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The impact of spraying the growth regulators "Gibberellin and Seasol" on some growth indicators and chemical content of local Pomegranate seedlings (*Punica granatum* L.).

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I. Abstract

The present study evaluated the response of local pomegranate seedlings (Punica granatum L.) to foliar application of the growth regulator gibberellin and the seaweed extract Seasol, with particular emphasis on vegetative growth parameters and leaf chemical composition. The results revealed that gibberellin spraying produced significant improvements in most of the studied vegetative traits, including plant height, stem diameter, number of leaves, and leaf area, which reached 118.65 cm, 12.23 mm, 57.16 leaves plant^{-1}, and 23.33 cm^2, respectively. In contrast, Seasol application at 8 ml L^{-1} was markedly effective in enhancing branch formation, recording the highest value of 14.77 branches plant^{-1}. The combined application of gibberellin and Seasol at 8 ml L^{-1} for each factor showed a significant interaction effect and resulted in the highest values for all investigated vegetative characteristics, reaching 133.67 cm for plant height, 18.80 mm for stem diameter, 39.99 leaves plant^{-1}, 30.87 cm^2 for leaf area, and 13.65 branches plant^{-1}. Regarding the chemical composition of leaves, foliar spraying with gibberellin at 8 ml L^{-1} significantly increased nitrogen, potassium, carbohydrate, and chlorophyll contents, which reached 3.18%, 2.12%, 20.12%, and 3.63 SPAD, respectively. Meanwhile, Seasol at the same concentration was superior in increasing leaf phosphorus content, reaching 0.39%. The interaction between gibberellin and Seasol at 8 ml L^{-1} also recorded the most pronounced improvement in the studied chemical traits, as leaf nitrogen, phosphorus, potassium, carbohydrate, and chlorophyll contents reached 3.99%, 0.38%, 2.76%, 23.51%, and 23.60 SPAD, respectively. Overall, the findings indicate that the combined foliar application of gibberellin and Seasol, particularly at 8 ml L^{-1}, can effectively enhance vegetative growth and improve the nutritional and physiological status of local pomegranate seedlings.

Key words: Punica granatum,Seasol,Gibberelin,pomegranate seedlings

II. Introduction

Pomegranate (*Punica granatum* L.) is an important deciduous fruit species belonging to the family Lythraceae. Under natural growth conditions, the plant usually develops as a compact, multi-stemmed shrub with several main branches emerging close to the soil surface (Singh *et al*., 2006; Holland *et al*., 2009). However, when cultivated under appropriate horticultural management, it may be trained to grow as a small tree, commonly reaching approximately 5 m in height, and sometimes exceeding this under favorable environmental conditions (Levin, 2006). The crop is well adapted to regions characterized by long, hot, and dry growing seasons, conditions that support the production of fruits with desirable quality attributes. Although Central Asia is generally considered the probable center of origin of pomegranate, its cultivation has expanded widely and it is now grown in many regions of the world, including the Mediterranean Basin, Asia, and California. Besides being an important fruit crop, pomegranate has been recognized as a traditional medicinal crop since time immemorial because of the occurrence of various bioactive phytochemicals in its fruits, flowers, bark, and leaves. These compounds are linked to antimicrobial, blood pressure control, and wound-healing effects. Pomegranate fruits are also very rich in antioxidant compounds such as polyphenols, flavonoids, anthocyanins, vitamin C, tannins, fatty acids, and proline. Furthermore, they have proteins, carbohydrates, and essential mineral elements like potassium, calcium, phosphorus, and magnesium (Pareek *et al*., 2017; Wu and Tian, 2017; Pinilla *et al*., 2019).

Chemical fertilizers and modern intensive farming methods have led to a number of environmental issues (Carson, 2002). However, with the growing awareness of the harmful impact of excessive use of chemical fertilizers on the agricultural system, human health, and the environment, more attention has been given to low-input and organic farming systems (Abdelaziz *et al*., 2007). In view of this, a few studies have been undertaken for better management of fertilizers and optimization of agricultural practices to minimize environmental and health hazards (Shanahan *et al*., 2011; Singh and Guleria, 2013; Mechergui *et al*., 2016). Therefore, providing plants with nutrients using organic materials is an important element in sustainable agriculture (Singh and Guleria, 2013). Out of these, seaweed extracts are some of the most important sources that have been playing a major role in plant nutrition and growth in an environmentally friendly way (Khan *et al*., 2009; Selvam and Sivakumar, 2014). These extracts are biodegradable, non-toxic, and have low pollution potential. They also include a variety of beneficial components, such as macro- and micronutrients, fatty acids, vitamins, organic matter, and naturally occurring plant growth regulators (Neish and Bourgougnon, 2014).

Spraying leaves is now recognized as a sound farming practice to provide plants with macro- and micronutrients, plant hormones, and other bioactive chemicals. This process can provide a quick response compared to uptake from the roots, especially under soil conditions that can be limiting in availability and/or uptake. Plant growth regulators are widely used in agriculture due to their role in the regulation of various plant physiological parameters and their ability to enhance plant performance in various soil and environmental conditions. Growth regulators have been reported to improve vegetative and fruit growth traits of fruit trees when applied as foliar sprays (Rademacher, 2015). Also, this application can aid in the biosynthesis of hormones, nutrient assimilation, food production, and synthesis of key plant products like proteins and carbohydrates. Hence, foliar nutrient application is considered an important method in managing fruit plant growth (Valero *et al*., 2018). Foliar spraying has also been reported to have a great impact on plant parameters, such as increases of chlorophyll and Fe levels in pear plant tissues (Alheidary *et al*., 2020).

In contemporary agricultural practices, bioactive compounds such as gibberellin and Seasol have gained increasing attention due to their capacity to be readily absorbed through plant vegetative tissues. Seaweed extracts, in particular, are recognized for their beneficial effects on plant performance because they contain a broad range of macro- and micronutrients, as well as biologically active organic compounds, including growth-promoting hormones, amino acids, vitamins, betaines, cytokinins, and sterols. These constituents collectively contribute to improving plant nutritional status, stimulating vegetative growth, and enhancing yield and fruit quality across various plant species (ElSherpiny *et al*., 2022). Calvo *et al*. (2014) found that physiological and biochemical processes associated with nutrient uptake and plant growth can be affected by seaweed-based products. Gibberellic acid (GA3) is also widely applied to control a number of plant growth processes, especially the elongation of stems, by promoting cell division and expansion. In this context, Sałata *et al*. (2013) suggested that a higher plant quality might be related to higher physiological activity prior to the summer season. These compounds could also help with photosynthesis and plant sap flow to boost plant growth and metabolic activity.

Based on this, investigating foliar application of growth regulators and nutrient sources is a promising method to enhance root growth, side branching, nutrient uptake, and plant biosynthetic response. Such bioregulators as GA3 are among the recently adopted concepts in sustainable agriculture to promote plant growth without adverse environmental effects. GA3 is regarded as a key bioregulator because of its strong growth- and productivity-enhancing ability in a number of horticultural crops, and its ability to enhance physiological processes in plants, particularly under stress conditions. Thus, and in view of the present status of pomegranate production in Basrah Governorate and realizing its importance in production, the present investigation was designed to assess the effect of Gibberellin and Seasol foliar spray on some growth parameters and seedling leaf chemical content of pomegranate.

III. Materials and Methods

The current experiment was carried out in the shaded nursery of the Agricultural Research Station, College of Agriculture, University of Basrah, during the 2024–2025 growing season. One-year-old local pomegranate seedlings (*Punica granatum* L.) were obtained from a commercial nursery. Prior to the initiation of the experiment, the seedlings were carefully selected to ensure uniformity in age, plant height, and general vegetative vigor. Throughout the experimental period, all seedlings were maintained under similar cultural and management practices to minimize variation unrelated to the applied treatments.

The study was designed to test the effect of foliar spraying with two growth-regulating substances, Seasol and gibberellin, on local pomegranate seedlings. Gibberellin was used at three concentration levels (0, 6 and 8 ml L^{-1}), whereas Seasol was applied at the same concentration levels as per the experimental design. The selected seedlings were planted in suitable pots filled with a growth medium of fine sand and peat moss in the ratio 1:2. The following plant measurements and analyses were then conducted in the laboratories of the Department of Horticulture and Landscape Engineering, College of Agriculture, University of Basrah, for the experiment.

Before transplanting, the growing medium was subjected to physical and chemical characterization. Random soil samples were collected, thoroughly mixed to obtain a representative composite sample, air-dried for 72 hours, and then passed through a 2-mm sieve. The prepared samples were analyzed in the laboratories of the Department of Soil Science, College of Agriculture, University of Basrah. The principal physicochemical properties of the soil medium used in the experiment are presented in Table (1).

Table (1). Physicochemical properties of the soil medium used for the experimental cultivation.

Soil property	Unit / measurement basis	Value
Soil reaction (pH)	1:1 soil–water suspension	6.50
Electrical conductivity (EC)	$dS\ m^{-1}$	3.85
Available nitrogen	ppm	194.00
Available phosphorus	ppm	45.68
Available potassium	ppm	177.00
Organic matter	%	0.092
Sand	%	60.00
Silt	%	30.00
Clay	%	10.00
Textural class	—	Mixed soil

In addition, the peat moss used as part of the growth medium was characterized according to its chemical and physical properties. These properties are shown in Table(2).

Table (2). Physicochemical composition of the peat moss substrate employed in the experiment.

Parameter	Unit of measurement	Value
pH	1:1	5.0–6.0
Organic matter	%	75
Nitrogen (N)	$mg\ L^{-1}$	166
Phosphorus (P)	$mg\ L^{-1}$	200
Potassium (K)	$mg\ L^{-1}$	199

According to the manufacturer.

This study used a commercial organic fertilizer (Seasol) produced by Seasol International Pty Ltd., Australia, which is a liquid seaweed extract primarily from the brown alga Durvillaea potatorum. It is rich in several bioactive and nutritional constituents such as carbohydrates, natural growth-regulating substances, trace elements, alginates, and vitamins, which have the potential to enhance plant growth and physiological activity.

Table (3) Nutrient contents of Seaweed extract 'Seasol'

N%	P_2O_5%	K_2O%	Mg%	Ca%	Fe %	Cu%	S%	I%	Na%	Cl ppm	B ppm
0.22	0.58	4.3	0.04	0.098	0.03	0.000064	0.2	0.012	0.9	0.33	0.0013

According to the manufacturer.

We estimated characteristics:

A) Physical characteristics

At the termination of the experimental period, the vegetative growth attributes of pomegranate seedlings were evaluated using standard measurement procedures. Plant height was recorded in centimeters by measuring the distance from the soil surface to the uppermost point of the main stem using a measuring tape. The diameter of the main stem was determined in millimeters at a fixed height of 5 cm above the soil surface with the aid of a vernier caliper. In addition, the branches emerging from the main stem were counted manually for each seedling, and the results were expressed as number of branches per plant. Similarly, the number of leaves per plant was also manually counted and given as leaves plant^{-}1. Leaf area was estimated by using a scanner-based image analysis method as described by Fladung and Ritter, (1991) in cm^2. To this end, the leaf images were scanned and processed using Digimizer software, which converts the scanned optical image into a digital image and accurately calculates leaf surface area.

B. Chemical Characteristics

Leaves were collected from the middle part of the pomegranate seedlings, as the leaves in this zone are physiologically active and representative of the nutritional status of the plant. The leaves were collected and washed with water to remove dust and adhering particles; then they were placed in plastic bags, labeled and brought to the laboratory for analysis. The samples were then placed in a ventilated electric oven at 70°C in paper bags with holes until they reached constant weight. The plant material was dried, after which it was ground and placed in appropriate containers for chemical analysis. The leaf samples were dried, ground and digested as described by Chresser and Parson, (1979).

Total N percentage of pomegranate leaves was analysed by the Micro-Kjeldahl method as described by Page *et al*.(1982).The concentration of phosphorus was determined colorimetrically at 470 nm using a spectrophotometer by the yellow color method of Jackson, (1958). After digestion, the percentage of potassium was determined using the method of Cresser and Parsons,(1979), and the reading was done by using a flame photometer, according to the method of Page *et al.* (1982). The total chlorophyll content was determined from fresh samples of the pomegranate leaves with 80% acetone as the extraction medium as described by Goodwin,(1976). Total carbohydrates were measured and calculated as mg 100g^{-1} dry matter in the leaves according to the modified phenol–sulfuric acid colorimetric method described by Dobois *et al*,.(1956).

Statistical Analysis:

The collected data were statistically analyzed using a Randomized Complete Block Design (RCBD). Analysis of variance was performed following the adopted experimental layout using the statistical software package GenStat,(2012). The experiment was replicated three times, and differences among treatment means were compared using the Least Significant Difference (LSD) test at the 5% probability level as described by Snedecor and Cochran, (1980).

Results

Vegetative characters:

Table 4 shows that vegetative growth parameters of local pomegranate plants were significantly affected by foliar application of gibberellin. Plant height, main stem diameter, number of leaves, leaf area, and number of branches were highest at the highest gibberellin level (8 ml L^{-1}), with 118.65 cm, 12.23 mm, 57.16 leaves $plant^{-1}$, 23.33 cm^2, and 10.34 branches $plant^{-1}$, respectively. These results showed that vegetative performance of the seedlings increased with an increase in GA_3 concentration over the control.

Table 4. Influence of foliar-applied gibberellin on vegetative growth attributes of local pomegranate plants.

Gibberellin concentration (ml L^{-1})	Plant height (cm)	Stem diameter (mm)	Number of leaves (leaf $plant^{-1}$)	Leaf area (cm^2)	Number of branches (branch $plant^{-1}$)
0	104.22	6.77	33.34	12.22	3.55
6	108.60	8.22	42.12	16.54	5.22
8	118.65	12.23	57.16	23.33	10.34
LSD at 0.05	7.61	0.78	1.37	10.48	1.13

Data pertaining to the effect of foliar application of different concentrations of Seasol on local pomegranate seedlings are presented in Table 5. Treatment with 8 ml L^{-1} Seasol also produced significant improvement in vegetative growth, with the highest value of 14.77 branches $plant^{-1}$ compared to 4.12 branches $plant^{-1}$ in the control. Further, the same concentration resulted in an increase in plant height, stem thickness, number of leaves, and leaf area, which shows that Seasol has a positive effect on vegetative development of plants.

Table 5. Response of vegetative growth characteristics of local pomegranate plants to foliar Seasol application.

Seasol concentration (ml L^{-1})	Plant height (cm)	Stem diameter (mm)	Number of leaves (leaf $plant^{-1}$)	Leaf area (cm^2)	Number of branches (branch $plant^{-1}$)
0	100.12	6.11	32.33	11.77	4.12
6	113.22	6.15	39.34	15.99	8.88
8	115.11	10.22	40.35	20.87	14.77
LSD at 0.05	7.61	0.78	1.37	10.48	1.13

The results of the combined effect of GA_3 and Seasol on vegetative growth traits are presented in Table 6. The combination of 8 ml L^{-1} GA_3 and 8 ml L^{-1} Seasol produced the most significant effect among all treatments. This combination gave the maximum values of plant height, main stem thickness, number of leaves, leaf area, and number of branches (133.67 cm, 18.80 mm, 39.99 leaves $plant^{-1}$, 30.87 cm^2, and 13.65 branches $plant^{-1}$, respectively). The results reveal that the combined treatment of both growth regulators proved more effective in improving the vegetative traits studied than the single treatments.

Table 6. Combined effect of GA_3 and Seasol foliar treatments on selected vegetative growth parameters of local pomegranate plants.

Gibberellin (ml L^{-1})	Seasol (ml L^{-1})	Plant height (cm)	Stem diameter (mm)	Number of leaves (leaves $plant^{-1}$)	Leaf area (cm^2)	Number of branches (branches $plant^{-1}$)
0	0	102.12	7.88	22.55	12.88	3.66
0	6	105.55	7.98	24.89	13.98	5.76
0	8	112.33	9.76	30.97	15.86	7.99
6	0	90.98	6.98	20.89	17.98	2.99
6	6	95.64	7.22	22.67	20.43	3.12
6	8	93.67	9.85	29.11	22.65	3.92
8	0	89.99	8.33	21.67	13.88	3.77
8	6	98.87	14.78	28.99	26.21	8.79
8	8	133.67	18.80	39.99	30.87	13.65

L.S.D. at 0.05		**13.18**	**1.36**	**2.38**	**18.15**	**1.95**

Chemical characteristics:

Table 7 reveals that several chemical constituents of the leaves of local seedlings of pomegranate were significantly influenced by foliar application of gibberellin. The treatment with 8 ml L^{-1} GA_3 had the highest value of nitrogen (3.18%), potassium (2.12%), carbohydrate content (20.12%), and chlorophyll (3.63 SPAD). From these results, one may conclude that the highest concentration of gibberellin resulted in a better biochemical status of the leaves as compared to lower concentrations and the control.

Table 7. Effect of foliar gibberellin application on selected chemical constituents of local pomegranate seedlings.

Gibberellin (ml L^{-1})	**Nitrogen (%)**	**Phosphorus (%)**	**Potassium (%)**	**Carbohydrates (%)**	**Chlorophyll (SPAD)**
0	2.22	0.10	1.51	16.22	2.44
6	2.62	0.17	1.88	18.45	2.98
8	3.18	0.22	2.12	20.12	3.63
L.S.D. at 0.05	**0.18**	**0.13**	**0.16**	**1.26**	**1.14**

Table 8 presents the individual effect of Seasol on the chemical characteristics of local pomegranate seedlings. The application of Seasol at 8 ml L^{-1} significantly increased the phosphorus content in the leaves, reaching 0.39%, whereas the control treatment recorded only 0.14%. The same treatment also improved nitrogen, potassium, carbohydrate content, and chlorophyll level, reflecting the positive contribution of Seasol to enhancing leaf chemical composition.

Table 8. Effect of Seasol foliar treatment on selected biochemical traits of local pomegranate seedling leaves.

Seasol concentration (ml L^{-1})	N (%)	P (%)	K (%)	Carbohydrates	Chlorophyll (SPAD)
0	2.11	0.14	1.24	14.33	2.23
6	2.31	0.22	1.89	15.89	2.98
8	2.99	0.39	2.09	18.12	2.99
LSD at 0.05	0.18	0.13	0.16	1.26	1.14

The interaction between gibberellin and Seasol on leaf chemical composition is shown in Table 9. The combined treatment of 8 ml L^{-1} GA_3 with 8 ml L^{-1} Seasol produced the highest values for all studied chemical traits. Nitrogen, phosphorus, potassium, carbohydrates, and chlorophyll reached 3.99%, 0.38%, 2.76%, 23.51, and 23.60 SPAD, respectively. These findings indicate that the combined foliar application of GA_3 and Seasol was more effective than their separate use in improving the chemical content of local pomegranate seedling leaves.

Table 9. Interactive influence of Gibberellin and Seasol foliar application on leaf chemical composition indicators of local pomegranate seedlings.

Gibberellin concentration (ml L^{-1})	Seasol concentration (ml L^{-1})	N (%)	P (%)	K (%)	Carbohydrates	Chlorophyll (SPAD)
0	0	2.11	0.12	1.22	13.82	14.51
0	6	2.17	0.23	1.99	14.96	17.03
0	8	2.99	0.30	2.45	16.690	17.10
6	0	2.13	0.13	1.12	12.28	18.44
6	6	2.67	0.15	1.62	16.73	19.07
6	8	3.11	0.18	2.32	18.43	18.93
8	0	2.24	0.13	1.14	13.95	18.33
8	6	2.98	0.20	1.34	19.58	20.30
8	8	3.99	0.38	2.76	23.51	23.60

LSD at 0.05	—	0.32	0.12	0.28	2.19	1.76

Discussion

The Gibberelin contains major and minor nutrients solution is responsible for the increase in leaf area after application. These nutrients help seedlings grow and increase leaf area by promoting cell division and elongation. Increased leaf quantity and individual leaf area improves photosynthetic efficiency, resulting in greater production of byproducts required for vegetative growth, including seedling leaf area. Cell elongation promotes leaf growth, This shows gibberellins assist in leaf expansion and increase the efficiency of photosynthesis in leaves., thus facilitating vegetative growth. The use of organic fertilizer led in increased height, diameter in main stem, leaf area, and primary branch number. This improvement is consistent with the findings of Salih *et al*. (2020), who reported that spraying organic fertilizer together with dry yeast extract significantly promoted vegetative growth, as reflected by increased plant height, main stem diameter, leaf area, and number of branches.

When Pomegranate seedlings are treated with Seasol, the number of branches on the plants may increase because the stimulant causes increased phosphorus accumulation in the leaves. Phosphorus is a necessary component of nucleic acids and participates in numerous enzymatic reactions. It is found in enzymes required for several energy reactions during respiration and photosynthesis, as well as nucleic acids such as DNA, RNA, tRNA, and ribosomal RNA. It also appears in the composition of certain fats (phospholipids), enzyme cofactors, NADP and NAD, and phosphorus complexes with energy-rich linkages (ATP and ADP). Because phosphorus is a component of nucleic acids, which are essential to living things, and because ATP and ADP are involved in energy transmission, phosphorus is an essential element in plants. NADP and NAD, enzyme cofactors, are required for both oxidation and reduction reactions and play important roles in processes such as respiration, glycolysis, photosynthesis, and fatty acid representation, among others. Regarding phospholipids, Protein appears to play a important in the synthesis of cell membranes. For its use in representation of nuclear proteins, phosphorus is abundant in the meristematic zones where growth occurs. Phosphorus-rich, well-balanced diets promote cell division and growth while also increasing the number of branches in the root system. This increases the system's ability to absorb nutrients and water, improving root quality and increasing disease resistance. Havlin & Associates,(2005).

The increase in branch number following foliar application of the nutrient solution may be attributed to the integrated role of Seasol constituents in enhancing several physiological processes. The nutrients supplied in Seasol can participate in the synthesis of chlorophyll and cytochrome, which can stimulate photosynthesis and energy production in plant tissues. Besides, these nutrients can also be involved in nucleic acid synthesis, in activation of root activity and in the uptake of other nutrients, thus contributing overall to the physiological status of the seedlings. The resulting better nutritional and metabolic condition is finally expressed in an increased active vegetative growth and an increased branch density. Furthermore, the growth regulator used might lead to the buildup of nutrients in the leaves, thereby enhancing their role in chlorophyll production. It can also decrease or inhibit chlorophyllase activity, thus slowing down chlorophyll degradation and increasing the stability of the pigment. Gibberellin increases the absorption surface, which may enhance vital plant processes. Increasing the total level of chlorophyll and the intensity of photosynthesis. The improvement in plant growth may also be associated with the ability of these bioactive compounds to stimulate the formation and regulation of key cellular constituents, such as phytohormones, lignin, proteins, carbohydrates, and mineral nutrients. In addition, they may enhance enzymatic activity, which contributes to more efficient metabolic reactions and supports overall vegetative development in pomegranate seedlings. This may increase metabolic activity in the cytoplasm. Gibberellin application promotes plant growth and biomass. Gibberellin caused the highest percentage stimulation of nitrate reduction, an indicator of nitrogen accumulation. It catalyzes the conversion of nitrates into nitrites, which is essential for plant protein synthesis. The active chemicals infiltrate plant cells and rapidly convert into the plant's own molecules with analogous activities. The chemical content of pomegranate leaves increased considerably due to the nutritional impact of Seasol on micro- and macronutrients. This resulted in enhanced element absorption, the growth of roots, stem thickness, and a variety of vegetative growth

(Jensen, 2004). Besides its role as a fertilizer, Seasol may also exert a hormone-like effect, which is considered one of the main reasons for its biostimulant activity in plants. This biostimulant response could be attributed to the bioactive constituents naturally present in Seasol, including sterols, polyamines, cytokinins, abscisic acid, gibberellins, and auxins (Craigie, 2011).
In addition, the growth-promoting effect of Seasol can be attributed to its rich composition of macro- and micronutrients, amino acids, and vitamins, which collectively enhance plant physiological activity. Moreover, plant growth regulators, including gibberellins, auxins (IAA), and cytokinins, play an important role in stimulating root formation and promoting vegetative growth (Ördög *et al*., 2004). Furthermore, commercial seaweed extracts (such as Seasol) contain an array of polysaccharides, including laminarin, alginates, carrageenans, and their degradation products, as well as micro and macro elements, sterols, betaines, and nitrogen containing compounds that have been linked to plant growth promotion abilities (Craigie,2011).This response is also due to the role of manganese that is needed in photosynthesis and synthesis of proteins, amino acids and chlorophyll. It interacts synergically with calcium, zinc and potassium and can help maintain the osmotic balance in cells, which leads to the retention and accumulation of sugars, proteins, organic acids and water in the plant cells (Abed *et al*.,2020).

Conclusions and Recommendations:
The findings of the present study indicate that foliar application of gibberellin as a growth regulator exerted a favorable influence on the growth and biochemical performance of local pomegranate seedlings. Among the applied concentrations, GA_3 at 8 ml L^{-1} was the most effective in enhancing key vegetative parameters, including plant height, main stem diameter, leaf number, and leaf area, as well as improving leaf nitrogen, potassium, carbohydrate, and chlorophyll contents. Hence, this concentration can be suggested for improving the vegetative performance and physiological status of these local pomegranate seedlings. However, application of Seasol at 8 ml L^{-1} was more effective in increasing the number of branches and the phosphorus content of leaves. The combined application of GA3 and Seasol at 8 ml L^{-1} for each treatment resulted in the best response for all traits investigated and therefore was the most favorable treatment under the conditions of this experiment. Accordingly, to obtain the best overall growth and chemical performance, GA3 + Seasol at 8 × 8 ml L^{-1} is recommended for local pomegranate seedlings.

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