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The Effects of Salinity and B Toxicity on Some Soil and Plant Parameters

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Abstract Ensuring the continuity of species that can grow naturally and increasing their availability without causing an economic burden in soils with salinity and boron toxicity has become an increasingly important worldwide issue. For this purpose, the effects of the *Limonium gmelinii* treated with NaCl, Na_2SO_4 to be grown on saline and boron toxicity areas with their respective plant and salt content, soil reaction and exchangeable Ca, Mg, K and N contents were investigated. The effect of the treatments on the increase of EC content in soil and plant was found to be significant. It also had an effect on the increase in the pH value of the soil. The effect of the decrease in the exchangeable Mg content in the soil and the increase in the Mg content in the plant was found to be significant. Moreover, while its effect on the decrease in Ca content in the soil was significant, it did not affect the Ca content in the plant. Its effect on the decrease in K content in the soil was found to be significant, but it did not affect the K content in the plant. Furthermore, the effect of treatments on N content in soil was found to be significant. It was observed that *Limonium gmelinii* can be grown in areas with NaCl, Na_2SO_4 and B toxicity without significant damage. Economic income can be obtained by determining the different post-harvest uses of the *Limonium gmelinii* plant, which is tolerant to such problem areas. Dried flowers can be used for decoration. In addition to the economic income to be obtained by growing it on unused and idle lands due to salinity and B toxicity problems, it can also offer a beautiful landscape with its green leaves and blue flowers in summer and winter seasons.

Keywords Salinity, Boron Toxicity, Halophyte Plant, *Limonium Gmelinii*

1. Introduction

Soil degradation is one of the most important problems that can be encountered in future food demand. A quarter of the earth is covered with land. However, very few of these areas are suitable for agricultural production due to many natural constraints such as mountainous, desert and barren areas [26].

According to Gupta [13], The problem of salinization has been encountered in Mesopotamia and the coastal desert of Peru for several millennia. In the USA, the Colorado Delta is one of the first areas to suffer from salinization problems. Besides, arid regions of India, West Asian countries, Peru, Argentina, Northern Brazil, Mexico, some parts of West African countries, Sudan, Somalia, Ethiopia, Kenya, Tanzania and parts of South Africa, Central and West Asia, Israel, Pakistan, Tar Desert, Northern Chile, Syria, Iraq, Iran and Jordan in the Middle East are other countries and regions that suffer from salinization in the world.

Considering the situation in Turkey, it is known that there is a salinity problem or threat on approximately 4 million hectares of land [21]. Barren lands are equal to 2% of Turkey's surface area, 5.48% of the total cultivated agricultural land, and 17% of the 8.5 million hectares of economically irrigable land. In addition, 74.2% of the total barren land consists of saline, 25.5% saline-alkaline and

0.5% alkaline soils [23].

Çarşamba Plain in Northern Anatolia, Tarsus Plain and some parts of Çukurova in Southern Anatolia, Salt Lake and Çumra Plain in Central Anatolia, Iğdır Plain in Eastern Anatolia, Menemen, Manisa, Salihli, Alaşehir Plains in Western Anatolia, Aşağı Kırıklar Region in Büyük Menderes Basin, Gödemerli Plain in Denizli-Sarayköy Irrigation Basin, some parts of Meriç Basin in Thrace Region are among the areas where salinity problem is seen [2]. With the start of dam irrigation, salinity has become a problem in the agricultural lands of Şanlıurfa Center, Harran and Akçakale. In the Harran Plain, there is a salinity problem on approximately 15,000 hectares [1]. Moreover, the total surface area of Konya Closed Basin is 4.329.969 hectares, 509.382 hectares of which have salinity and sodium problems. Moreover, the Lower Seyhan Plain has a width of 210,000 ha and there is a salinity problem in 36,434 hectares of areas with poor drainage [19]. On the other hand, 22.04% of the Develi Plain lands have moderate salinity problems, and 14.94% have very high salinity (ECe>16dS/m) areas. In these areas, it is not possible to make economic production. Only halophyte plants are able to survive [15]. Iğdır Plain is also located in the semi-arid climate zone, and 1/3 of the total usable area has been affected by salinization. Only 24,194 hectares of the plain can be cultivated [24].

Salinity is due to the concentration of dissolved mineral salts present in the waters or soils. Dissolved mineral salts include mainly soluble substances including Na, Ca, Mg and K cations and Cl, SO_4, HCO_3, CO_3 and NO_3 anions [15]. The increase in the salt concentration in the soil causes an increase in the osmotic pressure, making it difficult for the plant to take water from the soil, disrupting the structure of the soil, slowing the plant growth and even causing it to come to a standstill [8].

In saline and sodic soils, B levels can also rise to levels that can be toxic to plants [20]. The low boron levels in basic soils caused by the adsorbation of clay minerals are generally due to the boron levels in irrigation water. The removal of the boron from the soil by washing is negligible. Therefore, boron poisoning is more likely than boron deficiency, especially in salty and sodic (soda, sodium, alkaline) soils [3]. Boron toxicity is a nutritional problem that limits plant cultivation in agricultural soils of arid and semi-arid regions around the world [7].

Turkey has the largest B deposits in the world and Afyon, Aksaray, Balıkesir, Bigadiç, Burdur, Kemalpaşa, Eskişehir-Kırka, Germencik-Ömerli, Iğdır, Karasaz, Kayseri, Konya-Ereğli, Kütahya-Emet, Manyas, Susurluk/Demirkapı-Sultançayır, Salihli and Yüksekova regions are known to have toxic levels of B. In addition, the Western Anatolia Region contains 61% of the world's B reserves [25].

Salinity and B toxicity stand out as a negative factor threatening our future for Turkey as well as all over the world. It is very important to determine the plants that can adapt and survive in areas with salinity and B toxicity, and to define their characteristics. After harvesting from such plants, economic gains can be obtained by determining different usage areas. In addition, it can be determined whether the plants that adapt to these adverse conditions can be used for breeding purposes, and it can be ensured that the unused areas are brought into agriculture. Thus, they will not only meet the food needs of the increasing population, but will also contribute to the country's economy by being used in other areas of use.

Based on this, it was determined that perennial, herbaceous, height 20-60 cm, flowering period is July-August, non-endemic, grown in coastal and inland salty places, family Plumbaginaceae, genus *Limonium* MILLER, taxon *Limonium gmelinii* (Willd) O. KUNTZE, *Limonium gmelinii*, draws attention as an important ornamental plant. There were no previous studies on the subject of *Limonium gmelinii* plant. As a result of the study, taking into account the data obtained, the recognition and dissemination of *Limonium gmelinii* plant, which can store the soil in its leaves or remove it with special glands, determine the salt ion status and activity it has taken from the soil, and according to the result of the study, it is applied to salty soils with B toxicity. Presenting it as an alternative halophyte ornamental plant, contributing to the evaluation of this plant, which can grow spontaneously in nature in salty regions, in the field of agriculture, shedding light on the studies that can be done to determine other usage areas, encouraging research on the subject constitute the original value and purpose of the study.

2. Materials and Methods

Table 1. Some characteristics of the experiment soil

Soil	Unit	Analysis result
pH	--	7.6
EC	dS/m	0.44
Organic matter	%	0.92
$CaCO_3$	%	48.69
Field capacity	%	26.50
Total N	%	0.095
Useful K for Plant	kg K_2O/da	29.9
Extractable Ca	kg CaO/da	1540.0
Extractable Mg	kg MgO/da	58.7

The experiment was set up as 1 Plant x 1 Soil x 3 Subjects (NaCl, Na_2SO_4, B) x 4 Doses x 5 Replications according to the design of the randomized block. The study was carried out in the modern glass greenhouse of Akdeniz University, Faculty of Agriculture. After being grown for 72 days in plastic viols containing a peat-perlite mixture, the seeds were transferred to 60 black plastic pots of 23 liters. The pots were filled with silty loamy (48.7% silt, 34.5% sand, 16.8% clay) soils taken from 0-20 cm depth from the Tehnelli series soil surface, located within the borders of Akdeniz University Aksu Dairies Research and Application Station.

Some values of the experiment soil are given in Table 1. In the study, *Limonium gmelinii* plant was used. It can grow in soils with pH of 6.1-6.5 (slightly acidic), 6.6-7.5 (neutral), and 7.6-7.8 (slightly alkaline) [4]. The typical habitats of the plant are salty, and it is frequently seen in marshy meadows, salty areas, and abandoned areas [14].

Initially, 4 plants were planted in the pots. Then, thinning was done and 3 plants were left in each pot. Before starting the applied irrigations, EC and pH measurements were conducted. The pH was found to be 6.8, and the EC value of the control irrigation water was determined as 0.69 mS/cm (less salty). Moreover, while EC value for NaCl treatments was 6.4 mS/cm (saline), 12.04 mS/cm (high saline), and 16.80 mS/cm (very high saline), it was 10.08 mS/cm (high saline), 17.84 mS/cm (very high saline), and 24 mS/cm (very high saline) for Na_2SO_4 treatments. After the plants were transferred to the pots, they were irrigated daily for a 2.5-month adaptation period so that they could adapt to the greenhouse environment. During the experiment, irrigation applications were made by considering approximately 70% of the field capacity. Irrigations were applied as 0.5 liters 9 times in 10-day periods throughout the development period. During the summer period, daily irrigations were continued, and with the decrease in temperatures, irrigation was continued every two days.

Different compounds and different concentrations of these compounds (0, 50, 100, 150 mM for NaCl; 0.50, 100, 150 mM for Na_2SO_4; 0.5, 10, 15 mg/lt for B) were used as the experiment factor. The values used were determined by considering similar literature studies and limit values. Since the form of boron mineral that can be taken by plants is Boric acid (H_3BO_3), B doses were applied in the form of H_3BO_3 in the study.

Fresh leaf EC values were determined after the 2nd and 3rd leaves were taken from each of the three plants in a pot, and the leaf discs were kept in de-ionized water for 4 hours [9,11]. The EC values of the dry leaves were obtained by measuring the EC value of the solution again after the leaf discs, whose fresh leaf EC values were determined, were kept at 100^{o}C for 10 minutes [9,11]. The membrane damage index was calculated using the formula (Lt – Lc / 1-Lc) x 100. The Lt used in the calculation is the EC value of the leaf under salinity and drought stress before autoclaving / EC after autoclaving. Moreover, the Lc is the EC values of the control leaf before autoclaving / EC values after autoclaving.

For the plant, K, Ca, and Mg values were determined by the wet digestion-ICP method [18]. In soil analysis, total N values were found by the Kjeldahl method [17]. Extractable K, Ca, and Mg values were determined by reading the ICP method in the extract obtained by saturating the soil with ammonium acetate [22]. Soil texture was determined by the hydrometer method [6]. Soil pH was measured with a pH-meter in a 1:2.5 soil:water mixture and soil electrical conductivity (EC) was measured with an EC-meter in a 1:2.5 soil:water mixture [16]. Organic matter was found according to the Modified Walkley-Black method [5]. The percentage of lime ($CaCO_3$) in soil was determined by the Scheibler calcimeter [10]. Field capacity was determined by using soil samples with retained water content under 1/3 atmospheric pressure using a pressure membrane instrument [5].

At the end of the experiment, descriptive statistics are presented with the mean. Normality assumption was evaluated with the Shapiro Wilks test. In the analysis of the difference between the numerical data of more than two groups, one-way analysis of variance (ANOVA) was performed for the normally distributed data. Duncan's test was used to determine the significance levels of the differences between the treatments. Kruskal Wallis test was used in the analysis of data that did not show a normal distribution. As a result of the significant difference, Bonferroni-Dunn Procedure was applied in pairwise comparisons. All statistical calculations were made on the computer using the SAS 9.4 program. Besides, $p<0.05$ was considered statistically significant.

3. Results and Discussion

Dominant compounds that cause salt stress in soils are NaCl and Na_2SO_4. B toxicity can also be seen in such salty and sodic soils. For this reason, different concentrations of NaCl, Na_2SO_4 and B compounds were applied in the study and their effects on some soil and plant parameters were observed. For this purpose, 0, 5, 50, 100, 150 mM concentrations of NaCl and Na_2SO_4 and 0, 5, 10, 15 mg/lt concentrations of B as boric acid (H_3BO_3) were used. Since boron is taken up by plants as boric acid $B(OH)_3$ mainly by passive absorption, boric acid has been used in applications.

3.1. pH Values of the Soil

The effect of NaCl treatments on soil pH values was $p<0.05$ and a statistical difference was found. Since pH values were determined in the range of 7.62-7.70, it was evaluated in the medium alkaline class. The effect of B treatments was $p<0.05$ and there was a statistical difference. Since the pH values of B treatments were determined as 7.70-7.80, it was classified as medium alkaline. It was observed that the degree of alkalinity in general increased with B treatments. Considering the effect of Na_2SO_4 treatments on soil pH values, it was found to be significant with $p<0.05$. Values were in the range of 7.82-8.04 and evaluated in the medium alkaline class. It was understood that the degree of alkalinity increases with the increase in dose with treatments, compared with the control. The effect of all treatments on pH values was $p<0.05$ and a statistical difference was found. When Figure 1 is evaluated, it was understood that the pH value increased more with Na_2SO_4 treatments in general, and all of the samples were evaluated as medium alkaline.

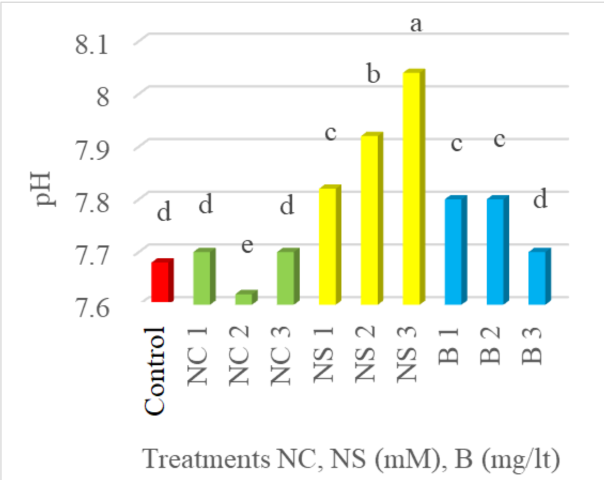

Figure 1. The effect of treatments on soil pH values (NC: NaCl, NS: $NaSO_4$)

3.2. EC Values of the Soil

The effect of NaCl treatments on soil EC values was found to be significant, with $p<0.05$. EC values also increased with the increase in treatment doses. The effect of B treatments was $p>0.05$ and it was not found significant. A statistical difference was found because the effect of Na_2SO_4 treatments was $p<0.05$. Furthermore, with the increase in the treatment doses, the EC values increased. Considering the effect of all treatments on EC values, it was found to be significant since $p<0.05$.

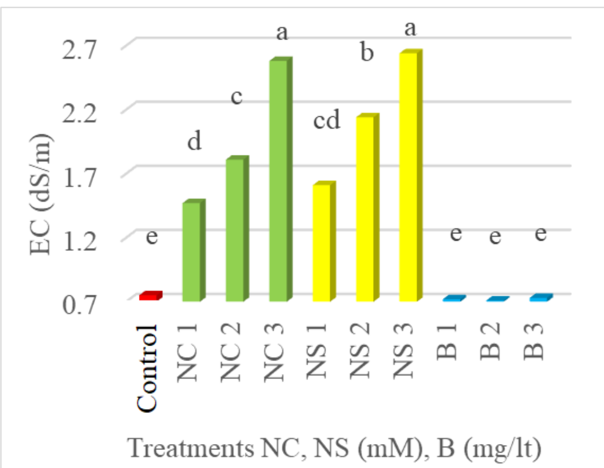

Figure 2. Effect of treatments on soil EC values

When a general evaluation is made in Figure 2, it is understood that soil EC values increased more with Na_2SO_4 treatments. In NaCl and Na_2SO_4 treatments, EC values increased with increase in the dose. Moreover, it was observed that B treatments did not have much effect. Besides, the highest EC values were determined in 150 mM Na_2SO_4 treatment.

3.3. EC Values of Fresh Leaves

The effect of NaCl treatments on plant fresh leaf EC values was $p<0.05$, and a statistical difference was found. Compared to the control, the EC values of fresh leaves were determined at the highest level in 100 mM NaCl treatment. It is understood that treatments at a dose of 150 mM reduced the EC value by removing excess salt from the plant. The effect of B treatments on fresh leaf EC values was found to be significant since $p<0.05$. EC values increased with increasing doses. The effect of Na_2SO_4 treatments on fresh leaf EC values was $p<0.05$ and it was found to be statistically significant.

Since the effect of all treatments on fresh leaf EC values was $p<0.05$, a statistical difference was found. When Figure 3 is evaluated in general, a sequence such as Na_2SO_4>NaCl>B>Control was determined. In the 100 mM treatments of NaCl and Na_2SO_4, the EC values were maximized, while at 150 mM there was a decrease with the removal of excess salt from the leaf. The plant *Limonium gmelinii* continued to grow despite the salinity created in the soil. No decrease was detected in leaf number and plant biomass.

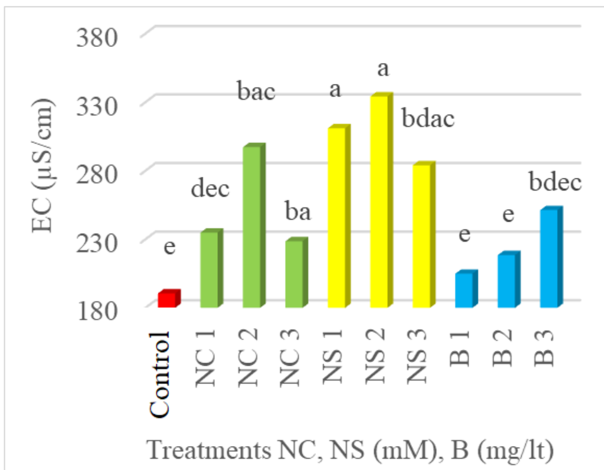

Figure 3. The effect of treatments on fresh leaf EC values

3.4. EC Values of Dry Leaves

The effect of NaCl treatments on dry leaf EC values was $p>0.05$, and there was no statistical difference. While the highest value was obtained at 100 mM, the values decreased at 150 mM by removing the accumulated salt from the plant. The effect of B treatments was found to be significant, with $p<0.05$. The values increased with increasing doses. The effect of Na_2SO_4 treatments was

$p<0.05$, and a statistical difference was found in terms of dry leaf EC values. The highest value was obtained at 100 mM, while a decrease was observed at 150 mM.

The effect of all treatments on dry leaf EC values was $p<0.05$ and a statistical difference was found.

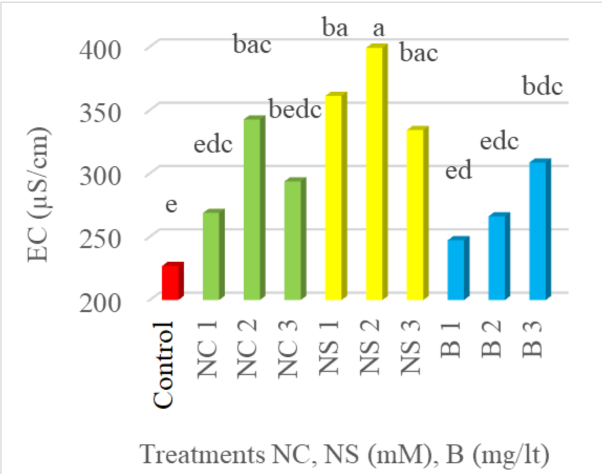

Figure 4. The effect of treatments on dry leaf EC values

According to Figure 4, a sequence was formed between treatments as Na_2SO_4 >NaCl>B>Control. Among the average values of fresh and dry leaf EC, the highest value was obtained in Na_2SO_4 treatments.

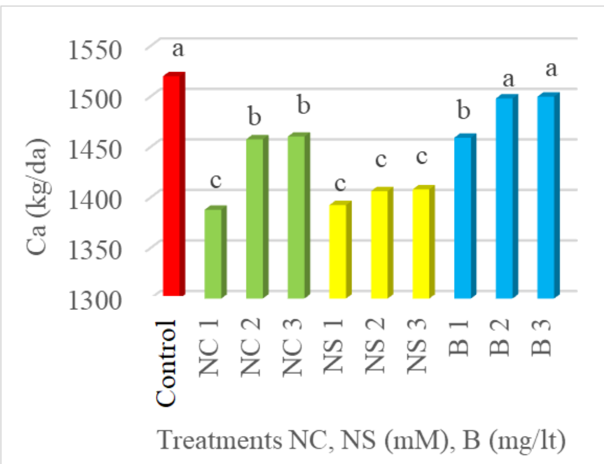

Figure 5. The effects of treatments on soil Ca values of the soil

3.5. Ca Values of the Soil

The effect of NaCl treatments on soil Ca values was found to be significant since $p<0.05$. There was a decrease in Ca values with treatments. Moreover, the effect of B treatments was $p<0.05$ and a statistical difference was found. A decrease in Ca values was observed with treatments. The effect of Na_2SO_4 treatments was found to be significant, with $p<0.05$. The effect of all treatments on Ca values was $p<0.05$ and a statistical difference was found. In terms of Ca content between treatments, it can be sorted as Control>B>NaCl>Na_2SO_4 (Figure 5). Among the treatments, the lowest Ca values were determined in the Na_2SO_4 treatments. Hence, high Na and Cl concentrations in the soil solution caused a decrease in Ca values.

3.6. Ca Values of the Plant

The effect of NaCl treatments on Ca values of the plant was $p>0.05$ and there was no statistical difference. The effect of B treatments was $p>0.05$, while the effect of Na_2SO_4 treatments was $p>0.05$, thus, it was not found significant. Since the effect on Ca values between all treatments was $p>0.05$, there was no statistical difference. As a result of Na_2SO_4 treatments, Ca values were observed at the lowest levels. In B treatments, on the other hand, Ca values tended to increase with the increase in treatment dose. The highest Ca content of B treatments was determined with a dose of 15 mg/lt. It was determined that while it increased at 50-100 mM in NaCl treatments, it decreased below the control value at 150 mM. In other words, when the NaCl treatment doses increased above 100 mM, a rapid decrease in Ca values occurred. Since high Na and Cl concentrations in the soil solution limit the uptake and accumulation of macronutrients such as Ca, decreases in values were observed with increasing the treatment dose (Figure 6).

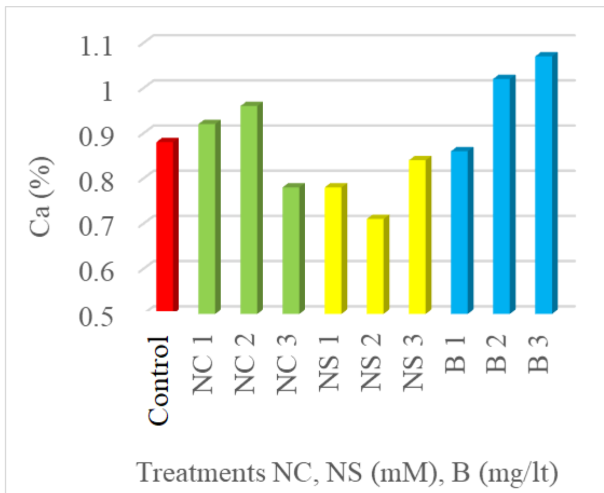

Figure 6. The effects of treatments on Ca values of the plant

3.7. Mg Values of the Soil

The effect of NaCl treatments on soil Mg values was $p>0.05$ and it was not found significant. Compared to the control, an increase in Mg values occurred in the treatments. The effect of B treatments was $p>0.05$, while the effect of Na_2SO_4 treatments was $p>0.05$ and no statistical difference was found. While Mg values increase at 10 mg/lt B treatment, there was a slight decrease at 5-15 mg/lt. An increase in Mg values was observed with Na_2SO_4 treatments. The effect of all treatments was $p>0.05$ and no statistical difference was found. While the control Mg value was 75.78 kg/da, it increased to 79.96 kg/da with 150 mM Na_2SO_4 treatment. In general, Mg values increased as a result of the treatments (Figure 7).

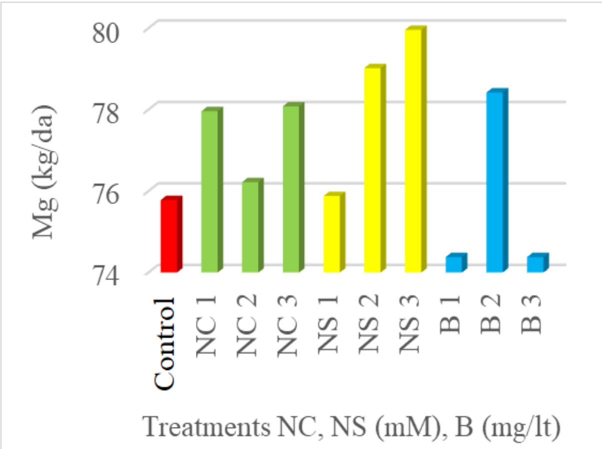

Figure 7. The effects of treatments on Mg values of the soil

3.8. Mg Values of the Plant

Since the effect on plant Mg values as a result of NaCl treatments was p>0.05, no statistical difference was found. While the effect of B treatments on Mg values was p>0.05, the effect of Na_2SO_4 treatments was p>0.05, and there was no significant difference. Moreover, the effect of all treatments on plant Mg content was p>0.05 and there was no statistical difference. In Na_2SO_4 treatments, a decrease in Mg values was observed with increasing doses. In NaCl treatments, it remained close to the control (62-64%). In B treatments, there was an increase at 10 mg/lt and a decrease at 5-15 mg/lt (Figure 8).

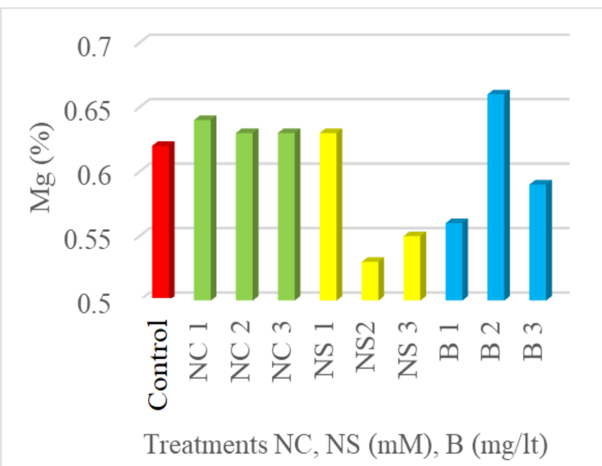

Figure 8. The effects of treatments on Mg values of the plant

3.9. K Values of the Soil

The effect of NaCl treatments on soil K values was found to be significant, with p<0.05. As NaCl treatment doses increased, K values decreased. The effect of B treatments on K values was p<0.05, and a statistical difference was found. A decrease in K value was observed in 5 mg/lt B treatments, and there was no significant change in 10-15 mg/lt treatments. The effect of Na_2SO_4 treatments was p<0.05 and a statistical difference was found. A decrease in the K value was observed with treatments. The effect of all treatments was found to be significant, with p<0.05. In general, among the treatments, it was observed that the K values decreased more with the NaCl treatments. Besides, Na_2SO_4 treatments were also determined below the control value (Figure 9).

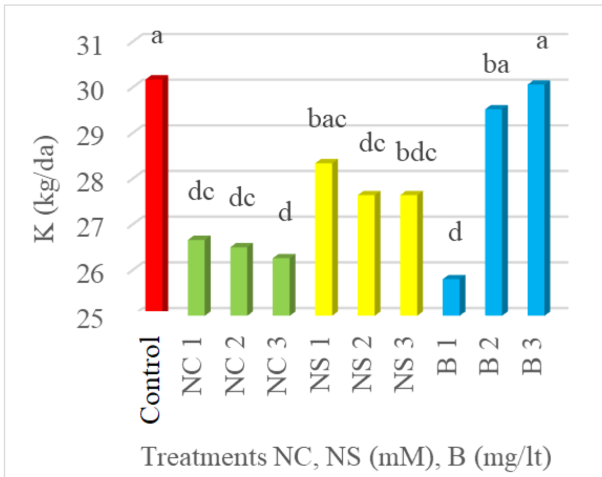

Figure 9. The effect of treatments on K values of the soil

3.10. K Values of the Plant

Since the effect of NaCl treatments on K values of the plant was p>0.05, no statistical difference was found, and the effect of dose increase on the decrease in K content was found to be insignificant. The effect of B treatments was p>0.05 and it was not found significant. In B treatments, K values remained close to the control (2.57-2.61%). The effect of Na_2SO_4 treatments was p>0.05, and there was no statistical difference. The effects of the treatments on the reductions in K values were insignificant. Among all treatments, the effect on K was p>0.05 and it was not found statistically significant. While K values were not affected much by B treatments, it was observed that there were decreases in NaCl and Na_2SO_4 treatments (Figure 10). In another study, K levels of leaves in *L. albuferae* and *L. dufourii* were found to be lower in salt-treated plants than in controls (Gonzalez et al. 2021).

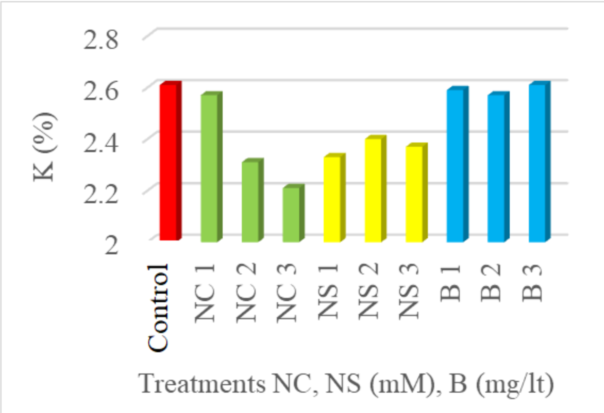

Figure 10. The effect of treatments on K values of the plant

3.11. N Values of the Soil

The effect of NaCl treatments on soil total N values was $p<0.05$ and a statistical difference was found. While a slight decrease in 50 mM was observed with NaCl treatments, at 100-150 mM, N values were determined almost at control levels. Moreover, the highest N values were determined in Na_2SO_4 treatments. The effect of Na_2SO_4 treatments on the total N values was $p<0.05$, and a statistical difference was found. While N values decreased at 5 mg/lt dose of B treatments, it remained at control levels at 10-15 mg/lt doses. Since the effect of B treatments on extractable Mg content was $p>0.05$, there was no statistical difference between treatments in terms of extractable Mg content. The effect of all treatments on the total N was found to be significant, with $p<0.05$ (Figure 11).

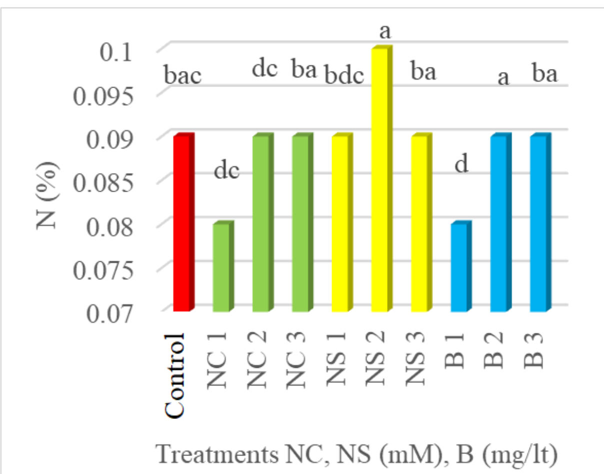

Figure 11. The effect of treatments on N values of the soil

4. Conclusions and Suggestions

As a result of the treatments, the pH values of the experiment soil, which was classified as medium alkaline, reached the highest values with the Na_2SO_4 treatments. In general, a ranking as Na_2SO_4>B>NaCl>Control occurred among the treatments in terms of pH values. Additionally, soil EC values were determined more in 150 mM Na_2SO_4 treatment. Among the treatments, a ranking can be made as Na_2SO_4>NaCl>Control>B, taking into account the EC values. Fresh leaf EC values increased in general treatments, and the highest values were determined in Na_2SO_4 treatments. Thus, Na_2SO_4>NaCl>B>Control sorting can be done for fresh leaf EC values. Dry leaf EC values increased in general, as did fresh leaf EC values. The highest values were found in Na_2SO_4 treatments. Furthermore, Na_2SO_4>NaCl>B>Control sequence was formed in terms of fresh leaf EC values. While plant Ca value increased with B treatments, it decreased with Na_2SO_4 treatments. In NaCl treatments, a decrease in values was observed at 150 mM. Among the treatments, a sequence was formed as B>NaCl>Control>Na_2SO_4 for plant Ca values. The effect of NaCl treatments on plant Mg values was not much. In general, while a decrease in Mg values was observed in Na_2SO_4 and B treatments, the highest Mg values were determined in 10 mg/lt B treatments. Besides, the effects of treatments on plant Mg values were listed as NaCl>Control>B>Na_2SO_4. While B treatments did not affect plant K values much, decreases were observed in NaCl and Na_2SO_4 treatments. In terms of plant K values, the ordering was Control>B>Na_2SO_4>NaCl. In addition, soil K values decreased with the treatments. The lowest K values were determined in NaCl treatments. Also, treatments were listed as Control>B>Na_2SO_4>NaCl in terms of their K content. Soil Ca values decreased with treatments in general. The lowest Ca values were determined in Na_2SO_4 treatments. It was observed that soil Ca values were less affected by B treatments than other treatments. In terms of soil Ca values, an ordering as Control>B>NaCl> Na_2SO_4 occurred. Moreover, Soil Mg values increased with NaCl and Na_2SO_4 treatments. The highest Mg values were determined in Na_2SO_4 treatments. In general, a ranking as Na_2SO_4>NaCl>Control>B occurred in terms of soil Mg values. Soil N values increased mostly in Na_2SO_4 treatments and it was generally observed at control levels with NaCl and B treatments. As soil N content, an ordering as Na_2SO_4>Control>NaCl=B occurred.

Limonium gmelinii plants used in the study continued to grow without being damaged by salinity by taking up excess Na and Cl salts and accumulating on their leaves. Especially in Na_2SO_4 applications, a visible dense salt accumulation occurred on the leaves. However, no adverse effects were observed in plant development and growth. In B applications, the plant has salt secretion glands. It is understood that it removes excess B from the soil and plant content. As a result of B applications, there was no regression in general plant growth, but inward curling and color change (yellowing) was observed in some leaves. As a result, no negative effects were determined in the plant properties of *Limonium gmelinii*, which were evaluated with NaCl, Na_2SO_4 and B treatments, to prevent plant growth. *Limonium gmelinii* can be grown in areas with salinity and B toxicity without any major problems. *Limonium gmelinii*, an ornamental plant with blue flowers, will provide a visual beauty when growing in such problem areas. This ornamental plant, which grows naturally in Turkey, can be promoted and its cultivation can be encouraged. Today and in our future, every inch of land is used in agricultural production and making it sustainable will benefit both our food supply and our economic development. It is very important to identify plants that tolerate such problem areas and to determine how they can be benefited.

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