

Article

Impact of the Biostimulants Algevit and Razormin on the Salinity Tolerance of Two Tomato Cultivars

Mihaela Covașă , Cristina Slabu , Alina Elena Marta , Ștefănica Ostaci  and Carmenica Doina Jităreanu

Department of Plant Science, Iasi University of Life Sciences, 3 Sadoveanu Alley, 700490 Iasi, Romania; cristinaslabu@yahoo.com (C.S.); alinamarta_fiziologie@yahoo.com (A.E.M.); stefanaostaci@gmail.com (Ș.O.); doina.jitareanu@iuls.ro (C.D.J.)

* Correspondence: miha_bologa@yahoo.com

Abstract: The global water crisis and the expansion of saline soils present significant challenges to agricultural sustainability. To address these issues, innovative solutions are needed to harness seawater and adapt plants to high-salinity conditions. Biostimulants represent an innovative strategy for mitigating the adverse effects of salinity on crops. This study examined the impact of two biostimulants, Algevit (based on marine algae) and Razormin (based on plant extracts), on the salinity tolerance of two Romanian tomato varieties, Buzau 4 and Buzau 22. The research was conducted under greenhouse conditions and assessed parameters such as plant height, flower and fruit counts, photosynthetic fluorescence, chlorophyll content, stomatal conductance, and proline concentration. The results showed that Algevit had a more significant impact compared to Razormin, enhancing plant growth, maintaining higher chlorophyll levels (in the Algevit variants, values ranged from 27.43 to 44.99 SPAD units, while in the Razormin variants, they ranged from 24.23 to 41.63 SPAD units), and improving photosynthetic efficiency. Both tomato varieties responded positively to the treatments, with Buzau 4 demonstrating greater salinity tolerance, especially when treated with Algevit. These findings suggest that integrating biostimulants into crop management can effectively reduce the negative effects of salinity and support sustainable agriculture in salt-affected regions. The study highlights the importance of applying biostimulants in managing soil salinity and freshwater scarcity in the context of climate change.

Keywords: abiotic stress; photosynthetic fluorescence; plant extracts; proline; stomatal conductance; marine algae



Academic Editor: Jose M. Mulet and Vincenzo Candido

Received: 23 December 2024

Revised: 26 January 2025

Accepted: 28 January 2025

Published: 29 January 2025

Citation: Covașă, M.; Slabu, C.; Marta, A.E.; Ostaci, Ș.; Jităreanu, C.D. Impact of the Biostimulants Algevit and Razormin on the Salinity Tolerance of Two Tomato Cultivars. *Agronomy* **2025**, *15*, 352. <https://doi.org/10.3390/agronomy15020352>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The global water crisis and the annual expansion of saline soils present major challenges to agricultural sustainability. In response to these difficulties, it is crucial to develop innovative solutions that can harness the potential of seawater and identify plant species capable of adapting to high-salinity conditions. Biostimulants represent an innovative and effective solution for mitigating the adverse effects of salinity such as osmotic stress, ionic toxicity, reduced growth, and the slowed development of crops [1]. These products, due to their chemical properties, protect essential physiological processes in plants and help to maintain agricultural productivity in hostile environments. The implementation of such strategies can effectively manage the negative impacts of salinity, turning the challenges of saline resource utilization into opportunities for sustainable agriculture.

Tomatoes (*Solanum lycopersicum* L.), recognized as one of the most economically important vegetable crops, exhibit heightened sensitivity to saline environments, rendering them susceptible in areas impacted by excessive salt build-up in the soil [1].

In light of these challenges, the use of biostimulants has gained traction as a promising solution to enhance plant tolerance to salinity stress by improving essential physiological and biochemical processes [2]. Biostimulants are natural or synthetic compounds that act by activating the internal defense mechanisms of plants, thereby enhancing their tolerance to salt stress [3]. Recent studies have demonstrated that biostimulants stimulate proline accumulation, helping plants to cope with abiotic stress [4]. Furthermore, these compounds can enhance photosynthetic efficiency, leading to increased photosynthetic fluorescence and improved utilization of solar energy by the plants [5]. Biostimulants also regulate stomatal conductance, a crucial factor in controlling water loss and maintaining water balance under osmotic stress [6]. Chlorophyll content, essential for plant health [7], is enhanced through the use of biostimulants, thereby facilitating more efficient photosynthesis under saline conditions [2].

The accumulation of proline, an essential osmoprotectant, plays a crucial role in enhancing salinity tolerance by helping plants to maintain cellular functions under osmotic stress [4]. Additionally, biostimulants have been shown to improve photosynthetic efficiency and chlorophyll content, both essential for plant health and productivity, especially under saline conditions [5]. Parameters, such as photosynthetic fluorescence, stomatal conductance, and fruit yield, are critical for assessing the overall impact of salinity and for evaluating the effectiveness of biostimulants in promoting tomato resilience [8–10].

Additionally, the potential use of seawater for irrigation in salt-affected areas is gaining attention. While high levels of salinity in seawater can be detrimental to most crops, recent advancements in agricultural practices have highlighted the possibility of utilizing diluted seawater or saline water with improved management strategies. This approach can provide an alternative water source in regions facing freshwater scarcity, promoting sustainable agricultural practices [3]. By integrating biostimulants with salt-tolerant tomato varieties, researchers aim to enhance the resilience of these crops under saline irrigation conditions.

Many studies show that irrigation with saline water or cultivation in saline soils improves fruit quality by enhancing the biosynthetic capacity of compounds with antioxidant activity [11]. Similar studies have shown that in tomatoes, the content of vitamin C and lycopene in fruits increases under moderate saline-stress conditions [12–14]. There is a high potential for improving fruit quality under saline stress. The more we understand the mechanisms involved in enhancing plants' resistance to saline stress, the better agricultural and horticultural practices can manage these extraordinary possibilities through which plants activate physiological and biochemical mechanisms to adapt to various saline-stress conditions.

Biostimulants have emerged as a promising approach to enhancing plant resistance to saline-stress factors. When applied in small quantities, which optimizes costs, they impart new traits to plants, improving their resilience to abiotic stress. Given the high costs associated with soil desalination and the insufficient freshwater resources for irrigation in many regions, agricultural research is increasingly focused on identifying sustainable solutions to enhance plant tolerance to abiotic stress. This concern is particularly relevant in the context of the climate changes observed in recent years. This research investigated the impact of two biostimulants, Algevit (based on marine algae) and Razormin (based on plant extracts), on the salinity tolerance of two Romanian tomato cultivars, Buzau 4 and Buzau 22. The study focused on several critical parameters, including plant height, flower and fruit counts, photosynthetic fluorescence, chlorophyll levels, stomatal conductance, and proline concentration. The results of this study provide an in-depth understanding

of how biostimulants can enhance tomato resilience and support sustainable agricultural practices under high-salinity conditions.

Limited information is available on the salinity tolerance of these tomato cultivars and the interactions between this abiotic stress factor and the biostimulants Algevit and Razormin. The findings of this study contribute valuable insights, facilitating a more targeted application of these tomato varieties on saline-affected soils, while emphasizing the effects of these biostimulants in such conditions. Both varieties of tomatoes are popular among local growers due to their adaptability and the excellent taste qualities of their fruits. They contribute to the genetic diversity of tomatoes in Romania and are considered part of the country's horticultural heritage.

These tomato varieties constitute a valuable resource for future research and breeding strategies, providing an essential starting point in developing cultivars with high salinity tolerance. Their adaptability to the stresses caused by saline conditions makes them ideal for creating resilient and sustainable crops capable of facing the challenges of climate change, which are leading to the expansion of saline areas, as well as to the use of alternative water sources. In this context, biostimulants, such as Algevit, derived from marine algae rich in nutrients and bioactive compounds, offer promising solutions for enhancing plant tolerance to salinity. The use of these biostimulants can promote sustainable agriculture in salinity-affected areas, harnessing marine resources in an ecological and efficient manner.

2. Materials and Methods

2.1. Plant Materials

The biological material consisted of two Romanian tomato cultivars, Buzau 4 and Buzau 22 (both obtained by SCDL Buzau), acquired from a local seed supplier. In terms of salinity tolerance, no specific data have been reported in the scientific literature for these tomato varieties. However, their selection was based on their high productive potential and the favorable taste profile appreciated by Romanian consumers. According to the Vegetable Research and Development Station Buzau (SCDL Buzau), these varieties exhibit a flavor comparable to that of traditional tomatoes, which enhances their market value. Furthermore, both varieties are suitable for cultivation in open fields as well as in greenhouses, offering flexibility in agricultural practices.

Both varieties are characterized by determinate growth, firm fruits, and strong resistance to transport and storage. The Buzau 22 variety produces globular, slightly flattened fruits with a smooth and mildly ribbed surface, while the Buzau 4 variety yields round fruits.

2.2. Preparation and Analysis of Biostimulants

Razormin (product by Atlantica Agricola Spania, Alicante, Spain) is a biostimulant formulated to support plant growth and development. It contains a combination of free amino acids, vitamins, and essential microelements, as well as growth-promoting substances beneficial for both the roots and aerial parts of plants. The chemical composition includes, as follows: 4% total nitrogen; 2.1% organic nitrogen; 0.9% nitric nitrogen; 1% ammoniacal nitrogen; 4% phosphorus soluble in water; 3% potassium soluble in water; 7% free amino acids; 3% polysaccharides; 0.4% iron soluble in water; 0.1% manganese soluble in water; 0.1% boron soluble in water; 0.085% zinc soluble in water; 0.02% copper soluble in water; and 0.01% molybdenum soluble in water [15]. Razormin stimulates metabolic processes, enhances root development, and improves the plant's ability to withstand abiotic stress.

Algevit (product by Vitaterra Professional Spania, Salamanca, Spain) is a natural biostimulant, based on a marine algae extract, used to stimulate plant growth and resilience. It contains essential natural phytohormones (such as auxins, cytokinins, and gibberellins),

amino acids, vitamins, microelements, and polysaccharides. The chemical composition includes, as follows: marine algae extract from *Ascophyllum nodosum* 30%; potassium oxide 3.9%; alginic acid 1.5%; and mannitol 0.5% [16]. Algevit helps to stimulate root and shoot growth and increases resistance to abiotic stress by activating plant defense mechanisms.

A 0.3% concentration of Razormin and Algevit was applied in two passes, with the conical spray nozzle moved perpendicularly to the plants in a zigzag motion, from bottom to top and back. The biostimulants were applied in isolation from other plant pots and the pots were covered with protective film during application. No adjuvants were included in the biostimulant solutions.

2.3. Treatments and Growth Conditions

This experiment was conducted in 2023 at the IULS (Iasi University of Life Sciences) in Romania, under controlled greenhouse conditions. The temperature ranged between 22 °C and 28 °C during the day and 16 °C to 18 °C at night. The photosynthetic photon flux density (PPFD) was maintained at 700 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$, with a relative humidity of 60–70%. Natural lighting was used throughout the experiment. The experiment followed a bifactorial design with 15 dm³ plant pots filled with 10 kg of universal garden soil (produced by AgroCs Romania, Brasov). This soil mix, based on a peat substrate and enriched with humus from mature bark, contained, as follows: N (150–400 mg/L); P₂O₅ (80–250 mg/L); K₂O (250–600 mg/L); and various nutrients (Cd 1 mg/L, Pb 100 mg/L, Hg 1 mg/L, As 20 mg/L, Cr 100 mg/L, Cu 100 mg/L, Mo 5 mg/L, Ni 50 mg/L, Zn 300 mg/L). The granulation of the soil ranged from 0.001 mm to 0.002 mm.

The experimental design followed a randomized block structure with four replications.

Treatments were applied at 14-day intervals when the plants reached the following stages: 6–8 true leaf stage; 10–12 leaf stage; and just before the onset of the first inflorescence.

Biostimulants (Razormin and Algevit) were applied as foliar sprays, while a saline solution (300 mM NaCl) was applied to the root system (100 mL per pot). The treatments were applied sequentially, one hour apart, on the same day, with biostimulants first, followed by the saline solution. A manual sprayer with a 2 L capacity was used for the biostimulants. The sprayer's parameters included, as follows: a working pressure of 0.3–0.4 MPa; a flow rate of 0.7–0.8 L/min; a spray distance of 60 mm; and a 45 mm piston diameter with a conical nozzle. All treatments were performed under controlled conditions in the greenhouse (temperature at 22 °C, relative humidity at 60%).

The experimental groups were as follows: control (plants watered with regular water); R (plants treated with Razormin foliar spray); R × 300 mM NaCl (plants treated with Razormin spray and irrigated with a 300 mM NaCl solution); A (plants treated with Algevit spray); A × 300 mM NaCl (plants treated with Algevit spray and irrigated with a 300 mM NaCl solution); and 300 mM NaCl (plants irrigated with a saline solution of 300 mM NaCl). Each irrigation involved applying 100 mL of 300 mM NaCl solution, which corresponds to 10.8 dS/m, representing moderately saline soil.

2.4. Measured Traits

2.4.1. Biometric and Gravimetric Assessments

Observations were conducted on the growth and fruiting characteristics of the tomato plants, including stem height, the number of flowers per inflorescence, fruit count, and fruit weight. These measurements were taken at 14-day intervals following the application of the treatments.

2.4.2. Physiological Analysis

Leaf Chlorophyll Content

Chlorophyll content was measured using a Minolta SPAD-502 Chlorophyll Meter (product by *Konica Minolta Sensing*, Seoul, Republic of Korea). For each treatment, the chlorophyll levels were recorded from the same four healthy leaves of each plant. The leaves were selected from the middle section of the stem.

The SPAD device measures the absorption of light by the leaf at two specific wavelengths: one that is absorbed by chlorophyll; and another that is not affected by chlorophyll. The device then calculates a SPAD index, which is proportional to the chlorophyll content in the leaf. Within a few seconds, the device displays the SPAD index on the screen, expressed in a dimensionless unit that serves as an indirect indicator of chlorophyll content.

Stomatal Conductance

Stomatal conductance was measured with the SC-1 Leaf Porometer (product by *Meter Group*, Pullman, WA, USA), a portable instrument designed to assess water vapor exchange between the leaf and the surrounding atmosphere. Widely used in plant physiology studies, the SC-1 is valued for its portability, user-friendliness, and accuracy.

The SC-1 Leaf Porometer operates by measuring the diffusive resistance of water vapor exiting the leaf through the stomata. Diffusive resistance is the inverse of stomatal conductance; therefore, once resistance is measured, it can be converted into stomatal conductance. Essentially, the porometer measures the rate at which water vapor fills a chamber of a known volume placed on the leaf surface. The SC-1 directly displays stomatal conductance values on its screen, expressed in standard units of $\text{mmol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$.

Variability in stomatal conductance provides valuable insights into plant health, water-use efficiency, and the plant's response to various stress factors. The SC-1 is ideal for quick and accurate assessments of stomatal conductance, making it an important tool in eco-physiological studies, evaluating plant adaptability to stress, and managing water-use efficiency in agriculture.

The measurements were taken in the morning between 8:00 and 10:00 AM, at a temperature of 25 °C, and a photosynthetic photon flux density (PPFD) of $700 \mu\text{mol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$.

Chlorophyll Fluorescence

Chlorophyll fluorescence parameters were measured using the OS30p+ Hand Held Chlorophyll Fluorometer (product by *Opti-Sciences*, Hudson, NH, USA). To ensure that the plants were adapted to darkness, specialized leaf clips were applied for a 30 min period [17]. The fluorescence signal was captured under red actinic light with a peak wavelength of 627 nm, applied for 1 s at a maximum intensity of $3500 \mu\text{mol}$ photosynthetically active radiation (PAR) $\text{m}^{-2} \text{s}^{-1}$. Fluorescence measurements were taken on four leaves per pot, using the same leaves previously employed for the SPAD and leaf porometer readings. The following parameters were assessed: the maximum quantum yield of primary photochemistry (F_v/F_0); the photochemical efficiency of PS II (F_v/F_m); and the performance index of PS II (PI).

The OS30p+ Hand Held Chlorophyll Fluorometer is used in studies that assess plant responses to stress factors, nutrient availability, and environmental changes.

All measurements were performed on 4 leaves per pot. The same leaves were used for all the monitored parameters, with one reading taken on each leaf.

2.4.3. Biochemical Analyses

Proline Quantification

Proline content was measured in leaves following the application of the three treatments at the conclusion of the experiment, using a modified version of the Bates method (1973). To begin, 0.5 g of plant tissue (fresh material) was homogenized in 5 mL of 3% aqueous sulfosalicylic acid, and the mixture was centrifuged at 5000 rpm for 10 min. Next, 2 mL of the supernatant were combined with 2 mL of ninhydrin reagent and 2 mL of glacial acetic acid in a test tube; the reaction proceeded for 1 h at 100 °C. The reaction was terminated by placing the test tube in an ice bath. The resulting mixture was extracted with 4 mL of toluene and vigorously shaken for 15–20 s. The colored toluene phase was separated from the aqueous phase; absorbance at 520 nm was measured using a Specord 210 plus spectrophotometer (product by *Analytic Jena*, Jena, Germany) with toluene serving as the blank control [18]. The concentration range of the proline standard curve used was between 0.05–1.5 nmol/mg^{−1}.

The proline content was calculated in nmol·mg^{−1} fresh weight (FW) using the following formula: (Abs_{extract} − blank)/Slope × Vol_{extract}/Vol_{aliquot} × 1/FW, where Abs_{extract} represents the absorbance of the extract, blank denotes the absorbance of the blank, and Slope corresponds to the regression slope (expressed in nmol^{−1}). Vol_{extract} is the total volume of the extract, Vol_{aliquot} is the volume used in the assay, and FW refers to the fresh weight (mg) of the plant material [19].

For the quantitative analysis, leaves from the middle part of the stem were selected. The leaves used for the readings with the SPAD device, leaf porometer, and fluorometer were collected.

2.5. Statistical Evaluation

Statistical differences between treatments were evaluated using standard statistical software, applying one-way and two-way ANOVA with replication. The factors considered were tomato varieties, salt concentration, and biostimulants. In cases where significant differences were observed, the Tukey multiple comparison test was applied. A significance level of $p < 0.05$ was used to determine the main effects. For the statistical analysis, in addition to Excel 2016, IBM SPSS Statistics, V.21 (USA), was also used.

3. Results

3.1. Impact of Biostimulants on Tomato Plant Growth and Fruiting Under Saline Stress

Following the initial treatment, it was noted that, in comparison to the control group, the application of Algevit led to the most significant increases in plant height for both tomato varieties. This treatment resulted in a height increase of 3.25 cm compared to the control for the Buzau 4, and a 5.25 cm increase for the Buzau 22.

On the other hand, the NaCl treatment (300 mM) caused a marked reduction in plant height, resulting in the lowest values observed across all treatments. Compared to the control group, a decrease in height was recorded, ranging from 4.75 cm for Buzau 22 to 6 cm for Buzau 4.

The R × 300 mM NaCl treatment had a negative effect on plant height for both varieties compared to the control, decreasing height. However, the reduction was significant only for the Buzau 4 variety, which recorded a value 4.75 cm lower compared to the control. The A × 300 mM NaCl treatment kept the height of the Buzau 4 variety consistent with the control, while the Buzau 22 variety showed a slight increase in average plant height (Figure 1a). The A × 300 mM NaCl treatment proved significantly more effective in promoting plant height compared to both the R × 300 mM NaCl and 300 mM NaCl treatments. The R × 300 mM NaCl treatment showed a slight advantage over the 300 mM

NaCl treatment for both varieties, suggesting that the presence of this biostimulant supports maintaining greater height under saline conditions, closer to that of the control group.

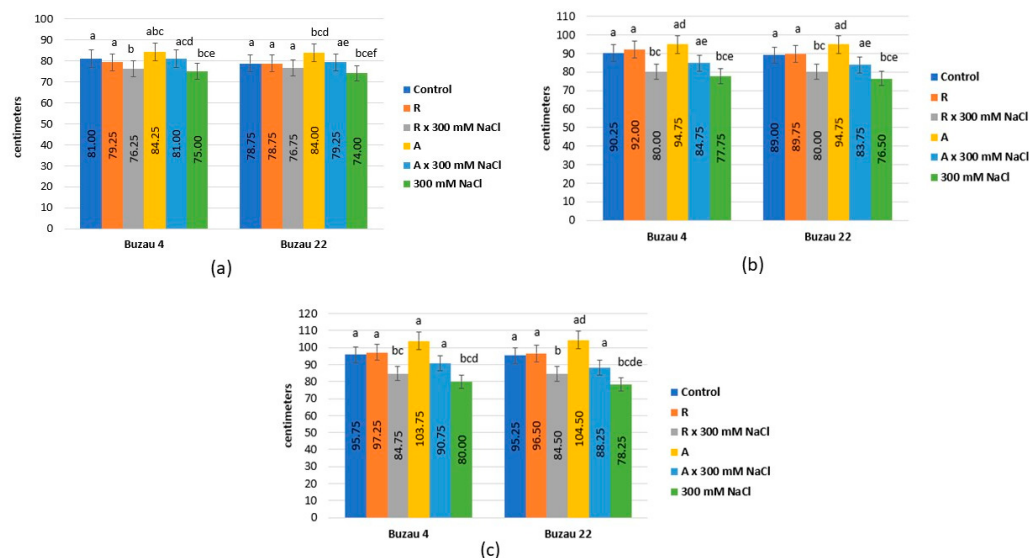


Figure 1. Effect of biostimulants on tomato plant height under saline stress following: the first treatment (a); second treatment (b); and third treatment (c). Different letters denote statistically significant differences as determined by the Tukey test. Error bars represent the standard deviation ($\pm$ SD).

After the second treatment, the analysis of tomato plant height for both varieties showed that the biostimulant Algevit is the most beneficial for plant growth, under both normal conditions and in combination with 300 mM NaCl (Figure 1b).

The 300 mM NaCl treatment had a significant negative effect on plant height (−12.50 cm lower compared to the control for both varieties); however, this effect can be partially counteracted by the treatments with Razormin, and, particularly, with Algevit, which resulted in a stem growth increase compared to the 300 mM NaCl control group, with values ranging from 2.25 cm to 7.25 cm. In the presence of NaCl, Algevit proved to be more effective than Razormin, maintaining a greater plant height.

Even after the third treatment, the biostimulant Algevit showed a beneficial effect on the growth of tomato plants for both varieties, even in combination with 300 mM NaCl. Treatment with 300 mM NaCl alone significantly reduces plant growth; however, this effect can be partially mitigated by Razormin and Algevit treatments, with Algevit being significantly more effective. The graph (Figure 1c) shows that, for both varieties, the biostimulant treatments help to maintain average plant heights within normal limits under saline stress from the application of 300 mM of NaCl.

After the three treatments, it was observed that the Buzau 4 and Buzau 22 varieties responded similarly to most treatments, although Buzau 22 appeared to be slightly more sensitive to the effects of NaCl than Buzau 4.

After the three treatments were applied, the number of flowers was recorded. For both varieties, the 300 mM NaCl treatment resulted in the lowest number of flowers (15.57 fewer compared to the control for Buzau 4 and 17 fewer for Buzau 22). In both varieties, the treatments with Razormin and Algevit produced a higher number of flowers than the control, with values ranging from 1.25 to 9.25, and the Algevit treatment showing the highest values (Figure 2). The combined treatments (R $\times$ 300 mM NaCl and A $\times$ 300 mM NaCl) resulted in fewer flowers compared to the individual treatments (R and A), but more flowers than the 300 mM NaCl treatment alone. Although a reduction in the negative effects of salinity was observed in the presence of the biostimulants, the differences were not statistically significant.

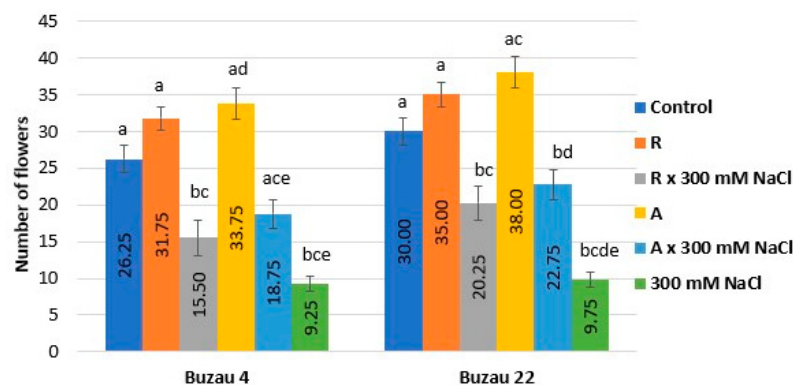


Figure 2. Effect of biostimulants on the number of flowers per plant under saline stress after the third treatment. Different letters indicate statistically significant differences based on Tukey's test. Error bars represent the standard deviation ($\pm$ SD).

At the conclusion of the experiment, the number of fruits was recorded following the three treatments. The results indicated that the control plants from both varieties yielded fewer fruits in comparison to those treated with Algevit and Razormin (Figure 3). The results are numerically different, but without a statistically significant difference.

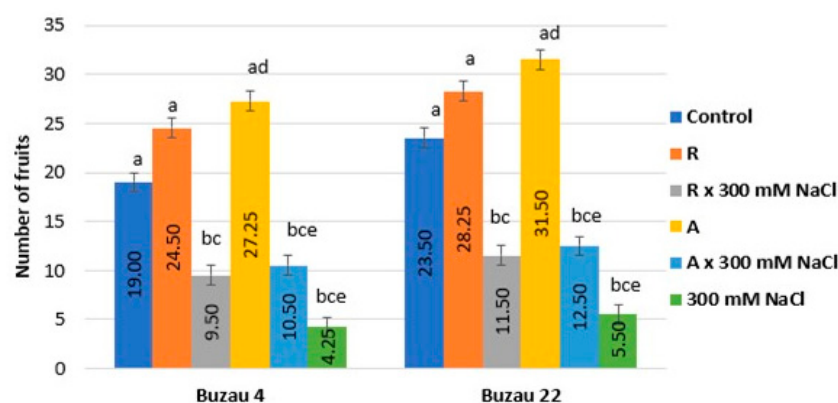


Figure 3. Effects of biostimulants on the number of fruits per plant under saline stress after the third treatment. Different letters represent statistically significant differences, as determined by the Tukey test. Error bars indicate the standard deviation ($\pm$ SD).

The highest fruit production was observed in the Algevit treatment for both varieties, followed by the Razormin treatment. The 300 mM NaCl treatment had a negative effect on fruit production for both varieties, significantly reducing the number of fruits. In the case of the Buzau 4 variety, the number of fruits decreased by 14.75 compared to the control, while for Buzau 22, it decreased by 18.

This trend also persisted in the treatments where NaCl was combined with the biostimulants Razormin and Algevit; however, the number of fruits was much higher (the values ranged from 5.25 to 7 compared to 300 Mm NaCl), indicating that Razormin and Algevit helped both varieties to exhibit better tolerance to osmotic stress.

Another biometric index that was analyzed was the average weight of fruits per plant. The results showed that the fruit weight was higher in the Buzau 22 variety compared to Buzau 4 for all studied variants (Figure 4). Buzau 22 is a variety characterized by fruits that are heavier than the other variety chosen for this study. The treatment with Razormin increased the fruit weight (106.75 for Buzau 4 and 237.25 for Buzau 22) compared to the control (88.50 for Buzau 4 and 212.50 for Buzau 22) for both varieties, suggesting that this treatment may stimulate fruit weight growth. The same effect was observed for the Algevit treatment (113.75 for Buzau 4 and 249.75 for Buzau 22). The Algevit treatment increased

the fruit weight even more than the Razormin treatment, indicating that Algevit is a more effective treatment for enhancing fruit weight.

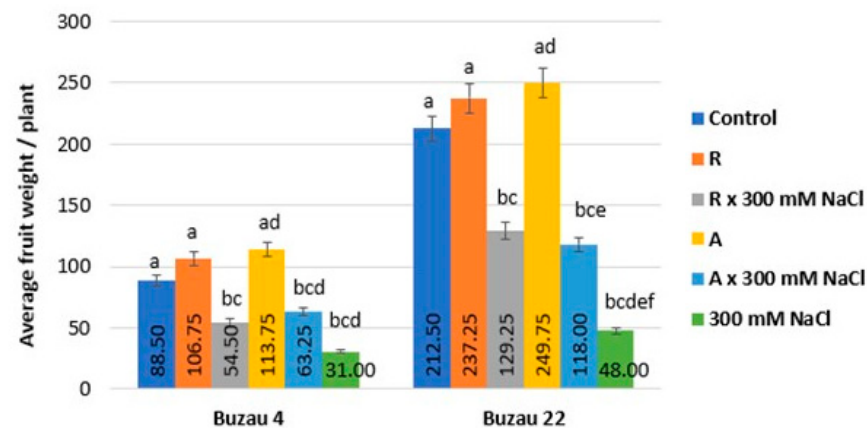


Figure 4. Effect of biostimulants on the average fruit weight per plant under saline stress after the third treatment. Different letters indicate statistically significant differences, as determined by the Tukey test. Error bars represent the standard deviation ($\pm$ SD).

In the case of the $R \times 300$ mM NaCl variant (54.50 for Buzau 4 and 129.25 for Buzau 22), a significant reduction in fruit weight was observed in both varieties compared to the individual Razormin treatment. This indicates that NaCl exerts a stress effect on the plants, reducing the effectiveness of the Razormin treatment. Fruit weight also significantly decreased for the $A \times 300$ mM NaCl variant (63.25 for Buzau 4 and 118.00 for Buzau 22), similar to the $R \times 300$ mM NaCl combination, suggesting once again that 300 mM of NaCl induces stress in plants, diminishing the beneficial effect of the Algevit treatment.

The 300 mM NaCl treatment resulted in a drastic reduction in the average weight of fruits per plant (31.00 for Buzau 4 and 48.00 for Buzau 22). This confirms that exposure to the 300 mM NaCl concentration significantly reduced fruit weight. Treatments with Razormin and Algevit stimulated an increase in fruit weight; in the cases where the saline solution was also applied, they resulted in higher fruit weight values compared to the variant treated with the 300 mM saline solution alone. These results show that the two biostimulants studied enhanced tolerance to saline stress.

3.2. Effect of Biostimulants on Chlorophyll Content in Tomato Plants Under Saline Stress

Following the first treatment, both tomato varieties showed a significant increase in chlorophyll content with the application of the biostimulant Razormin, indicating its potential to enhance chlorophyll levels in the leaves. For the Buzau 4 variety, the chlorophyll content increased by 4.74 SPAD units compared to the control, while for the Buzau 22 variety, it increased by 2.38 SPAD units. A similar trend was observed in plants treated with Algevit, with this biostimulant leading to the highest chlorophyll content (37.87 for Buzau 4 and 36.68 for Buzau 22, compared to 31.89 for the Buzau 4 control and 33.76 for the Buzau 22 control) (Figure 5a). It increased by 5.98 SPAD units compared to the control for Buzau 4 and by 3.10 SPAD units for Buzau 22. The results indicate that when the Razormin treatment is combined with 300 mM of NaCl, the values significantly decreased in both varieties compared to the Razormin treatment applied alone. In this situation, the values decreased by 3.94 for Buzau 4 and by 6.8 for Buzau 22.

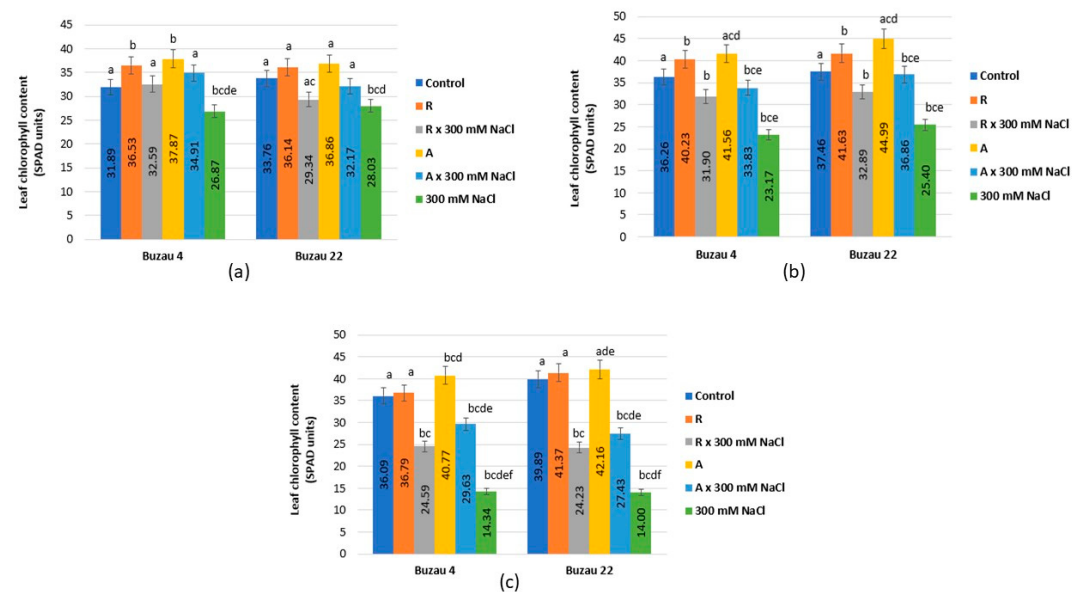


Figure 5. Effect of biostimulants on leaf chlorophyll content (SPAD units) under saline stress following: the first treatment (a); the second treatment (b); and the third treatment (c). Significant differences between treatments are indicated by different letters, as determined by the Tukey test. Error bars represent the standard deviation ($\pm$ SD).

This suggests that saline stress negatively affects the positive impact of the Razormin treatment on chlorophyll content. Similarly, the addition of 300 mM of NaCl to the treatment with Algevit reduced its effectiveness, but not as dramatically. The chlorophyll content decreased, ranging from 2.96 in Buzau 4 to 4.69 in Buzau 22, suggesting that Algevit may enhance resistance to salt stress more effectively than Razormin.

The exclusive application of 300 mM of NaCl significantly reduced chlorophyll content compared to all the other treatments, reaching the minimum values in the graph (26.87 SPAD units for Buzau 4 compared to 31.89 for the control and 28.03 for Buzau 22 compared to 33.76 for the control). This indicates that saline stress significantly decreases chlorophyll content in the leaves.

After the second treatment, the enhanced effectiveness of the Algevit treatment on chlorophyll content was again noted for both varieties, particularly for the Buzau 22 variety, which exhibited a higher level of chlorophyll (44.99 SPAD units) compared to Buzau 4 (41.56 SPAD units) (Figure 5b). The saline stress induced by the application of 300 mM of NaCl significantly reduced chlorophyll content under all conditions, with values ranging between 23.17 SPAD units and 44.99 SPAD units; however, the Algevit treatment combined with saline stress (300 mM NaCl) showed a smaller decrease compared to the Razormin treatment under saline stress, indicating the greater resistance of the Algevit treatment to saline stress, especially for Buzau 22. Following the second treatment, in terms of chlorophyll content, the Buzau 22 variety appeared to be more tolerant to saline stress than Buzau 4, as it generally exhibited higher chlorophyll content under saline stress and less of a decrease when treated with Algevit combined with 300 mM of NaCl.

After the third treatment, Razormin maintained a slight increase in chlorophyll levels in both varieties, although this was lower compared to the values observed after the previous treatments. A significant decrease in chlorophyll was noted under the influence of saline stress combined with the Razormin treatment, which was much more pronounced than in the earlier treatments (Figure 5c). This indicates that saline stress has a strongly negative long-term impact on chlorophyll and that the Razormin treatment does not compensate for these effects on the chlorophyll content.

The Algevit treatment continued to be effective in both varieties, increasing chlorophyll levels compared to the control. Even after the third treatment, Algevit combined with 300 mM of NaCl maintained its effect better than the Razormin treatment combined with 300 mM of NaCl, suggesting an improvement in tolerance to saline stress. The treatment with 300 mM pf NaCl resulted in the lowest chlorophyll values in both varieties, with a massive decrease compared to the control values, confirming the very negative effect of 300 mM of NaCl on chlorophyll in the long term.

3.3. Effect of Biostimulants on Stomatal Conductance in Tomato Plants Under Saline Stress

Following the first treatment, the stomatal conductance analysis revealed that the biostimulant Razormin resulted in higher values in both tomato varieties (281.85 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and 288.12 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22), compared to the control group (257.23 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and 277.87 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) (Figure 6a). This suggests that Razormin has a stimulative effect on the stomata, contributing to a greater opening, which may promote gas exchange and transpiration. The treatment with the biostimulant Algevit also increased conductance, but to a lesser extent in Buzau 4 (272.45 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) and a slightly greater extent in Buzau 22 (288.91 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) compared to Razormin.

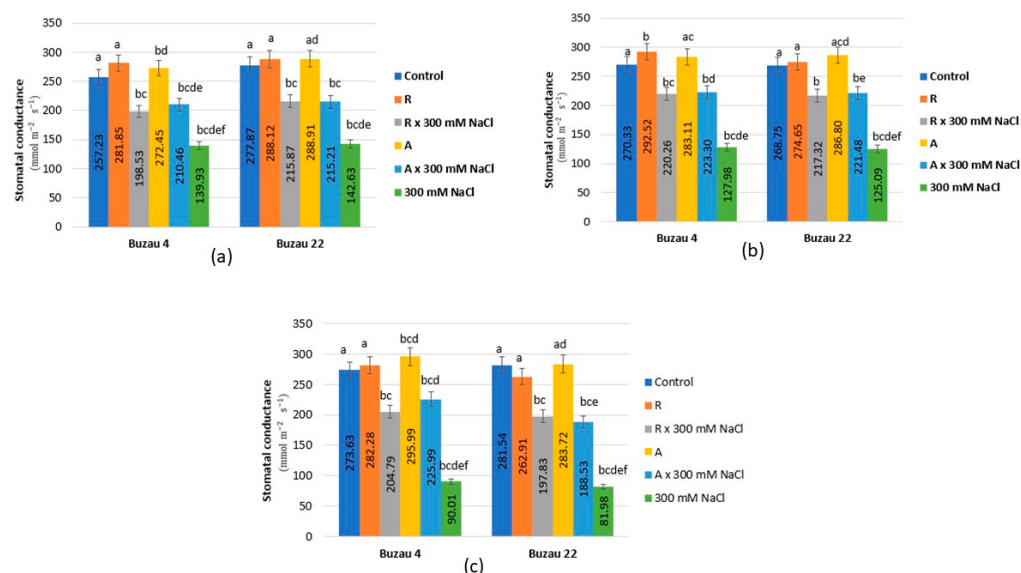


Figure 6. Effect of biostimulants on stomatal conductance ($\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) under saline stress following: the first treatment (a); second treatment (b); and third treatment (c). Significant differences between treatments are denoted by different letters, as determined by the Tukey test. Error bars represent the standard deviation ($\pm\text{SD}$).

Razormin in combination with 300 mM of NaCl maintained a higher stomatal conductance (198.53 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and 215.87 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) compared to the treatment with 300 mM of NaCl alone (139.93 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and 142.63 $\text{mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22), although this was significantly lower than the average value recorded for the plants in the Razormin-only variant. The combined effect of the biostimulant Algevit with 300 mM of NaCl exhibited a similar trend, with conductance values higher (210.46 for Buzau 4 and 215.21 for Buzau 22) than those of the NaCl-only treatment but lower than those observed with Algevit applied individually. The combined treatments, R $\times$ 300 mM NaCl and A $\times$ 300 mM NaCl, provided partial protection against saline stress, reducing the impact of NaCl on stomatal conductance.

In both varieties, the application of NaCl alone significantly reduced stomatal conductance. This considerable decrease indicates that saline stress reduces stomatal opening, a common mechanism through which plants respond to osmotic stress. Based on the data obtained after the second treatment, a similar trend can be observed, with some notable variations in the responses of the Buzau 4 and Buzau 22 tomato varieties to biostimulant treatments and saline stress (300 mM NaCl). The control values for both varieties are similar and relatively close ($270.33 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and $268.75 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) to the initial values obtained after the first treatment. These stable values indicate a consistent baseline condition for both varieties in the absence of treatment.

The treatment with the biostimulant Razormin continued to result in higher stomatal conductance values for both varieties, although the effect was more pronounced in Buzau 4 ($292.52 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) than in Buzau 22 ($274.65 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$). Similar to the first treatment, the biostimulant Algevit also increased stomatal conductance in both varieties ($283.11 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and $286.80 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) (Figure 6b). In plants from the $R \times 300 \text{ mM NaCl}$ variant, stomatal conductance remained above the values ($220.26 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and $217.32 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) observed in the 300 mM NaCl-only variant ($127.98 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and $125.09 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) but was still well below those of the R-only variant. A similar behavior was observed in plants from the $A \times 300 \text{ mM NaCl}$ variant ($223.30 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and $221.48 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22).

As observed after the first treatment, stomatal conductance drastically decreased for both varieties in the 300 mM NaCl variant. The very low values in this case clearly demonstrate the negative impact of high salinity on stomatal opening and suggest a reduction in transpiration to conserve water under saline stress conditions.

After the third treatment, the stomatal conductance values for the two tomato varieties, Buzau 4 and Buzau 22, once again reflect the effects of the biostimulant treatments and the stress induced by NaCl. The control values remained relatively constant ($273.63 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4 and $281.54 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22) with a slight increase compared to the previous treatments. This may indicate stability in the stomatal parameters in the absence of treatment (Figure 6c).

In contrast to the previous treatments, the biostimulant Razormin had a more modest effect on stomatal conductance, even causing a decrease in Buzau 22 ($262.91 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) compared to the control. The biostimulant Algevit continued to exert a positive and consistent effect on stomatal conductance, particularly in Buzau 4 ($295.99 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$), where the increase was significant. When biostimulants were combined with NaCl, stomatal conductance decreased (the values ranged between 81.98 and $225.99 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) compared to the variants treated only with biostimulants but remained higher than in the 300 mM NaCl-only variant ($81.98 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 22 and $90.01 \text{ mmol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for Buzau 4), suggesting a moderate protective effect.

The exclusive application of 300 mM of NaCl after the third treatment caused an extreme reduction in stomatal conductance, significantly lower than the values observed in previous treatments. This demonstrates the accumulated impact of long-term saline stress on the stomata.

3.4. Effect of Biostimulants on Chlorophyll Fluorescence in Tomato Plants Under Saline Stress

After the first treatment, the F_v/F_m ratio values for the two tomato varieties, Buzau 4 and Buzau 22, following different treatments, suggested clear variations regarding their ability to adapt to saline stress induced by NaCl and their response to biostimulants.

The values for Buzau 4 (0.74) and Buzau 22 (0.76) fell within the moderate range, indicating a healthy baseline state for PSII without external stress (Figure 7). Data regarding

moderate values for various plant species have been published in several articles [8,17]. Buzau 22 had a slightly higher value, indicating somewhat higher photosynthetic efficiency under normal conditions. Following the application of biostimulants, Razormin was found to significantly increase the Fv/Fm ratio for both tomato varieties compared to the control group. A similar trend was observed with Algevit, which resulted in even higher Fv/Fm values, approaching the upper range reported in the literature. In the R × 300 mM NaCl variant, the values decreased to 0.66 for Buzau 4 and 0.69 for Buzau 22, with both falling outside the optimal range, indicating that saline stress affected PSII, even with the application of the Razormin biostimulant. However, Buzau 22 still had a slightly higher value, suggesting a moderate recovery capacity.

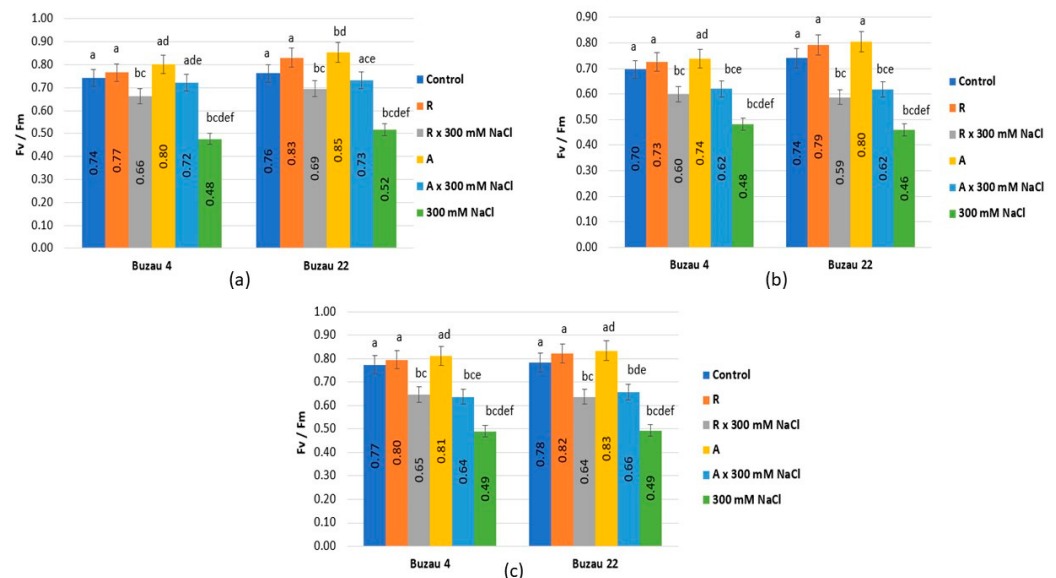


Figure 7. Effect of biostimulants on the Fv/Fm ratio under saline stress following: the first treatment (a); second treatment (b); and third treatment (c). Significant differences between treatments are denoted by different letters, as determined by the Tukey test. Error bars represent the standard deviation ($\pm$ SD).

For the plants in the A × 300 mM NaCl variant, in the presence of the Algevit biostimulant and saline stress, the values decreased to 0.72 for Buzau 4 and 0.73 for Buzau 22. This indicates a better ability to withstand stress in the Algevit treatment compared to Razormin, suggesting that the Algevit biostimulant is more effective in mitigating the negative impact of saline stress on the Fv/Fm ratio. In the 300 mM NaCl variant, the values decreased drastically to 0.48 for Buzau 4 and 0.52 for Buzau 22, indicating a severe impact on PSII and a marked reduction in photosynthetic efficiency. This reflects the sensitivity of the plants to saline stress and demonstrates that, without the protection provided by biostimulants, both varieties are profoundly affected.

After the second and third treatments, the photosynthetic efficiency of the Buzau 4 and Buzau 22 varieties remained relatively good under the treatments with Razormin and Algevit; these treatments appear to enhance activity at the PSII level (Figure 7).

The Algevit treatment seems to be the most effective at maintaining Fv/Fm values within the optimal range, even under saline-stress conditions, for both varieties studied.

Saline stress caused by 300 mM of NaCl had a significantly negative impact on plant health; however, the treatments with Razormin and Algevit contributed to maintaining better photosynthetic efficiency compared to direct exposure to salinity.

It is important to note that although biostimulant treatments improved photosynthetic performance, saline stress continued to negatively affect PSII; its management remains

crucial for the overall health of the plants. These data suggest that the application of biostimulants can help plants to better cope with abiotic stress, having the potential to be used in crop management strategies, especially under saline stress conditions.

After the first treatment, the F_v/F_0 ratio values for the control group were relatively similar for both varieties: 2.39 (Buzau 4) and 2.47 (Buzau 22). These values provide a baseline for plant health in the absence of any treatment (Figure 8). Under the Razormin treatment (variant R), a significant increase in F_v/F_0 values was observed compared to the control, suggesting that the Razormin biostimulant improved PSII function in both tomato varieties, with a more pronounced effect in Buzau 22, where the value was higher.

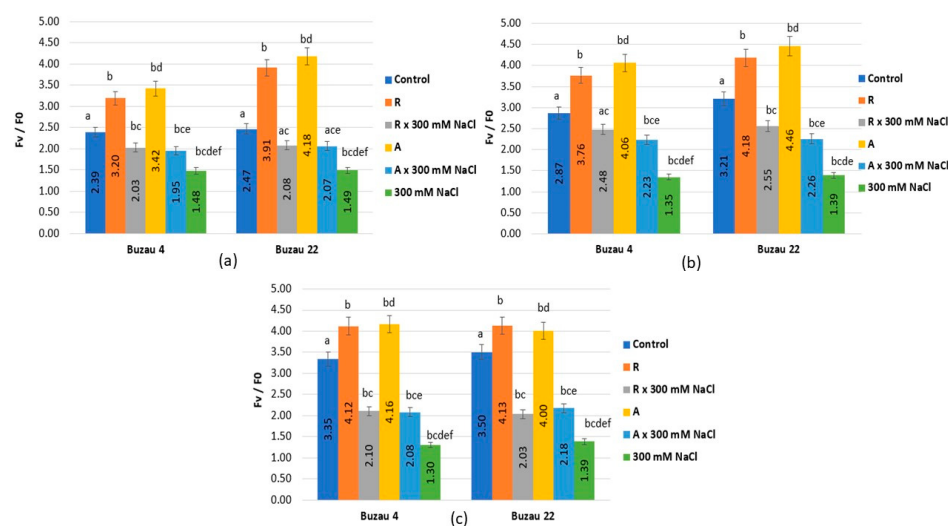


Figure 8. Effect of biostimulants on the F_v/F_0 ratio under saline stress following: the first treatment (a); second treatment (b); and third treatment (c). Significant differences between treatments are denoted by different letters, as determined by the Tukey test. Error bars represent the standard deviation ($\pm$ SD).

The same upward trend in F_v/F_0 values was maintained for plants treated with Algevit, with the highest values observed in this variant for both varieties. This result suggests that Algevit had a stronger positive effect on PSII than Razormin, particularly for Buzau 22.

The values obtained for the $R \times 300$ mM NaCl variant (Razormin treatment $\times$ saline stress) were lower than in the R variant, suggesting that saline stress negatively affects PSII efficiency, even in the presence of the biostimulant. However, the values were still slightly higher than in the NaCl-only treatment, indicating that Razormin offers partial protection against saline stress. Similar to the $R \times 300$ mM NaCl treatment, saline stress significantly reduced F_v/F_0 values, even with the presence of the Algevit biostimulant. However, the protective effect of the biostimulant is evident, with values higher than in the NaCl-only 300 mM treatment.

The plants in the 300 mM NaCl variant exhibited the lowest values for both varieties, confirming that saline stress severely affects PSII function and photosynthetic efficiency.

After the second treatment, the values for plants treated with the biostimulants Razormin and Algevit continued to significantly improve the F_v/F_0 ratios, indicating sustained support for photosystem II in the absence of saline stress. The Razormin biostimulant appears to provide better protection under saline stress conditions than Algevit, as suggested by the higher F_v/F_0 values for both varieties in the combined $R \times 300$ mM NaCl treatment (the values ranged between 4.06 and 4.46, compared to 2.23 and 2.26, respectively). Buzau 22 generally showed higher values (ranging from 1.39 to 4.46) than Buzau 4 (ranging from 1.35 to 4.06) under all conditions, indicating greater photosynthetic resistance

and a more effective response to saline stress (Figure 8). After the third treatment, the biostimulants Razormin and Algevit continued to maintain high Fv/F0 values in the absence of saline stress, demonstrating their positive effect on the functioning of photosystem II, even after multiple treatments (Figure 8).

In the presence of saline stress, the low Fv/F0 values indicated that stress still affected photosystem II; however, both Razormin and Algevit provided significant protection, although their effects did not fully counteract the negative impacts of salinity. In comparison, Buzau 4 benefited slightly more from the Algevit biostimulant, while Buzau 22 appeared to respond better to the combined treatment A $\times$ 300 mM NaCl, suggesting varietal differences in the capacity to utilize biostimulants for protection against saline stress in terms of the Fv/F0 ratio.

These data reinforce the conclusion that biostimulants are effective in partially reducing the effects of saline stress on photosystem II efficiency and that the response to biostimulants and stress varies between varieties. This information can assist in decision-making related to the cultivation and treatment of tomato varieties in high-salinity environments.

Treatment with Razormin improved photosynthetic performance in both tomato varieties compared to the control value, indicating a stimulation of photosynthetic activity due to the biostimulant. The impact of the treatment was stronger in the Buzau 22 variety, where the PI increased significantly from 2.28 to 3.89 (Figure 9).

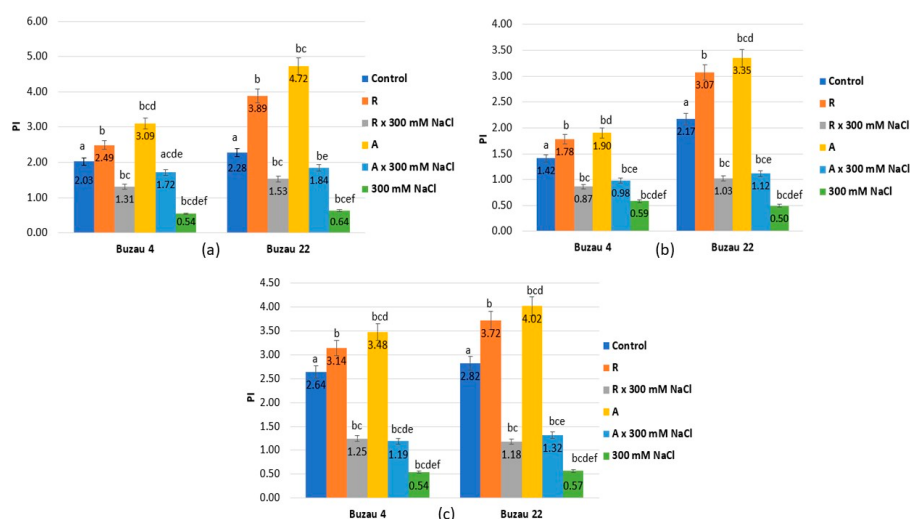


Figure 9. Effect of biostimulants on the performance index (PI) under saline stress following the first treatment (a), second treatment (b), and third treatment (c). Significant differences between treatments are denoted by different letters, as determined by the Tukey test. Error bars represent the standard deviation ($\pm$ SD).

Under the influence of the 300 mM NaCl treatment combined with Razormin, PI values decreased for both varieties (1.31 for Buzau 4 and 1.53 for Buzau 22) but remained higher than those in the 300 mM NaCl-only treatment (0.54 for Buzau 4 and 0.64 for Buzau 22). This indicates that partial protection was provided by the Razormin treatment, although its effectiveness decreased in the face of high saline stress. The treatment with Algevit led to an even more pronounced increase in PI (3.09 for Buzau 4 and 4.72 for Buzau 22) for both varieties compared to Razormin (2.49 for Buzau 4 and 3.89 for Buzau 22), suggesting that Algevit is more effective in stimulating photosynthetic activity. The increase was more evident in the Buzau 22 variety.

The Algevit treatment under 300 mM NaCl stress resulted in higher PI values than the stress condition without treatment, and slightly higher than in the R $\times$ 300 mM NaCl treatment. Thus, Algevit offers more effective protection than Razormin under saline stress.

The high saline stress of 300 mM of NaCl caused a drastic decrease in PI for both varieties, indicating severe impairment of photosynthetic activity.

After the second treatment, Buzau 22 continued to demonstrate superior photosynthetic capacity and better resistance to saline stress, especially in the presence of biostimulants. However, the decrease in PI indicates a greater vulnerability to prolonged stress in the absence of these treatments. The biostimulant Algevit was superior to Razormin in maintaining PI under stress conditions, confirming that it provides more effective and longer-lasting protection (Figure 9). The lower PI values (ranged from 0.50 to 3.35) after the second treatment reflect the cumulative impact of saline stress, suggesting that in order to maintain photosynthetic efficiency over time, periodic treatments may be necessary, and possibly, an increased dosage of biostimulants.

After the third treatment, the PI values under control conditions were higher than in previous treatments (ranged from 2.64 to 2.82) suggesting a potential recovery capacity and an enhancement of photosynthetic capacity in the absence of saline stress. Buzau 22 remained slightly more efficient, although the difference between the varieties was reduced, indicating that both varieties perform well under optimal conditions. The Razormin treatment continued to increase PI (ranged from 3.14 for Buzau 4 to 3.72 for Buzau 22) compared to the control, with values higher than those observed after the second treatment, indicating the cumulative efficacy of the biostimulant. Buzau 22 responded better to the treatment, showing a higher PI, confirming that this variety is more receptive to biostimulants under non-stress conditions (Figure 9).

Under 300 mM NaCl saline stress, PI values for both varieties decreased significantly but were slightly higher than in previous treatments, suggesting partial adaptation to stress. However, the effect of Razormin was limited under saline stress, with only a marginal improvement in mitigating the NaCl-induced stress. The biostimulant Algevit resulted in the highest PI values for both varieties (ranging from 3.48 to 4.02), indicating that it continued to be more effective than Razormin (ranging from 3.14 to 3.72) in stimulating photosynthetic activity. Buzau 22, in particular, benefited more from this treatment, and the higher PI response suggests that Algevit amplified photosynthetic capacity even after repeated treatments.

For plants in the A $\times$ 300 mM NaCl variant, PI values were higher than those in the Razormin treatment under saline stress, confirming that Algevit offers better protection against saline stress. While the values were lower than under non-saline conditions, Algevit appears to partially protect PSII; Buzau 22 continued to show a slightly higher PI value, suggesting a mild adaptability to saline stress with the support of the biostimulant. In the plants from the 300 mM NaCl variant, PI remained low for both varieties (0.54 for Buzau 4 and 0.57 for Buzau 22) similar to the values seen in previous treatments. This indicates that the 300 mM NaCl saline stress severely affected photosynthetic activity in the absence of biostimulant treatments and that this low value remained constant, suggesting a limited capacity of plants to adapt to prolonged saline stress.

In conclusion, the slightly higher PI values observed in the third treatment under saline-stress conditions suggest a limited adaptation. However, the presence of biostimulants, especially Algevit, remains crucial in maintaining a minimum level of photosynthetic performance.

3.5. Effect of Biostimulants on Proline Content in Tomato Plants Under Saline Stress

The very low proline values in the control group (0.095 for Buzau 4 and 0.099 for Buzau 22) for both tomato varieties suggest that, in absence of stress, plants do not accumulate significant amounts of proline.

Treatment with Razormin led to a notable increase in proline levels in both varieties (0.295 for Buzau 4 and 0.349 to Buzau 22), indicating that Razormin may stimulate proline synthesis (Table 1).

Table 1. Proline content in tomato leaves under saline conditions and biostimulant treatments. Distinct letters within a column represent significant differences between treatments, based on the Tukey test ($p < 0.05$).

Proline Content (nmol mg ^{−1} FW) Following the Third Treatment		
Variants	Buzau 4	Buzau 22
Control	0.095 ^a	0.099 ^a
R	0.295 ^a	0.349 ^b
R × 300 mM NaCl	0.868 ^{bc}	0.998 ^{bc}
A	0.345 ^{bd}	0.449 ^{bd}
A × 300 mM NaCl	0.903 ^{bce}	1.03 ^{bce}
300 mM NaCl	0.695 ^{bcde}	0.799 ^{bce}

Tomato plants in the 300 mM NaCl group exhibited a considerable increase in proline content (0.695 for Buzau 4 and 0.799 for Buzau 22) compared to the control group, although the levels were significantly lower than those observed in the R × 300 mM NaCl (0.868 for Buzau 4 and 0.998 for Buzau 22) and A × 300 mM NaCl groups (0.903 for Buzau 4 and 1.03 for Buzau 22). This suggests that while salt stress (300 mM NaCl) leads to a significant accumulation of proline, the biostimulants (Razormin and Algevit) mitigate the impact of salinity by further increasing proline levels.

When compared to the R and A groups, plants in the 300 mM NaCl group showed a higher proline content; however, the values were still much lower compared to the significant differences observed between the control group and 300 mM NaCl treatment. This observation was consistent across both varieties.

Plants in the R × 300 mM NaCl group showed a significant accumulation of proline, suggesting that Razormin helps to manage salt stress by increasing proline levels. Similarly, plants in the A × 300 mM NaCl group also exhibited a significant proline accumulation, indicating that Algevit has a similar efficiency in promoting proline synthesis under stress conditions.

4. Discussion

The 300 mM NaCl treatment had a significant negative impact on plant height; however, this effect was partially mitigated by the application of Razormin and, particularly, Algevit. An analysis of tomato plant height following the three treatments indicated that the biostimulant Algevit was the most effective in promoting plant growth, both under normal conditions and in combination with 300 mM of NaCl. The two studied varieties, Buzau 4 and Buzau 22, exhibited similar responses to most treatments, although Buzau 22 appeared to be slightly more sensitive to the salinity stress induced by NaCl compared to Buzau 4. Similar findings, showing that biostimulants can enhance plant growth under saline stress conditions, have also been reported by other authors in the scientific literature [19–22].

Saline stress can induce flower abortion in various plant species, including tomatoes. Excessive salinity disrupts the osmotic and nutritional balance of plants, which can significantly reduce their growth and development. In the case of tomato plants, saline stress negatively affects both the formation and retention of flowers, often leading to their abortion before they can develop into fruits [23–25].

An additional biometric parameter assessed in this research was the number of flowers. Following the three treatment applications, the data revealed that use of the biostimulants

Algevit and Razormin, in combination with NaCl, appeared to reduce the negative impact of salinity on flower production when compared to the NaCl-only treatment. These findings suggest that biostimulants might offer partial protection against saline stress, which typically leads to flower drop [23–25].

In this study, the number of fruits was also monitored. It was observed that the tomatoes of both varieties in the 300 mM NaCl variant were severely affected by salinity; in this context, the number of fruits decreased significantly compared to the other variants. Moreover, many studies have shown the negative impact of salinity stress on the number of fruits per plant [26–28].

Similar to the previous biometric measurements, the treatments with Razormin and Algevit stimulated an increase in fruit weight. In cases where the saline solution was also applied ($A \times 300$ and $R \times 300$), the fruit weight was higher compared to the variant treated only with a 300 mM saline solution. These results demonstrate once again that the two studied biostimulants enhance tolerance to saline stress [26–28].

Salinity significantly influences the chlorophyll content in plant leaves; this effect has been extensively documented in the scientific literature. Saline stress caused by high NaCl concentrations disrupts the physiological processes of plants, leading to a reduction in chlorophyll synthesis [29,30]. Osmotic stress results in water loss from cells, limiting chlorophyll production. Additionally, salinity interferes with the uptake of the essential nutrients (potassium, magnesium, nitrogen) required for chlorophyll synthesis, which can lead to leaf chlorosis. Moreover, the accumulation of excess salt triggers oxidative stress through the production of reactive oxygen species (ROS), which can impair chlorophyll and other cellular components [31,32]. These effects can be measured using SPAD devices, which assess chlorophyll levels [33]. Studies show a consistent decline in chlorophyll content under high-salinity conditions, negatively affecting plant growth and photosynthetic efficiency [34].

In our experiment, after the application of the three treatments, a significant decrease in chlorophyll content was observed under the influence of saline stress (300 mM NaCl) and saline stress combined with the Razormin treatment ($R \times 300$ mM NaCl), with this decrease being much more pronounced than in the previous treatments. This suggests that saline stress exerts a strong and long-term negative impact on chlorophyll content and that the Razormin treatment is insufficient to counteract these effects. In contrast, the Algevit treatment continued to be effective in both varieties, increasing chlorophyll levels compared to those of the control. Even after the third treatment, the combination of Algevit and 300 mM NaCl maintained its effects better than the combination of Razormin and 300 mM NaCl, indicating an improvement in tolerance to saline stress. This suggests that, due to its chemical composition, Algevit is able to significantly mitigate the negative effects that 300 mM NaCl has on chlorophyll content. Biostimulants have demonstrated the potential to reduce chlorophyll degradation in tomatoes subjected to saline stress. Several studies suggest that biostimulants, such as Algevit and Razormin, can enhance plant tolerance to abiotic stress, including salinity. They help to improve chlorophyll content and protect plants from the oxidative damage caused by high salt concentrations [35,36].

Stomatal conductance serves as an indicator of the plant's tolerance to osmotic stress [37]. Stomatal conductance is a critical physiological parameter that is significantly affected by saline stress. When plants are exposed to high salinity, such as with NaCl treatments, they often experience a reduction in stomatal conductance [38]. This occurs as a protective response to minimize water loss and reduce further dehydration in the plant cells. The decrease in stomatal conductance limits transpiration, which in turn helps the plant to conserve water under the osmotic stress caused by the salt.

Salinity-induced stress disrupts various physiological processes in plants, including nutrient uptake and photosynthesis [39]. To cope with this stress, plants frequently close their stomata to minimize water loss, a response that is especially evident in species vulnerable to high salinity. Studies have shown that plants, such as tomatoes (*Solanum lycopersicum*) and other crops, exhibit reduced stomatal conductance under saline conditions, with sensitive varieties showing more pronounced decreases.

In addition to this, the extent of stomatal closure is also influenced by the plant's tolerance to salinity, with more salt-tolerant varieties maintaining better stomatal function under stress [40]. Biostimulants can help to prevent the decline in stomatal conductance in plants exposed to saline stress. Saline stress negatively affects stomatal function, often causing partial or complete stomatal closure, which reduces gas exchange and impairs photosynthesis [41].

The drastic decrease in stomatal conductance in the plants of the Buzau 4 and Buzau 22 varieties under the 300 mM NaCl treatment indicates a strong conservation response to saline stress, characterized by a marked stomatal closure to reduce water loss. Buzau 22 exhibited the most significant sensitivity in this case, having the lowest conductance value across all treatments. The protective effect of the biostimulants on the stomata was also evident in the combined NaCl treatments, although it was more limited for Buzau 22, indicating a possible higher sensitivity of this variety to saline stress. Exclusive treatment with NaCl showed a dramatic reduction in stomatal conductance, particularly for Buzau 22, suggesting a significant impairment of stomatal mechanisms due to repeated exposure to high salinity. Overall, Buzau 4 appears to tolerate the combined effects of biostimulants and saline stress better than Buzau 22, which demonstrated greater sensitivity to prolonged NaCl exposure.

Following the three treatments, it can be concluded that the Buzau 4 variety exhibits better tolerance to saline stress, especially when treated with the biostimulant Algevit, which maintains its beneficial effect on stomatal conductance. The Buzau 22 variety, although initially showing slightly higher conductance under control conditions, is more sensitive to saline stress and shows a weaker response to the combined effects of biostimulants and NaCl, especially after multiple treatments. These results suggest that biostimulants, particularly Algevit, may be effective in mitigating the effects of saline stress on stomatal conductance, especially in varieties with higher intrinsic salt tolerance such as Buzau 4.

This research also explored the impact of biostimulants on chlorophyll fluorescence parameters (F_v/F_m , F_v/F_0 , and PI) in the tomato varieties Buzau 4 and Buzau 22 under saline stress. The evaluation of chlorophyll fluorescence is a crucial method in plant physiology studies, offering insightful data on the condition of PSII [42]. The F_v/F_m ratio is a crucial measurement in assessing chlorophyll fluorescence and, by extension, the photosynthetic efficiency of plants. The values of this ratio provide information about the health and integrity of photosystem II (PSII), where higher values indicate high photosynthetic efficiency and a healthy plant state, while lower values suggest stress or photosynthetic damage [43–45]. The F_v/F_0 ratio is a chlorophyll fluorescence parameter commonly used to assess the health and efficiency of photosystem II (PSII) in plants [46]. It acts as a measure of the plant's efficiency in converting light energy into chemical energy within PSII [46–48]. The higher this ratio, the better the photosynthetic efficiency of PSII, indicating healthy plants that are unaffected by stress.

The photosynthetic performance index (PI) is a fluorescence parameter that reflects the efficiency of photosystem II (PSII) and is sensitive to changes induced by stress and treatments. It is calculated based on several fluorescence parameters, providing an overview of the photosynthetic capacity and the general health status of the plant [17].

Both Razormin and Algevit treatments demonstrated positive effects on the photosynthetic efficiency of tomato plants, as indicated by improvements in the Fv/Fm and Fv/F0 ratios. Algevit showed a more pronounced impact, particularly under saline-stress conditions, suggesting its superior ability to enhance PSII activity and overall photosynthetic performance.

The two tomato varieties, Buzau 4 and Buzau 22, exhibited different levels of sensitivity to saline stress. Buzau 22 generally maintained slightly higher values for chlorophyll fluorescence parameters (Fv/Fm and PI), indicating better photosynthetic resilience and a more robust response to the applied biostimulants compared to Buzau 4.

Although both biostimulants provided significant protection against the negative effects of high salinity (300 mM NaCl), this protection was not complete. The observed values under stress conditions were still below those seen in the control plants, highlighting the persistent detrimental effects of salinity on PSII function, even with biostimulant application. Repeated applications of biostimulants led to sustained improvements in photosynthetic indicators across multiple treatment cycles. This suggests that a consistent and periodic application of biostimulants, like Algevit, may help to maintain photosynthetic efficiency over time, especially under stress conditions.

The ability of biostimulants, particularly Algevit, to mitigate the impact of saline stress points to their potential use as part of integrated crop management strategies. Their application could be beneficial in regions prone to salinity issues, aiding in the maintenance of plant health and productivity.

The PI values highlighted the enhanced photosynthetic capacity provided by biostimulants. Algevit, in particular, was more effective in stimulating PI, even under high saline stress, suggesting that it supports better recovery and stabilization of photosynthetic processes.

Proline is an amino acid crucial for helping plants to cope with a variety of abiotic stresses such as high salinity, temperature extremes, and drought. It plays a key role in osmotic regulation, enabling plants to retain water and maintain turgor pressure, even in saline environments [49]. Additionally, proline helps to stabilize proteins and membrane structures, protecting them from denaturation or degradation under stress conditions [50,51]. Additionally, proline exhibits antioxidant activity, helping to mitigate the buildup of reactive oxygen species (ROS), which are detrimental by-products produced during cellular metabolism under stress [52]. When conditions return to normal, proline can be quickly broken down, providing a source of energy and the carbon precursors essential for cellular recovery.

The synthesis and accumulation of proline are crucial adaptive mechanisms for plants in hostile environments, enabling them to maintain functionality and survive. Proline can serve as a biomarker for abiotic stress, and its measurement could be used to select plants that are more resilient to stress, contributing to the development of stress-resistant crops [53]. Therefore, determining proline concentrations in plants subjected to salt stress provides valuable information about the levels of stress experienced by the plants, as well as the effectiveness of their defense and adaptation mechanisms. Monitoring proline can be a valuable tool in both research and agriculture to develop and select crops that are more resilient to salinity [49].

The results of the proline content analysis indicated that the 300 mM NaCl treatment induces a significant accumulation of proline in both varieties, reflecting an adaptive response to stress. Both Razormin and Algevit were effective in increasing proline levels, suggesting that these treatments may help plants to better cope with osmotic stress by increasing the concentration of vacuolar sap. By activating defense mechanisms, both

Algevit and Razormin contributed to a higher accumulation of proline, thereby improving plant resistance to abiotic stress.

Proline plays a fundamental role in plant adaptation to osmotic stress [54]; the use of biostimulants, like Razormin and Algevit, can enhance plant tolerance to salt-stress conditions.

5. Conclusions

The findings of this study indicate that the use of biostimulants, especially Algevit, positively impacts tomato plants subjected to saline stress.

Algevit proved to be more effective than Razormin in alleviating the adverse effects of salinity, contributing to increased plant height, maintaining higher chlorophyll content, and enhancing photosynthetic efficiency.

The two tomato varieties, Buzau 4 and Buzau 22, showed similar responses to the treatments; however, Buzau 4 exhibited greater tolerance to saline stress, especially when treated with the biostimulant Algevit. These differences suggest genetic variability in the capacity for adaptation to abiotic stress, which could be leveraged for the selection of more resilient cultivars.

The application of biostimulants, particularly Algevit, emerges as a promising strategy within integrated crop management, especially in regions with saline-affected soils. The regular use of these products can help to maintain plant health and enhance yield, offering a sustainable solution for agriculture under abiotic stress conditions.

Author Contributions: Conceptualization, M.C.; methodology, M.C., C.S. and C.D.J.; software, M.C. and Ş.O.; validation, M.C., A.E.M., C.S., Ş.O. and C.D.J.; formal analysis, M.C. and C.S.; investigation, M.C.; resources, M.C. and C.D.J.; data curation, M.C.; writing—original draft preparation, M.C.; writing—review and editing, M.C.; funding acquisition, M.C. and C.D.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Cuartero, J.; Fernández-Muñoz, R. Tomato and salinity. *Sci. Hortic.* **1998**, *78*, 83–125. [\[CrossRef\]](#)
2. Rouphael, Y.; Colla, G. Synergistic Biostimulatory Action: Designing the Next Generation of Plant Biostimulants for Sustainable Agriculture. *Front. Plant Sci.* **2018**, *9*, 1655. [\[CrossRef\]](#)
3. Yakhin, O.I.; Lubyantsev, A.A.; Yakhin, I.A.; Brown, P.H. Biostimulants in Plant Science: A Global Perspective. *Front. Plant Sci.* **2017**, *7*, 2049. [\[CrossRef\]](#) [\[PubMed\]](#)
4. Ashraf, M.; Foolad, M.R. Roles of Glycine Betaine and Proline in Improving Plant Abiotic Stress Resistance. *Environ. Exp. Bot.* **2007**, *59*, 206–216. [\[CrossRef\]](#)
5. Calvo, P.; Nelson, L.; Kloepper, J.W. Agricultural uses of plant biostimulants. *Plant Soil.* **2014**, *383*, 3–41. [\[CrossRef\]](#)
6. Taiz, L.; Zeiger, E.; Moller, I.M.; Murphy, A. Abiotic stress. In *Plant Physiology and Development*, 6th ed.; Sinauer Associates, Inc.: Sunderland, MA, USA, 2015; pp. 731–760.
7. Richardson, A.D.; Shane, P.D.; Graeme, P.B. An evaluation of noninvasive methods to estimate foliar chlorophyll content. *New Phytol.* **2002**, *153*, 85–194. [\[CrossRef\]](#)
8. Kalaji, H.M.; Oukarroum, A.; Alexandrov, V.; Kouzmanova, M.; Brestic, M.; Zivcak, M.; Samborska, I.A.; Cetner, M.D.; Al-lakhverdiev, S.I.; Goltsev, V. Identification of nutrient deficiency in maize and tomato plants by in vivo chlorophyll a fluorescence measurements. *Plant Physiol. Biochem.* **2014**, *81*, 16–25. [\[CrossRef\]](#)
9. Chaves, M.M.; Flexas, J.; Pinheiro, C. Photosynthesis under drought and salt stress: Regulation mechanisms from whole plant to cell. *Ann. Bot.* **2009**, *103*, 551–560. [\[CrossRef\]](#) [\[PubMed\]](#)
10. Ashraf, M.; Harris, P.J.C. Photosynthesis under Stressful Environments: An Overview. *Photosynthetica* **2013**, *51*, 163–190. [\[CrossRef\]](#)

11. Santander, C.; Vidal, G.; Ruiz, A.; Vidal, C.; Cornejo, P. Salinity Eustress Increases the Biosynthesis and Accumulation of Phenolic Compounds That Improve the Functional and Antioxidant Quality of Red Lettuce. *Agronomy* **2022**, *12*, 598. [\[CrossRef\]](#)
12. Sumalan, R.M.; Ciulca, S.I.; Poiana, M.A.; Moigradean, D.; Radulov, I.; Negrea, M.; Crisan, M.E.; Copolovici, L.; Sumalan, R.L. The Antioxidant Profile Evaluation of Some Tomato Landraces with Soil Salinity Tolerance Correlated with High Nutraceutical and Functional Value. *Agronomy* **2020**, *10*, 500. [\[CrossRef\]](#)
13. Ilahy, R.; Tlili, I.; Pék, Z.; Montefusco, A.; Daoood, H.; Azam, M.; Siddiqui, M.W.; R'him, T.; Durante, M.; Lenucci, M.S.; et al. Effect of Individual and Selected Combined Treatments with Saline Solutions and Spent Engine Oil on the Processing Attributes and Functional Quality of Tomato (*Solanum lycopersicon* L.) Fruit: In Memory of Professor Leila Ben Jaballah Radhouane (1958–2021). *Front. Nutr.* **2022**, *28*, 9. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Oliveira, C.E.d.S.; Zoz, T.; Seron, C.d.C.; Boleta, E.H.M.; de Lima, B.H.; Souza, L.R.R.; Pedrinho, D.R.; Matias, R.; Lopes, C.d.S.; Neto, S.S.d.O.; et al. Can saline irrigation improve the quality of tomato fruits? *Agron. J.* **2022**, *114*, 900–914. [\[CrossRef\]](#)
15. Available online: <https://diaplant.ro/produse/ingrasaminte/ingrasaminte-foliare/stimulator-razormin/> (accessed on 11 November 2024).
16. Available online: <https://seminteplante.ro/7016-algevit-biostimulator-pe-baza-de-alge-marine-1-litru.html> (accessed on 11 November 2024).
17. Maxwell, K.; Johnson, G.N. Chlorophyll fluorescence—A practical guide. *J. Exp. Bot.* **2000**, *51*, 659–668. [\[CrossRef\]](#)
18. Bates, L.S.; Waldren, R.P.; Teare, I.D. Rapid determination of free proline for water-stress studies. *Plant Soil.* **1973**, *39*, 205–207. [\[CrossRef\]](#)
19. Carillo, P.; Gibbon, Y. PROTOCOL: Extraction and Determination of Proline. Prome-TheusWiki. 2011. Available online: https://www.researchgate.net/publication/211353600_PROTOCOL_Extraction_and_determination_of_proline (accessed on 11 November 2024).
20. Liu, M.; Wang, G.; Liu, G. Biostimulants Promote the Sedimentation of Salts to Restore Tomato Plant Growth Under Salt Stress. *J. Soil Sci. Plant Nutr.* **2023**, *23*, 1830–1844. [\[CrossRef\]](#)
21. Gedeon, S.; Ioannou, A.; Balestrini, R.; Fotopoulos, V.; Antoniou, C. Application of Biostimulants in Tomato Plants (*Solanum lycopersicum*) to Enhance Plant Growth and Salt Stress Tolerance. *Plants* **2022**, *11*, 3082. [\[CrossRef\]](#)
22. Zuzunaga-Rosas, J.; González-Orenga, S.; Tofei, A.M.; Boscaiu, M.; Moreno-Ramón, H.; Ibáñez-Asensio, S.; Vicente, O. Effect of a Biostimulant Based on Polyphenols and Glycine Betaine on Tomato Plants' Responses to Salt Stress. *Agronomy* **2022**, *12*, 2142. [\[CrossRef\]](#)
23. Ghanem, M.E.; van Elteren, J.; Albacete, A.; Quinet, M.; Martínez-Andújar, C.; Kinet, J.M.; Pérez-Alfocea, F.; Lutts, S. Impact of salinity on early reproductive physiology of tomato (*Solanum lycopersicum*) in relation to a heterogeneous distribution of toxic ions in flower organs. *Funct. Plant Biol.* **2009**, *36*, 125–136. [\[CrossRef\]](#) [\[PubMed\]](#)
24. Bigot, S.; Pongrac, P.; Šala, M.; van Elteren, J.T.; Martínez, J.P.; Lutts, S.; Quinet, M. The Halophyte Species *Solanum chilense* Dun. Maintains Its Reproduction despite Sodium Accumulation in Its Floral Organs. *Plants* **2022**, *11*, 672. [\[CrossRef\]](#) [\[PubMed\]](#)
25. Zhang, P.; Senge, M.; Dai, Y. Effects Of Salinity Stress At Different Growth Stages On Tomato Growth, Yield And Water Use Efficiency. *Commun. Soil Sci. Plant Anal.* **2017**, *48*, 624–634. [\[CrossRef\]](#)
26. Zhang, P.; Senge, M.; Dai, Y. Effects of Salinity Stress on Growth, Yield, Fruit Quality, and Water Use Efficiency of Tomato under Hydroponics System. *Rev. Agric. Sci.* **2016**, *4*, 46–55. [\[CrossRef\]](#)
27. Ghoname, A.A.; Fawzy, Z.F.; El-Bassionya, A.M. Adverse Effect of Salinity Stress on Tomato Fruit Quality. *Acta Sci. Agric.* **2019**, *3*, 66–69. [\[CrossRef\]](#)
28. Roșca, M.; Mihalache, G.; Stoleru, V. Tomato responses to salinity stress: From morphological traits to genetic changes. *Front. Plant Sci.* **2023**, *10*, 1118383. [\[CrossRef\]](#)
29. Okon, O.G. Effect of Salinity on Physiological Processes in Plants. In *Microorganisms in Saline Environments: Strategies and Functions*; Giri, B., Varma, A., Eds.; Soil Biology; Springer: Cham, Switzerland, 2019; Volume 56, pp. 237–262. [\[CrossRef\]](#)
30. Wang, X.; Chen, Z.; Sui, N. Sensitivity and responses of chloroplasts to salt stress in plants. *Front. Plant Sci.* **2024**, *15*, 1374086. [\[CrossRef\]](#)
31. Hao, S.; Wang, Y.; Yan, Y.; Liu, Y.; Wang, J.; Chen, S.A. Review on Plant Responses to Salt Stress and Their Mechanisms of Salt Resistance. *Horticulturae* **2021**, *7*, 132. [\[CrossRef\]](#)
32. El-Dakak, R.A.; Badr, R.H.; Zeineldein, M.H. Effect of chilling and salinity stress on photosynthetic performance and ultrastructure of chloroplast in faba beans (*Vicia faba* L.) leaves. *Rend. Lincei Sci. Fis. Nat.* **2023**, *34*, 447–456. [\[CrossRef\]](#)
33. Ling, Q.; Huang, W.; Jarvis, P. Use of a SPAD-502 meter to measure leaf chlorophyll concentration in *Arabidopsis thaliana*. *Photosynth. Res.* **2011**, *107*, 209–214. [\[CrossRef\]](#)
34. Sharma, M.; Tisarum, R.; Kohli, R.K. Inroads into saline-alkaline stress response in plants: Unravelling morphological, physiological, biochemical, and molecular mechanisms. *Planta* **2024**, *259*, 130. [\[CrossRef\]](#) [\[PubMed\]](#)
35. Meddich, A. Biostimulants for Resilient Agriculture—Improving Plant Tolerance to Abiotic Stress: A Concise Review. *Gesunde Pflanz.* **2023**, *75*, 709–727. [\[CrossRef\]](#)

36. Ruzzi, M.; Colla, G.; Roupael, Y. Editorial: Biostimulants in agriculture II: Towards a sustainable future. *Front. Plant Sci.* **2024**, *15*, 1427283. [\[CrossRef\]](#)
37. Lungoci, C.; Motrescu, I.; Filipov, F.; Jitareanu, C.D.; Teliban, G.-C.; Ghitau, C.S.; Puiu, I.; Robu, T. The Impact of Salinity Stress on Antioxidant Response and Bioactive Compounds of *Nepeta cataria* L. *Agronomy* **2022**, *12*, 562. [\[CrossRef\]](#)
38. Brugnoli, E.; Lauteri, M. Effects of Salinity on Stomatal Conductance, Photosynthetic Capacity, and Carbon Isotope Discrimination of Salt-Tolerant (*Gossypium hirsutum* L.) and Salt-Sensitive (*Phaseolus vulgaris* L.) C3 Non-Halophytes. *Plant Physiol.* **1991**, *95*, 628–635. [\[CrossRef\]](#)
39. Kusvuran, S. Effects of drought and salt stresses on growth, stomatal conductance, leaf water and osmotic potentials of melon genotypes (*Cucumis melo* L.). *Afr. J. Agric. Res.* **2012**, *7*, 775–781.
40. Bologa (Covașă), M.; Jităreanu, C.D.; Slabu, C.; Marta, A.E. The influence of salt stress on stomatal conductance of some tomato local cultivars from N-E Romania. *Bul. USAMV Iași Științific Pap. Ser. Hortic.* **2016**, *59*, 45–47.
41. İkiz, B.; Dasgan, H.Y.; Balik, S. The use of biostimulants as a key to sustainable hydroponic lettuce farming under saline water stress. *BMC Plant Biol.* **2024**, *24*, 808. [\[CrossRef\]](#) [\[PubMed\]](#)
42. Jańczak-Pieniżek, M.; Pikuja, W.; Pawlak, R.; Dryga's, B.; Szpunar-Krok, E. Physiological Response of *Miscanthus sinensis* (Anderss.) to Biostimulants. *Agriculture* **2024**, *14*, 33. [\[CrossRef\]](#)
43. Björkman, O.; Demmig, B. Photon yield of O₂ evolution and chlorophyll fluorescence characteristics at 77 K among vascular plants of diverse origins. *Planta* **1987**, *170*, 489–504. [\[CrossRef\]](#) [\[PubMed\]](#)
44. Lichtenthaler, H.K. Chlorophylls and carotenoids: Pigments of photosynthetic biomembranes. *Methods Enzymol. Acad. Press.* **1987**, *148*, 350–382.
45. Krause, A.G.H.; Weis, E. Chlorophyll fluorescence and photosynthesis: The basics. *Annu. Rev. Plant Biol.* **1991**, *42*, 313–349. [\[CrossRef\]](#)
46. Strasser, R.J.; Tsimilli-Michael, M.; Srivastava, A. Analysis of the Chlorophyll a Fluorescence Transient. In *Chlorophyll a Fluorescence*; Papageorgiou, G.C., Govindjee, Eds.; Advances in Photosynthesis and Respiration; Springer: Dordrecht, The Netherlands, 2004; Volume 19. [\[CrossRef\]](#)
47. Ashraf, M.P.J.C.; Harris Phil, J.C. Potential biochemical indicators of salinity tolerance in plants. *Plant Sci.* **2004**, *166*, 3–16. [\[CrossRef\]](#)
48. Kalaji, H.M.; Govindjee, B.; Kościelniak, J.; Żuk-Golaszewska, K.Z. Effects of salt stress on photosystem II efficiency and CO₂ assimilation of two Syrian barley landraces. *Environ. Exp. Bot.* **2011**, *73*, 64–72. [\[CrossRef\]](#)
49. Acosta-Motos, J.R.; Ortuño, M.F.; Bernal-Vicente, A.; Diaz-Vivancos, P.; Sanchez-Blanco, M.J.; Hernandez, J.A. Plant Responses to Salt Stress: Adaptive Mechanisms. *Agronomy* **2017**, *7*, 18. [\[CrossRef\]](#)
50. Parida, A.K.; Das, A.B. Salt tolerance and salinity effects on plants: A review. *Ecotoxicol. Environ. Saf.* **2005**, *60*, 324–349. [\[CrossRef\]](#)
51. Verbruggen, N.; Hermans, C. Proline accumulation in plants: A review. *Amino Acids* **2008**, *35*, 753–759. [\[CrossRef\]](#) [\[PubMed\]](#)
52. Hayat, S.; Hayat, Q.; Alyemeni, M.N.; Wani, A.S.; Pichtel, J.; Ahmad, A. Role of proline under changing environments: A review. *Plant Signal. Behav.* **2012**, *7*, 1456–1466. [\[CrossRef\]](#) [\[PubMed\]](#)
53. Kaur, G.; Asthir, B.J.B.P. Proline: A key player in plant abiotic stress tolerance. *Biol. Plant.* **2015**, *59*, 609–619. [\[CrossRef\]](#)
54. Zhu, J.K. Regulation of ion homeostasis under salt stress. *Curr. Opin. Plant Biol.* **2003**, *6*, 441–445. [\[CrossRef\]](#)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.