the country's productive chain. In this context, African mahogany (*Khaya senegalensis*) belonging to the Meliaceae family has been highlighted in the market as an alternative form of wood exploitation in substitution of native mahogany, since it presents similar characteristics and is desirable for the sector.

However, abiotic conditions such as the excess of salts present in the country's soils have limited forest production and entailed enormous losses (Ribeiro et al., 2017). Because of this, studies about plant tolerance to salinity have been instrumental in minimizing production losses. Among the several mechanisms, the most expressive in plants is the one that tends to avoid the loss of water by the plants, the so-called osmotic adjustment.

In this process there are significant changes in the hydric relationships, considerably decreasing and sometimes, drastically, leaf water potential, directly influencing the plant's cellular turgescence, restricting gas exchange and photosynthetic processes, as well as altering the concentrations of organic and inorganic solutes within plants (Willadino & Camara, 2010). The accumulation of compatible solutes is not detrimental to cellular metabolism and, by increasing the osmotic pressure inside the cells, maintains the water absorption and turgor

pressure of the cells, which contributes to the continuity of physiological processes, even at levels smaller (Marijuan & Bosch, 2013)

Several are the organic solutes that have their concentrations altered front the abiotic stress, some of which are more expressive, such as compatible osmolytes, including proline, which accumulates in large quantities to benefit the osmotic adjustment of the cytosol and protection of cellular structures (Silveira et al., 2010), constituting the most studied compatible solute due to its responsiveness to stress conditions (Trovato et al., 2008). Verbruggen & Hermans (2008) states that in plants under stress, proline content may increase up to 100-fold compared to that observed in plants grown under normal conditions, considering that this accumulation provides an important parameter for the selection of resistant plants.

In view of the above, the present study aims to verify the accumulation of proline in young plants of African mahogany under different concentrations of sodium chloride.

MATERIAL AND METHODS

The experiment was conducted in a greenhouse at the State University of the Southwest of Bahia (UESB), *campus* of Vitória da Conquista, whose geographic coordinates are 14º 53 '08" south latitude and 40º 48' 02" west longitude Greenwich, with an altitude of 881 m. It has annual precipitation of 700 mm and according to the classification of Köppen, the climate of the region is typically tropical altitude (*Cwb*), with dry season in winter and hot and humid summers.

African mahogany seedlings grown in pots with washed sand were submitted to nutrient solutions with different concentrations of NaCl (00; 145; 270; 395 e 520 mM). These concentrations are expressed in the graph corresponding to the values of the electrical conductivities. The experiment was composed of six treatments, one control, and four replications, totaling 24 experimental plots, conducted in a greenhouse in a completely randomized design. At 120 days after treatment (DAT) the leaves and roots were collected, previously oven dried at 65 °C for 72 hours and then homogenized and ground in a knife mill. For the determination of proline was used the ninhydrin acid method of Bates et al. (1973).

The data were subjected to analysis of variance by the F test at 5% probability and the averages compared by the Tukey test at 5% probability.

RESULTS AND DISCUSSION

It is observed in figure 1, that the proline contents in the mahogany leaves differed significantly from the controls in all treatments analyzed. The treatment with 53.6 $dS.m^{-1}$ of electrical conductivity (EC) obtained higher levels of proline when compared with the control. Similar results were found by Ferreira-Silva et al. (2009) in studies with cashew seedlings submitted to saline stress. These results also corroborate those found by Mendes et al. (2007) in leaves of Brazilian Mahogany, which under water stress conditions, proline levels increased significantly with the prolongation of water deficiency, showing that abiotic stresses such as water deficiency and saline stress tend to increase proline contents leaves as tolerance mechanism.

The increase of the contents of this amino acid occurs due to the decrease of water in the foliar tissue of the plants, because, it acts on the resistance of plants against abiotic stresses exerting an osmoprotective role. That is, in the prevention of the production of free radicals or in the sequestration of reactive oxygen species (ROS) and also in osmoregulation (Paula et al., 2013).

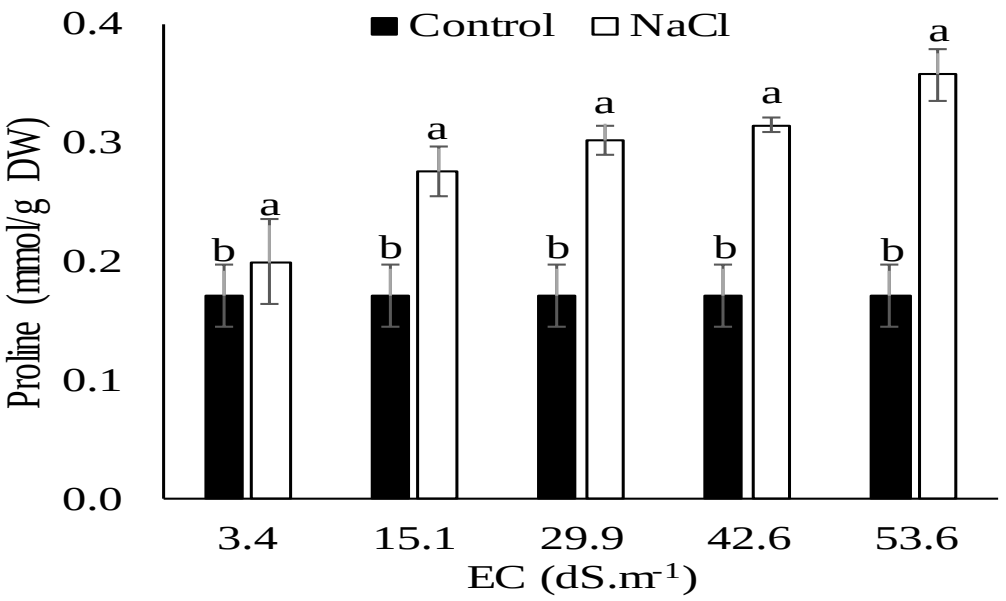

Figure 1. Proline content in African mahogany leaves submitted to salinity at 120 DAT. The columns are averages of 4 replicates and the bars represent the standard error of the mean. Lowercase letters indicate comparison between the effects of control plants and NaCl treatments by Tukey test ($p<0.05$)

The figure 2 shows that there was an increase in the proline content in the roots of the plants submitted to salt stress when compared to the control plants, being more expressive for the maximum concentration of NaCl.

It is verified when it relates the contents of proline between the leaves and the roots, there is differences between the control and the treatments are bigger in the roots. These results corroborate with those found by Nascimento et al. (2015) that when studying Jatobá seedlings submitted to salinity in a hydroponic medium, in which the roots revealed higher levels of proline in relation to the leaves.

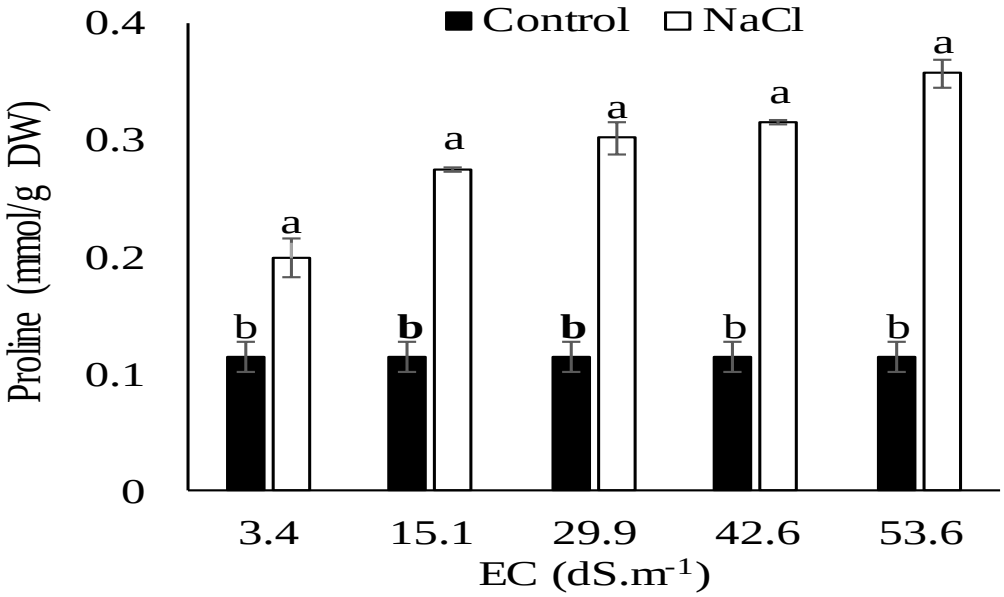

Figure 2. Proline content in African mahogany roots subjected to salinity to 120 DAT. The columns are averages of 4 replicates and the bars represent the standard error of the mean. Lowercase letters indicate comparison between the effects of control plants and NaCl treatments by Tukey test ($p<0.05$).

CONCLUSIONS

Salinity affects the physiological characteristics of plants, especially proline levels in leaf tissues and roots, showing an increase of these, evidencing the magnitude of this osmoregulator in the tolerance of plants to saline stress

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