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Effects and Interactions of Certain Salts on Germination and Seedling Development of Artemisia herba-alba Asso.

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Abstract

Effects of NaCl, Na2 SO4 and Mg SO4 and their combinations, on germination and seedling development of Artemisia Herba - alba, were investigated. Na Cl caused greater inhibition of both processes even at thelowest concentration . This is evidently due to the toxicity of Na and Cl. The effects of Mg SO4 on the other hand, was slight and gradual, indicating that such effects were due to osmotic action . Mgso4 combined with NaCl and with Na2SO4 did not only overcome the inhibitory effects of the other two salts, but there occurred also a highly significant synergism in both processes as a result of such . combinations

Introduction

Artmisia herba - alba Asso - Compositae, is one of the most valuable range shrubs in Iraqi dry regions (Al-Ani et al, 1970, Clor et al, 1974, kaul and Al-Mufti, 1974, Thalen, 1979. Because of its high nutritive value and palatibility, are remarkable drought resistance , this shrub becomes most promising native species for the improvement of the deteriorated rangelands in Iraq. The characteristics of its seeds and seed germination have been well studied (Al- Ani et al, 1071 a , Al- Charchafchi and Jawad, 1982,Clor et al, 1974,) A. herba - alba is usually found abunduntly on fine textured, non - saline soils (sandy loams and sandy clay loams) (Kaul and Al- Mufti, 1974, Thalen, 1970). Some of the desert forage shrubs are hajophtes or semi - halophytes and from our own experience it seems that A. herba - Alba is very salt sensitive, and the present study wass designed to thest, specially, this characteristic.

Materials and Methods

Seeds of A. herba-alba require afeer- riqening of about 6 -12 months, after their germination percentage becomes high and they remain viable for many years, specially if stored in cold environment. The seedsused in the prsent experiment were collected in December 1993. After storage at room temperature for a year, these seeds were transferred to a refrigerator at about 6°c. The present work started in early 1995. The salt solutins were preqared by using Van't Hoff formula as described by pauling and pauling (1975), and all concentrations were represented by osmotic pressure. Twenty five seeds were placed in each 9 cm petri dish, lined with a alyer of whatman filter paper , and moistened with 5ml. of the given solution. In case of combina tions, equal volumes of each corressponding

concentrations were mixed and 5 ml. of the mixture was added as usual to each petri dish. Each experimental unit consisted of four dishes. Germination counts were made every second day. Seedling length was measured by taking 5 seedlings randomly from each dish at the end of the experiment on the 8th day. The following salts and their mixtures were used: NaCl, Na2SO4, MgSO4, NaCl+MgSO4, and Na2SO4+MgSO4.

Results and Discussion

1- Germination : Evidently A. herba-alba is highly sensitive to salinity. specially with respect to NaCl. Thus at the lowest concentration of the individual salts, i. e., 1 atm the final germination percentage dropped sharply to about 35% in NaCl as compared to 100% in water and to 95% and 92% in MgSO4 and in Na2SO4 respectively, Fig. 1. It is possible that at this low concentration the effect of Nacl was due to the accumulation of Na and Cl that took place probably at a higher rate reaching the so called " ion excess" level (Faton , 1942, clarkson and Hanson, 1980). It has been indicated that NaCl has high permeatincharacteristics, and that less tolerant plants might accumulate more Na and Cl than the tolerant ones (Bernstein and Hayward, 1958, Greenway and Munns, 1980). These results are almost identical to those of Al- jibury and Clor, (1986) in connection with the hgihly salinity sensitive bitter lentil. At the second higher conceotration, i, e., 2.5 atm the final germination percentage in Na Cl was rduced even more sharply to about 15% while that in Na2SO4 dropped to about 58% indicating that, in the absence of Cl, pehaps the level of Na was increasing inside the cells to the level of toxicity, but at a lower rate. In the case of MgSO4, on the other hand the effect was slight, and possibly because so4 is easily incorporated in to many biochemical reactions. while mg had no toxic effect. As the concentration of all the three salts reached 5 atm (Fig. 1) germination percentage in Nacl, and in Na2SO4 dropped to less than 5% while that in Mgso4 still remained close to 50%. We assume, therefore tha the effects of NaCl, and Na2SO4 to a lower extent are due to ion toxicity at lower concentrations, and due to the combination of ion toxicity and osmotic action at higher concentrations. The effect of Mgso4, on the other hand was dominantly due to osmotic action.

Recovery Test: The non- geminated seeds (where germination percentage was less than 50) were rinsed with distilled water and transferred to new petri dishes containing 5 ml of distilled water. Regular germination counts, wre made and expressed on percentage basis on the 8th, day. The results are shown in table. 1. These results confirm the assumptions made above and indicate agian that at the lowest concentration, Nacl had caused appreciable damage to the cells. As the concentrations ncreased in all cases beyond 7.5 atm the effects were mainly osmotic. One problem however. becomes hard to explain; and that is why the seed, soaked for 8 days in concentrated solutions, were not noticeably damaged (Table 1). One possibility is that the osmotic concentrations were so strong that the seeds had no chance for abtaining enough water, which probably reduced the uptake of some ones.

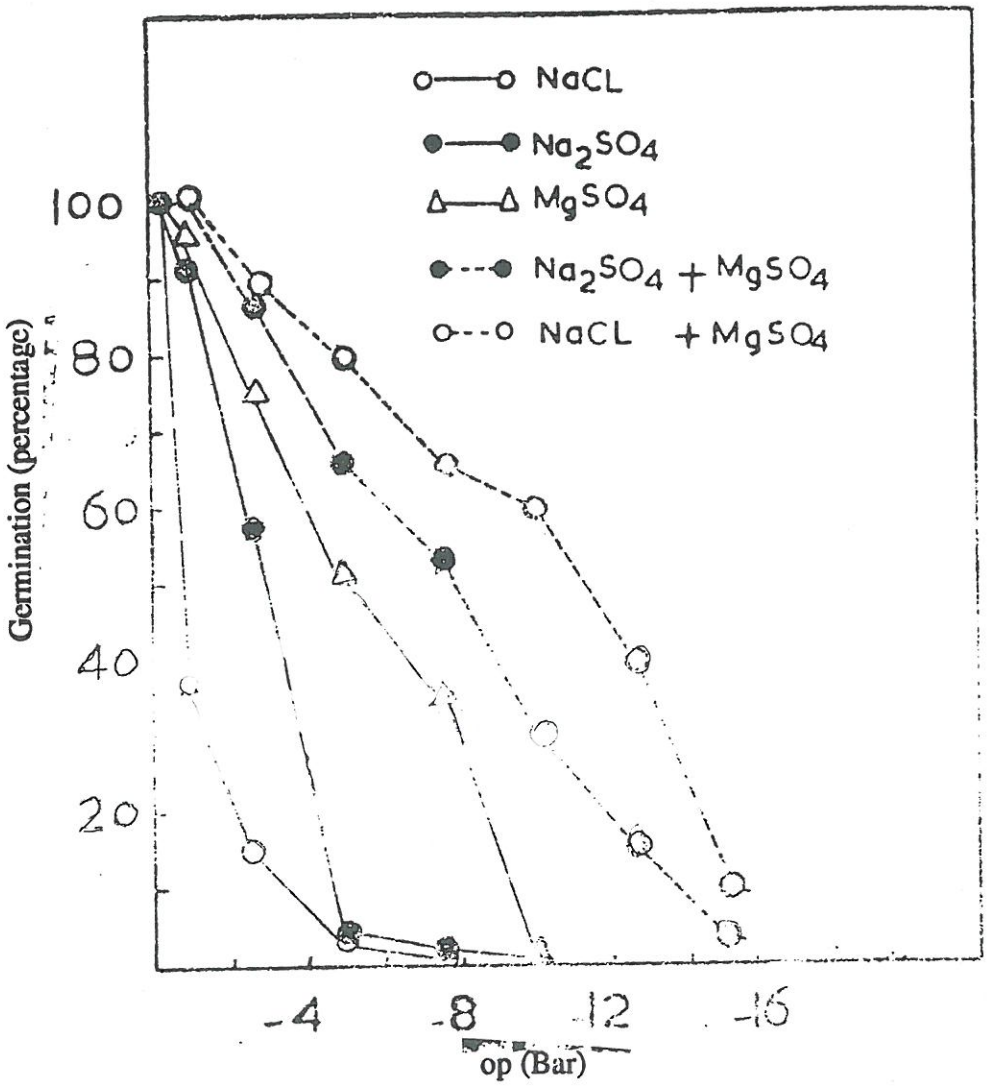

Fig. 1. Effects of certain salts and their combinations on seed germination of Arterisia herba - alba.

Synergism between MgSO4 and the other salts:

Effects on germination of MgSO4 with NaCl and with Na2SO4 are examined (Fig. 1), a remarkable synergism is observed in each case. It is possible that mg reduces somehow the uptake of Na or/ and causes its leakage out of the cells. Alternatively, Mg might cause better compartmentation of the different ions within the cells, which in turn leads to more favourable water balance (Flowars et al, 1977, Greenway abd nybbsm 1980).

Table 1. Recovery test. Non - germinated seeds (where germination percentages were less than 50%) were re - germinated in distilled water for 8 days. The figures for the second cycle of germination are calculated on percentage basis.

Concentration (first Cycle op (Bar).	Final germination percentage				
	NaCl	Na2SO4	MgSO4	NaCl+MgSO4	Na2SO4+MgSO4
1.0	43	-	-	-	-
2.5	69	-	-	-	-
5.0	77	69	-	-	-
7.5	80	85	85	-	-
10.0	82	90	84	71	-
12.5	85	85	83	78	77
15.0	80	64	88	78	77
20.0	60	65	88	80	78
25.0	38	52	74	76	81
30.0	28	55	72	75	75

2- Seedling Development: Although the effects of the individual salts on seedling development followed in general the same pattern as that on germination (Fig.2), yet the inhibitory effects of these salts on seedling elongation were more pronounced; and the effect of MgSO4 was not much different. It is natural that the process of germination differs from that of seedling development where many active processes such as cell division, cell elongation, and differentiation, that might become effected differently and more directly by differentions. The same explanation, therfore is assumed here also, specially with respect of toixe effects of NaCl at lower concentration, and the osmotic effects of all the salts at the higher concentrations.

Synergism : The synergistic action or, seedling development between MgSO4 and the other two sales is also remarkable and follows the same pattern (Fig.2). The explanation, however, is the same that was offered earlier, mainly with respect to the role of Mg and S04.

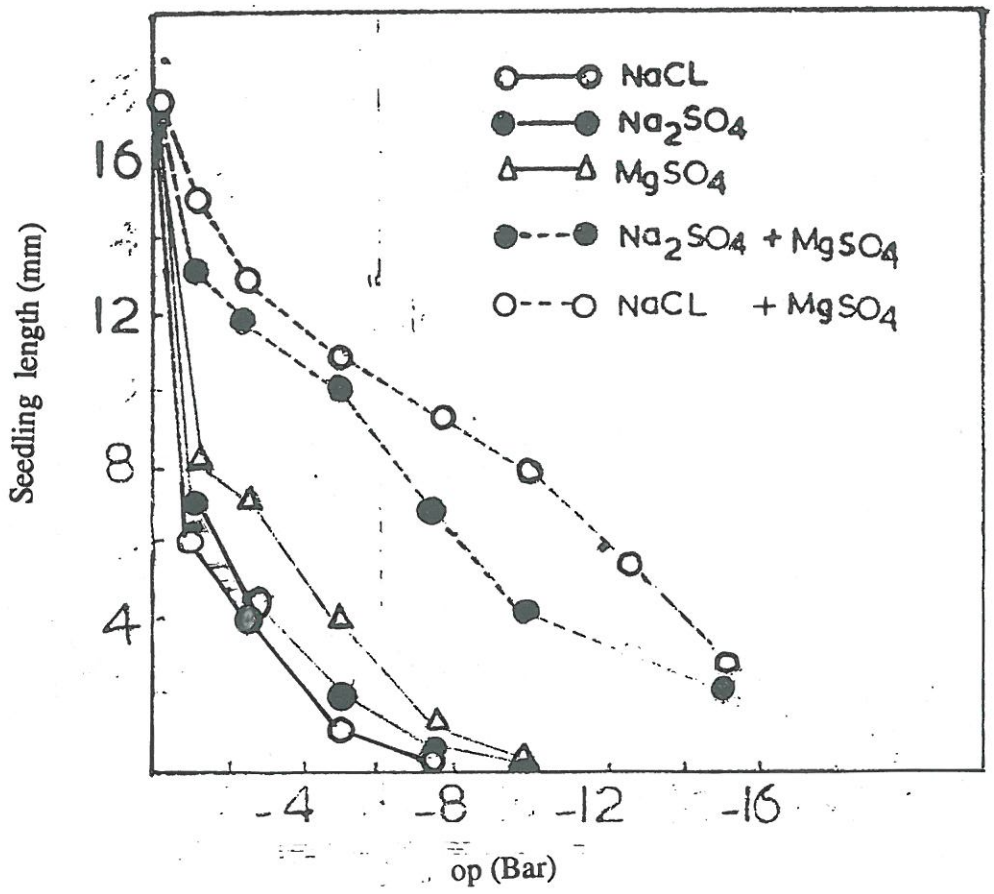

Fig.2. Effects of certain salts and their combinations on seedling development of Artemisia herba-

Al- Ani, T.A., M. M. Al- Mufti, N. A. Ouda, R. N. Kaul, and D. C. P. Thalen. 1970. Range Resources I. Range cover thypes of western and southern desert. Tech. Rep. no. 16. Inst. for Appl. Res. on natural resources, Abu - Ghraib, Iraq. 8 pp.

Al- Ani, T. A., M. M. Al-Mufti, and F.M. R. Al-charchafchi, 1971a. Range Resources of Iraq IV. Germinability of some native range species. of Iraq. Tech. Rep. no. 30. Inst. for Appl. Res. on natural resources, Abu-Ghraib, Iraq. 14 pp.

Al- Ani, T. A., M. M. Al-Mufti, F. M. R. Al-charchafchi, R. N. Kaul, and D. C. P. Thalen, 1971b. Studies or, nutrient composition of some range species. Iraq J. Agric. Sci. 6:3-19.

Al- Charchafchi, F. M. R. and M. Jawad. 1982. Effect of light, temperature, storage conditions and seed age on germination and growth of desert seeds. J. of Agric. and Water Resources Res. Vol. 1, 43-68.

Al-Jibury, L. K., M. A. Clor, and D. Talabany. 1986. Effects of certain salts and their combinations on germination and seedling development of Securigera securidaca. Arab Gulf J. Scient. Rds. 4(1) : 5 -12.

Bernstein, L. and H. E. Hayward. 1958. Physiology of salt tolerance. Ann. Rev. Plant Physiol. 9:25 -46.

Clarkson, D. T. and J, B. Hanson. 1980. The mineral nutrition of higher plants. Ann. Rev. Plant. Physiol. 31 : 239 -298.

Clor, M. A., T. A. Al- Ani, and F. M. Al-chatchafchi. 1974. Germination, storage conditions, and after-ripening of the seeds of Artemisia herba-alba. Tech. Rep. no. 76. Inst. for Appl. Res. on natural resourceaAbu - Ghraib, Iraq. 17 pp.es.

Eaton, F. MN. 1942. Toxicity and accumulation of chloride and sulfate salts. J. Agric. Res. 64 :357- 399.

Flowars, T. J., P. E. Troke and A. R. Yeo. 1977. The mechanisons of salt Tolerance in Halophytes. Amm. Rev. Plant physiol . 28: 89- 121.

Greenway , H. and R. Munns. 1980. Mechanisms of salt toerance in nonha- Ann. Rev, Plant. Physio. 31:149-190.

Kaul, R. N., and M. M. Al- Mufti. 1974. Range Resources of Iraq. XI.A. Preliminary ecological appraisal of Artemisia herba-alba vegetation. Tech. Rep. No. 55. Inst. for Appl. Res. on natural resources. Abu- Ghraib, Iraq. 29. pp.

Pauling, L. and P. Pauling. 1975. Chemistry. Freeman and Company. San Francisco. U. S. A. 767 p.

Thalen, D. C. P. 1979. Ecology and Utilization of Desert shrub Rangelands in Iraq. Dr. W Junk B. V. publishers. The Haque. 428 p.

التأثير المتداخل لبعض الاملاح على انبات ونمو بادرات نبات الشيح

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الملخص :

لقد تم دراسة التأثير المتداخل لبعض الاملاح (كلوريد الصوديوم وسلفات الصوديوم وسلفات المغنيسيوم) على انبات ونمو بادرات نبات الشيح

اظهرت نتائج البحث بان ملح الطعام له تأثيرا مثبطا على انبات ونمو بادرات نبات الشيح حتى ولو كانت الذاكرة المستخدمة في التجربة واطئة ، في حين ان ملح سلفات المغنيسيوم له تأثيرا تدريجيا على انبات ونمو بادرات نبات الشيح .

ان التداخل بين سلفات المغنيسيوم وكلوريد الصوديوم أو مع سلفات الصوديوم يؤدي الى تقليل الفعل المثبط لكلوريد الصوديوم ، وكذلك له تأثيرا متلازما حيث يؤدي الى زيادة في انبات ونمو بادرات نبات الشيح .