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EFFECT OF NACL ON SEED GERMINATION AND SEEDLING DEVELOPMENT OF BARLEY (HORDEUM VULGARE L)

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Abstract:-
Laboratory experiments were conducted to investigate the effect of different concentrations (0 ،20 ،40 ،75 90 and 150) mM of NaCl on seed germination and seedling development of barley (Hordeum vulgare L) Rihane 03. The results showed that the germination percentage, root and shoot lengths and fresh and dry weights, Chlorophyll and carotene concentration decreased in plant varieties with increase in salt level especially at 90,150 mM. However, variety Rihane 03 showed response at all salinity levels.

Key words:- *Barley, salinity, seed germination, seedling Development.*

INTRODUCTION

Barley (*Hordeum vulgare* L.) belongs to family Poaceae (Graminae) is widely grown fourth most important world cereal following maize, wheat and rice. It is the main cereal in several dry areas of the Middle East and North Africa and is important for the livelihood of the many poor farmers. It is a very important supply of feed and forage for livestock, and of food for humans [1]. Salinity is one of the major environmental factors that decrease crop productivity and threatens the global food balance. Some of the most serious soil salinity problems occur in arid and semi-arid regions of the world. Out these regions, it's affects agriculture in coastal areas and in areas affected by irrigation water of low quality. A soil is qualified as "saline" when its electrical conductivity is about 4 dS/m (≈ 40 mM ≈ 2.38 g/L of NaCl) or higher values, with an approximate osmotic pressure of 0.2 MPa [2]. With respect to more than 60 million hectare from the world regions (25%) of regions in all over the world) face with salinity problem, doing of project in along with decreasing of salt soil Damage is necessary [3]. Soil salinity may influence the germination of seeds either by creating an osmotic potential external to the seed preventing water uptake, or the toxic effect of Na+ and Cl- ions on germination seed. Salt and osmotic stresses are responsible for both inhibition or delayed seed germination and seedling establishment. Seed germination, seedling emergence and early survival are particularly sensitive to substrate salinity. Seedling are the most vulnerable stage in the life cycle of plants and germination determines when and where seedling growth begins Barley [4]. Salinity cause reduction in osmotic potential thereby causing a decrease in plant growth. Salt ions prevent water absorption by roots due to more negative water, potentials of soil solution and plants are subjected to a water deficit [5]. Seed germination and seedling growth are major Salinity may cause significant reductions in germination leading to reduced crop yields. Salt tolerance at germination stage is important factor. High concentration of salts have detrimental effects on germination of seeds [3]. Salinisation of agricultural soils is one of the major processes resulting in low crop productivity. One of the possible management options to the salinity problem, namely Saline Agriculture, aims at utilization (rather than reclamation) of saltaffected land to achieve economic crop production by growing suitable salt tolerant plants that provide a range of choices depending on the environmental conditions [1]. (*Hordeum vulgare* L.) is rated as salt tolerant among the crop plants. NaCl toxicity is largely attributed to the effects of Na+ and only rarely to those of Cl. Under saline field conditions, the plants may be subjected to different salt levels and ionic stresses. Unfortunately in Libya, there is a considerable area of land concerned by salinity. The objective of the present study was to investigate the effects of different concentrations of NaCl solution on seed germination and seedling Development of *barley* (*Hordeum vulgare* L) *Rihane* 03.

MATERIALS AND METHODS

The study was conducted in the Environment Lab Botany Department, Environment Lab Faculty Arts and Science-Tocra, Unviersty of Benghazy-Libya.

Plant materials*:*

The seeds *barley* cv. *Rihane 03* Lignee *527* NK 1272, 4 was obtained from Crops Department, Faculty Agricultural**,** Omar Al-mukhtar University, El-Beida-Libya.

Experimental design and treatments:

The study included two stages: First by planting seeds in petri dishes to investigate the effect different concentrations (0, 20, 40, 75, 90 nnd 150 mM of NaCl on seed germination and speed ratio of *barley (Hordeum vulgare* L) *Rihane 03*. second stage by using the pots sand soil. to study the content of chlorophyll and carotene.

First experiment

The germination of barley seeds is achieved in Petri dishes (10 seeds /dishes and 3dishes by treatment and accession). Each Petri dishes was covered with two Whatman No. 1 filter papers moistened with distilled water and were placed in an incubator**.** Under controlled conditions (23±1°C in dark). Sex levels of NaCl concentrations have been tested: (0, 20, 40, 75, 90 and 150) mM was applied in each petri dish of respective concentration. The respective salt solution of 10 ml was added to each petri dish Picture 1. The seedling were grown in the pots (sand soil) for Twenty days to study the content of chlorophyll and carotene Picture 2**.**

Measurements

Seeds were considered as being germinated when the radicle had protruded through the seed coat. The germination percentage was determined by counting the number of geminated seeds. The daily record of germinated seed was taken up to seven days from setting up of the test. After final count, germination percentage (GP) was calculated by using the GP = (Number of total germinated seeds /Number of total germinated seeds) x100

The germination rate GR: is the number of grains that germinate for each 24 h during seven days and germination (Number of total germinated seeds / Number of Days) Picture 1.

Shoot and root length (cm) was recorded at twenty days after planting. The uprooted seedlings were washed with tap water and excess water was soaked with tissue paper. Shoot and root length was measured with a ruler Picture 2. Fresh weights and Dry weight (mg) were recorded by an electronic balance. Dry weight of shoot and root was measured after keeping fresh plant sample in an oven at 60 C^o for 48 hours.

Chlorophyll and carotene was determined using the method of Arnon [1]. The contents of carotenoids (Car) and chlorophyll (Chl) a and b were extracted using acetone, and spectrophotometeric determination at 440, 645 and 663 nm of each sample was done three times. The calculations were Chl a = 12.7×OD663-2.69×OD645; Chl b

=22.9×OD6454.86×OD663 and Car = 4.7×OD440-0.27×(20.2×OD645+8.02×OD663).

Statistical analysis

The data were subjected to statistical analysis and significance of differences between treatments was determined by *ANOVA* WON –WAY, using Minitab version 16, The Dunnett comparison test Treatment of chloride and Control.

RESULTS AND DISCUSSION

The results revealed that several studied traits of *Barly* were significantly influenced by the salt. It was found that with increase in salinity. Final seeds germination "G%" were affected by salinity compared to the control (Picture 1). Decrease was expressed with the increase of NaCl concentrations (Table 1). The results were more pronounced at higher salinitylevels 90 and 150 mM. The minimum percentage germination (88.88 %) was shown by150 mM. The germination rate decrease was expressed with the increase of salt concentrations (Table 2). The minimum germination rate (2.88 %) was shown by150 mM.

Roots and shoots lengths: were decreased as NaCl concentrations were increased (Picture 2, Table 3). Moreover the fresh weights and Dry weight were significantly reduced under salt stress (Table 4). For both roots and shoots the maximum lengths value were expressed in the control conditions and the smallest with the highest NaCl concentration. Under salt stress conditions, the lowest mean lengths value for roots (13.77 ±3.70 and 12.23 ±2.63 cm) and shoots (10.90±.44and 8.80±2.06 cm) were showed with 90 and 150 Mm NaCl concentration respectively.

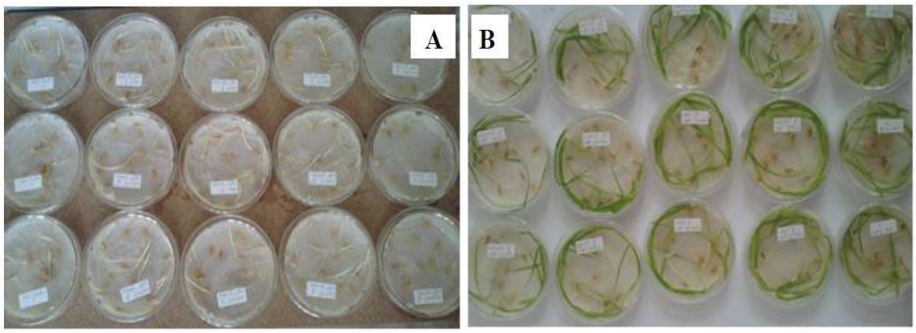
Chlorophyll and carotene were decreased with increasing NaCl concentration, increased significantly, the effects were much more pronounced under high NaCl on centration (Table 5; The lowest mean contents of chlorophyll(8.92±0.02 and 8.39±0.12) and carotene 0.225±0.03 and 0.188±0.001) were showed with 90 and 150 Mm NaCl concentration respectively.

Table 1: Effect of NaCl Mm on final germination percentage, germination rate and chlorophyll and carotene content of *barley*.

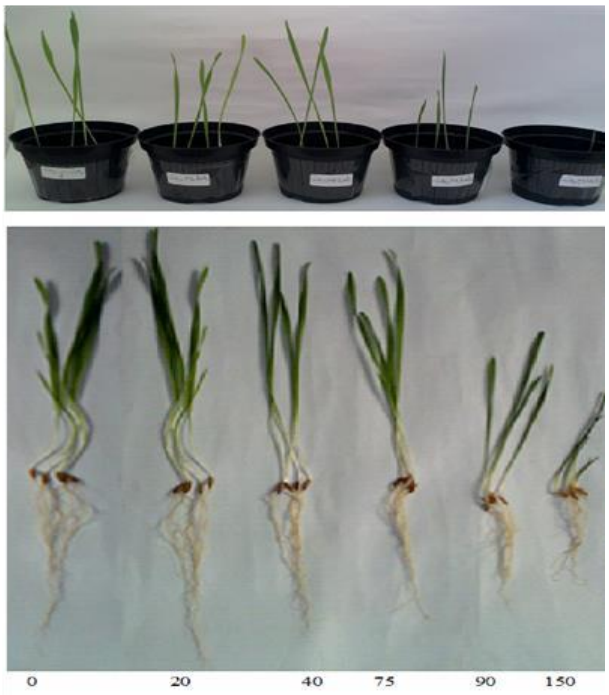
NaCl Mm	Germination% (GP)	Germination rate(GR) seed/day	chlorophyll content mg/g	carotene content mg/g.
0	100	0.05±3.33	0.001 ±10.72	**0.004 ± 0.255**
20	100	0.03±3.33	0.002 ±9.92	**0.003 ±0.248**
40	0.001±94.44	0.03±3.22	0.002±10.55	**0.002 ±0.241**
75	0.002±91.66	0.05 ±3	0.001±10.03	**0.003±0.231**
90	0.001 ±91.66	0.04 ±3	0.002 ±8.72	**0.003±0.225**
150	0.002±88.88	0.05±2.88	0.002 ±8.39	**0.002±0.188**

Table 2: Effect of NaCl Mm on, shoots and roots lengths, Shoots fresh and dry weight and roots fresh and dry weight of barley

NaCl Mm	shoots length (cm)	Roots length (cm)	Shoots fresh weight (mg)	Roots fresh weight (mg)	Shoots Dry weight (mg)	Roots Dry weight (mg)
0	± 13.81 3.12	4.35 ± 17.29	0.16 ± 112.40	± 138.70 0.04	0.002 ± 7.10	**± 12.00 0.003**
20	± 13.29 3.63	4.52 ± 16.10	0.03 ± 104.30	± 144.50 0.16	0.003 ± 7.60	**± 12.50 0.003**
40	± 12.50 1.87	4.24 ± 16.19	0.21 ± 105.10	± 169.40 0.04	0.002 ± 7.20	**± 12.00 0.002**
75	± 12.78 2.73	3.70 ± 16.78	0.02 ± 88.00	± 143.50 0.04	0.002 ± 6.90	**± 12.06 0.004**
90	± 10.90 2.44	3.70 ± 13.77	0.01 ± 71.50	± 117.6 0.03	0.001 ± 6.50	**± 11.80 0.003**
150	2.06 ± 8.80	2.63 ± 12.23	0.01 ± 51.50	± 116.30 0.02	0.001 ± 4.40	**± 11.90 0.003**



Picture 1: Germination of the seeds at the 7th day. Emergence of the shoot and growth of the roots"A" and seedling development of Barley Rihane 03 according to the salt concentration in the watering and free-s



Picture 2: Effect of NaCl effect of concentrations on the lengths of the roots and the shoots of Barley Rihane 03

Analysis of variance of data presented in showed that salt stress had adverse effect on germination and seedling growth of *barley*, was *P- Value*=0.00. The increase of salt concentration had a negative effect on germination for which the rate decrease, this result has also been reported by several authors Naseer *et al.* [7], Movafegh [8], Yousofinia [9] and Y. El Goumi[2]. This decrease might be caused by the high osmotic pressure of the solutions slowing down the intake of necessary water for germination and by the toxic effect of high salt concentration on embryo, that high salt concentration inhibits the mobilization of the seed reserves and the growth of embryonic axis [2].

By the same way the roots and the shoots lengths decreased, when salt concentration was increased. These results, in concordance with those of Movafegh [8], Faisalabad [10], El Goumi [2], and Ben Khaled [11]. At first, the salt stress induces rapid osmotic changes which affect the roots growth within a few minutes, and therefore the disruption of the shoots development likewise, toxic ions spread toward the leaves and accumulated there; this can lead to metabolic dysfunction and toxicity. Furthermore, salt stress affects the hormonal equilibrium (cytokinins/auxins) which causes trouble in shoot growth, impairment, and changes in biomass partitioning. Y. El Goumi. [2].

The fresh and dry weight decreased largely by the effect of salt stress; this decrease was also related to cultivars performances and it was important in the salt. The chlorophyll and carotene content was significantly reduced by the increase of NaCl concentration; similar results were reported too by Movafegh [8], Yousofinia [9] and Rahdari [12].

CONCLUSION

It is clear that all the studied traits were negatively affected by the increase of salt concentration. Germination and Germination rate were affected in the early stage of plant growth; therefore this impact can cause damage in crops production. This work shows that the salt tolerance index can be used as salt tolerance criterion to choose tolerant cultivars in cereals. *Rihan* was showed to be a salt-tolerant cultivar; while. Therefore, the farmers should be advised to use Tammela cultivar to be cultivated in salty soils.

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