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GERMINATION AND SEEDLING GROWTH RESPONSES OF *HALOXYLON SALICORNICUM* TO CERTAIN SALTS

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Haloxylon salicornicum (Chenopodiaceae), a valuable range-shrub in arid and semi-arid regions of Iraq, is considered as relatively salt tolerant or semi-halophyte. It also possesses certain morphological and eco-physiological characteristics for drought resistance (Clor et al., 1974). To understand such interactions, germination and subsequent seedling development were taken as starting point for such studies.

Germination tests on fresh seeds of *Haloxylon salicornicum* were made in glass petri dishes (9 cm dia) lined with Whatman No. 30 filter paper and moistened with 5 ml of the test salt solutions. There were four replications of 50 seeds per dish. The salt solutions were prepared by dilutions of a stock solution of 16 atm by Vant Hoff formula (Pauling and Pauling, 1975) using NaCl, Na_2SO_4, and $MgSO_4$. In case of combinations, equal volumes of the two respective salt solutions of the same osmotic concentrations were mixed. Petri dishes were kept in an incubator at 20°C, and under continuous fluorescent illumination. Germination counts were made on alternate days. Average seedling length was calculated by measuring the total length of ten seedlings taken randomly from each dish at the end of the experiment.

At a very low concentration, i. e. OP of 2 atm, germination percentage was dropped to 70% in Na_2SO_4, but only to 90% in NaCl and very slightly in $MgSO_4$. However, 50% reduction in germination occurred at the concentrations of 5 atm of Na_2SO_4, 9 atm of NaCl, and about 16 atm of $MgSO_4$ (Fig. 1). Thus as the concentration of the three salts was increased, reduction in germination percentage became more pronounced in Na_2SO_4 than in NaCl, and very moderate in $MgSO_4$.

Average seedling length was reduced in all three solutions. Again reduction was more pronounced in Na_2SO_4, less in NaCl, and moderately in $MgSO_4$. The patterns of reduction were also similar to those observed in germination (Fig. 2). When $MgSO_4$ was mixed with NaCl or with Na_2SO_4, inhibition of germination was completely eliminated and seedling growth improved.

The reduction in germination percentage of the seeds and the average seedling length of *Haloxylon salicornicum* in $MgSO_4$ was rather low and gradual, and this is in agreement with Al-Jibury and Clor (1986). Such reduction is most probably due to osmotic effect (diffusion pressure deficit gradient). High reduction in germination

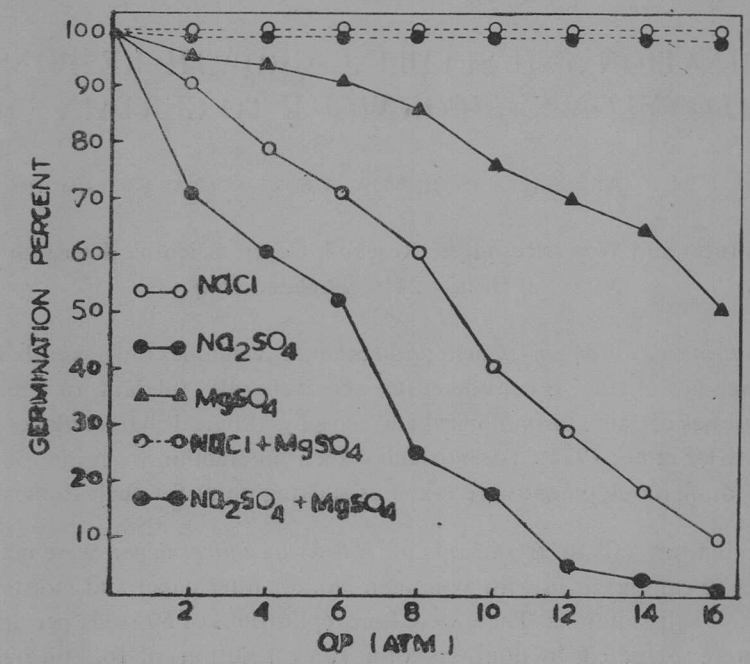

Fig. 1 Effects of certain salts and their combinations on seed germination of *Haloxylon salicornicum*

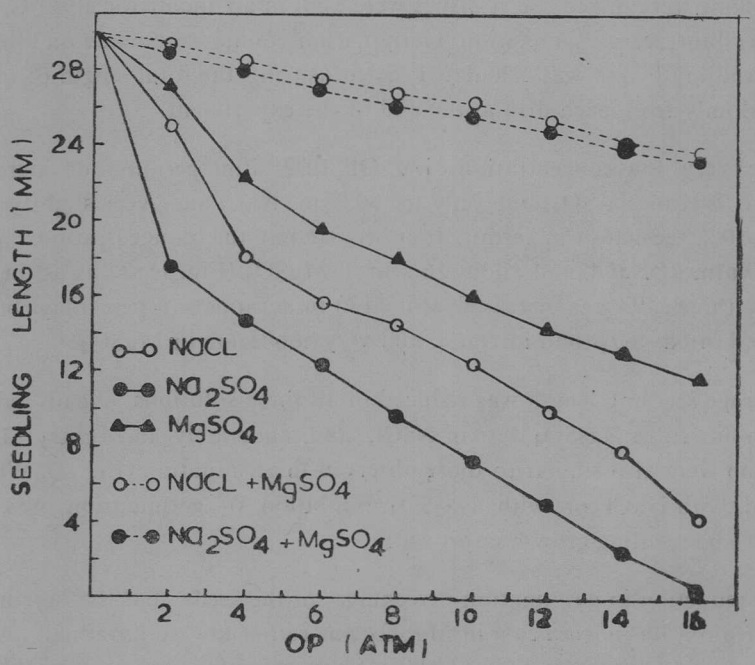

Fig. 2 Effects of certain salts and their combinations on seedling development of *Haloxylon salicornicum*

and in average seedling length in Na_2SO_4, on the other hand, is probably due to ionic or toxic effect of Na^+ that might accumulate inside the cells at lower concentrations (Greenway and Munns, 1980; Clarkson and Hanson, 1980,). The relatively less inhibitory action of NaCl is possibly due to certain beneficial effects of Cl^- and the ability of the plant to withstand higher concentrations of NaCl. As the concentrations increased, the osmotic effect became probably dominant and superimposed on the ionic effect in both solutions.

Na_2SO_4 reduced germination percentage and seedling growth more than NaCl. The situation is, however, reversed in the case of the highly salt sensitive *Artemisia herba-alba* (Compositae) also a native desert shrub grown in the same region. It appears, therefore, that the more halophytic shrubs are sensitive to Na_2SO_4.

The remarkable synergism between $MgSO_4$ and both NaCl and Na_2SO_4 is of particular interest and significance as well. Al-Jibury and Clor (1986) opined that Mg^{++} played a dominant role in the ionic cellular metabolic interactions. It could lead to a better compartmentalization of various ions in the cell, which in turn would lead to more favourable water balance and turgor pressure (Flowers et al., 1977; Greenway and Munns, 1980).

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