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Germination of *Senna Occidentalis* Link: Seed at Different Osmotic Potential Levels

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ABSTRACT

*The objective of this research was to study the effect of osmotic potential and salinity on the germination of seeds of **Senna occidentalis**, with and without a change of solutions. The percentage and rates of germination decreased according to decrease of potential, being more drastic when the substitutions of solutions were not made. The largest reductions were observed with the PEG solutions, with and without substitutions.*

Key words: Germination, seed, osmotic potential, *Senna occidentalis*

INTRODUCTION

Water stress acts by decreasing the percentage and rate of germination (Prusinski and Khan, 1990; Branccini et al., 1996), and for each species there exists a value of water potential below which germination does not occur (Bewley and Black, 1985). In order for the process of germination to start, it is necessary for the seed to reach an adequate level of hydration, which will permit a reactivation of the metabolic processes (Cordoba et al., 1995). Nassif and Perez (1997), studying germination in *Pterogyne nitens*, observed that PEG 6000 provoked larger decrease in the percentage and rate of germination of the seeds than did NaCl, CaCl2, KCl, and manitol, there occurring no germination at -1.2 MPa with PEG, and -2.2 MPa with NaCl.

Senna occidentalis presents promising results in biological activity against the etiological agent of malaria (Sala-Neto et al., 1990), and its leaves, as infusions, are purgative and emenagogous; the roots are vermicide, diuretic, abortive, and disobstructive (Lorenzi, 1982). As literature is scanty regarding germination of seed in medicinally potential species, the objective of this study was to verify the effects of osmotic potentials and salinity on the germination of seeds of this species, with and without changes of solution.

MATERIAL AND METHODS

The osmotic potentials utilized were 0 (control), -0.2; -0.4 and -0.6 MPa, with 3 replications with 50 seeds, previously scarified in concentrated sulfuric acid for 20 min, then washed in running water. The seeds were placed for germination under lighting conditions for 24 h (4 fluorescent lamps of 40w) at 25°C on humidified filter paper with 12ml of solution at different potentials. For the relationship between concentration and potential with the PEG (polyethylene glycol 6000)

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solution, the Villela et al. (1991) table was used, and for the NaCl solution, the equation cited by Parmar and Moore (1968) was used. As it was noticed that alterations occurred in the refractometric indexes of the solutions, the germination tests were done with and without changing solutions, and changing at 2 hours intervals for the PEG, and 4 hours intervals for the NaCl solutions in the 24 early hours and after the widely intervals, according to refractrometric indexes variations.

Observations of germination were made daily during 10 days, being considered as having germinated those seeds that presented approximately 2mm of root length (Rehman et al., 1996), which were removed. The rate, or velocity, of germination was calculated according to the formula of Maguire (1962). For statistical analysis, the data of germinating percentage were transformed to $\arcsin\sqrt{X/100}$. The design was a completely randomized one, and the averages compared by the Tukey method, at 5% level of probability.

RESULTS AND DISCUSSION

The final percentage results (Fig. 1) and the velocity of germination (Fig. 2) presented decrease as the potential went from 0 to -0.6 MPa in PEG and NaCl solutions, and was more drastic with PEG at -0.6 MPa, both with and without changing solution. When the potentials were PEG induced (Fig. 1 A) and the solution was renewed, the percentage of germination decreased from -0.4 MPa potential; when the solutions were not changed the decreasing was more accentuated at -0.2 MPa. The velocity of germination decreased rapidly with decrease of potential induced by PEG (Fig. 2 A), when a significant difference appeared with -0.2 MPa, with or without change of solution.

In Fig. 1 B, it could be seen that when the NaCl solutions were changed, the final percentages of germination did not differ significantly between the potentials used; however, with regard to the velocity of germination (Fig. 2 B), the data showed differences starting with -0.2 MPa, showing drastic reduction at -0.6 MPa. The change in the refractometric index of the NaCl solutions could have been due to the absorption by the seeds (Reman et al., 1996), where the content of Na^+ of the seeds, of the three species of *Cassia* tested, increased with the increase of the concentration of NaCl in the solution. However, when the NaCl solutions were not changed (Fig. 1 B), a significant difference was observed starting at -0.2 MPa, no germination occurring at -0.6 MPa, the same pattern was observed with the velocity of germination (Fig. 2 B).

Analyzing the results of percentage and rate of germination in PEG and NaCl solutions, it was seen that the decrease of potential affected the velocity more than the final percentage of germination, which agreed with the results found by Ashraf and Abu-Shakra (1978) and Nassiff and Perez (1997). The largest reduction found, both for final percentage and rate of germination when the seed treatment with PEG was compared to NaCl treatment, was also observed by Nassiff and Perez (1997) in seeds of *Pterogyne nitens*, where the limit of germination was -1.0 MPa for PEG and -1.8 MPa for NaCl, with velocity being more affected than germination potential. To *Senna occidentalis* the germination limit would be -0.2 MPa for PEG and NaCl solutions, without solutions changes, and -0.6 MPa for PEG and less than -0.6 MPa for NaCl, with change of solution.

This larger reduction, with PEG solution, when unchanged, could be attributed to high viscosity, where solubility and diffusion of oxygen were reduced compared to water (Mexal et al., 1975). Furthermore, by the same manner that PEG, of high molecular weight is excluded from cell walls, it is also excluded from the cellulose matter of filter paper (Hardegree and Emmerich, 1990), that with water absorption by the paper and by the seeds concentrate the free solution, resulting in the decrease the water potential value.

When the potential was sufficiently low, such as -0.6 MPa with no change of solution, the seeds could contain sufficient water (Bradford, 1990) to start the germination process (Phase I and II) without however, passing to root cell growth (Phase III). The process of elongation and the cellular wall synthesis are highly sensitive to water deficiency (Wenkert et al., 1978) and reduction in growth could be due to the decrease of turgor of these cells (Bradford, 1995).

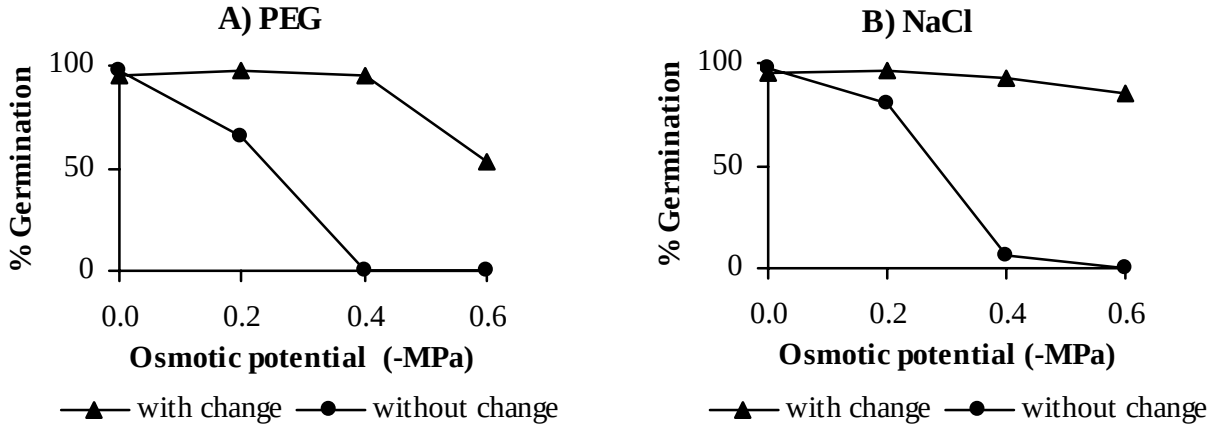

Figure 1 - Average percentage of germination of seeds of *Senna occidentalis*, submitted to different osmotic potentials with and without a change of solution, induced by PEG (**A**) and NaCl (**B**), under light, at 25°C.

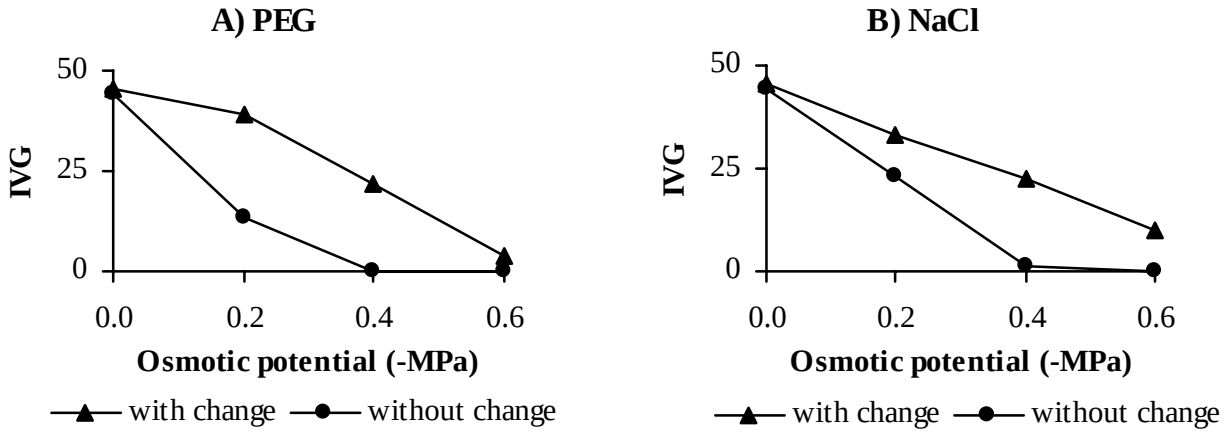

Figure 2 - Average velocity of germination (IVG) of *Senna occidentalis* seeds, submitted to different osmotic potentials with and without change of solution, induced by PEG (**A**) and NaCl (**B**), under light, at 25°C.

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RESUMO

O objetivo da pesquisa foi estudar o efeito de potenciais osmóticos e salinidade na germinação de sementes de *Senna occidentalis*, com e sem troca da solução. A porcentagem e a velocidade de germinação diminuíram com o decréscimo do potencial, sendo mais drástica quando as soluções não foram trocadas. As maiores reduções foram observadas nas soluções com PEG, com e sem troca da solução.

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