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EFFECT OF THE ALBIT-BR BIOSTIMULANT ON THE GROWTH, YIELD, AND QUALITY PARAMETERS OF TOMATO (*SOLANUM LYCOPERSICUM* L.) IN THE MOSCOW REGION

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SUMMARY

The conveyed experiment sought to test the effect of a novel biostimulant Albit-BR, on the growth, fruit yield, and quality traits of tomato (*Solanum lycopersicum* L.). The experiment took place in 2024 in the Federal State Budgetary Scientific Institution, Federal Scientific Vegetable Center, VNIISSOK, Moscow Region, Russia. The field layout had a randomized complete block design with a factorial arrangement of two factors replicated thrice. The first factor comprised four tomato cultivars (Malets, Revansh, Talisman, and Fonaric), while the second factor included seven different doses of the biostimulant Albit-BR (0.1, 0.5, 1, 2.5, 5, 10, and 50 L/ha) in comparison with non-treated plants (control). The results revealed the biostimulant Albit-BR application with different levels on tomato cultivars has shown significantly better effects on the growth, fruit yield, and quality parameters. The cultivar Malets treated with Albit-BR (2.5 L/ha) produced the highest yield (96.76 t/ha). Furthermore, the same cultivar treated with the biostimulant at 5 L/ha showed the maximum values of bioactive compounds—lycopene (23.02 mg/100 g) and beta-carotene (4.24 mg/100 g). Thus, the current findings indicated that the aforementioned biostimulant at 2.5 to 5 L/ha are required to be applied on tomato plants to improve its production potential with reasonably better quality.

Keywords: Tomato, biostimulant, Albit-BR, growth traits, fruit yield, quality traits, beta-carotene, chlorophyll, lycopene

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Key findings: The interaction of different tomato (*S. lycopersicum* L.) cultivars with various levels of the biostimulant Albit-BR enunciated significant differences for growth, fruit yield, and the majority of the studied quality parameters.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is the second-most important vegetable, following potato for its nutritional, health, and economical values worldwide (Delian *et al.,* 2017). However, the tomato is more vulnerable to numerous biotic and abiotic stress conditions during its growth and life stages (Bai *et al.,* 2018). The current climate change phenomenon also disrupts food security due to unexpected considerable fluctuations in precipitation, temperature, and water-deficit conditions. These extreme weather occurrences will result in reduced crop production, less access to food, and alterations in the food quality. The frequency and intensity of severe climate events can interrupt the food supply chain and cause price inflation of foodstuffs (Shahzad *et al.,* 2021).

During the period of 2010–2012, the Southern U.S., Western Russia, Western Australia, and East Africa experienced extreme high temperatures and less precipitation than previous averages and reported a 14%–80% decline in yields of several crop species (Anderson *et al.,* 2020). Elevated temperatures during critical growth stages can stunt plant development, reduce grain filling, and lead to lower overall production. Less rainfall can exacerbate these effects by causing drought stress, which further hinders plants' growth, leading to crop failure.

The new biostimulant Albit-BR is a remedy and ameliorant to use in different soils. It is a liquid compost based on grain crop sprouts, which develops favorable conditions for maximal propagation of beneficial endophytic microflora and reduces the pathogenic fungi (Zlotnikov, 2021). Additionally, it stimulates natural soil nitrogen fixation, transfers phosphorus, potassium, and other elements into available form for plant nutrition, accelerates decomposition and humification of plant residues, and enhances the cation exchange capacity. Albit-BR cleans the soil from pollution, reducing the toxicity of pesticides.

In integration, these effects enable the process of soil restoration, improve soil fertility, and, eventually, enhance crop yield (Zlotnikov, 2020). Earlier studies showed the application of biostimulant Albit-BR (10 L/ha) and adding it to soil a day before planting tomato seedlings significantly and positively affected leaf area, fruit setting, fruit weight, and overall yield under field conditions (Zlotnikov, 2021). According to Yakob and Sabirovich (2024), maximum values for leaf area (119.8 cm^2) and total yield (78.81 t/ha) resulted from tomato plants treated with 2.5 L/ha of Albit-BR. Moreover, the highest marketable yield (76.92 t/ha) of tomato emerged when applying 2.5 L/ha of the Albit-BR biostimulant (Yakob and Sabirovich, 2025). Thus, the following study aimed to determine the impact of various doses of the biostimulant Albit-BR on the growth, fruit yield, and quality attributes of four different tomato cultivars under field conditions. Though previous proof existed that the biostimulant has had positive impacts on tomato production, no prior trials occurred on the four cultivars mentioned in this experiment. Hence, the results obtained from this experiment are considerably of great importance.

MATERIALS AND METHODS

Description of study site

The presented study happened from April to September 2024 at the Federal State Budgetary Scientific Institution, Federal Scientific Vegetable Center, Moscow Region, Russia, with a temperature range between 18 °C and 26 °C and annual precipitation of 703.5 mm. The field had a heavy loamy soil texture with a maximum field moisture capacity of 38%–45%, humus content ranging from 2.5% to 3.2%, soil pH (5.1–6.0), content of mobile phosphorus (10.1–25.0 mg.eq/100 g of soil), exchangeable potassium (8.1–17.0 m.eq/100 g), content of exchangeable calcium (5.6–11.8 mg.eq/100 g), and exchangeable magnesium ranging at 1.4–2.9 m.eq/100 g).The field (201.6 m^2) has coordinates of 55°39′15″ latitude north of the equator and 37°11′59″ longitude east of the prime meridian. In this experiment, determining the effect of the biostimulant Albit-BR occurred on four tomato cultivars. Both the biostimulant and the tomato cultivars used in this experiment came from the Federal State Budgetary Scientific Institution, Federal Scientific Vegetable Center, VNIISSOK, Moscow Region, Russia.

Treatments and experimental design

The study involved four tomato cultivars (Revansh, Malets, Talisman, and Fonaric) and seven different doses of the biostimulant Albit-BR (0.1, 0.5, 1, 2.5, 5, 10, and 50 L/ha), and their assessment underwent comparison with the control. The biostimulant is a product of the Albit Scientific and Industrial Limited Liability Company, with all the cultivars used, except Fonaric, bred in the Federal Scientific Vegetable Center. The different doses of the biostimulant dissolved in 5-liter working solution preceded their application on the soil (plots) one day before seedling transplanting. The experiment layout was in a randomized complete block design with a factorial arrangement of two factors and three replications. On June 2, eight seedlings (40 days old) succeeded in transplanting at a spacing of 70 cm × 37.5 cm. Two sample plants attained random selection for data collection for all parameters, except the fruit yield and yield components, with their data recorded in the net plot area.

Parameters studied

Growth and yield parameters

In tomato plants, the data on plant height and leaf area received one-time recording, with the former being recorded during the incipience of harvesting, and whereas recording the latter was 40 days after transplanting. The data obtained on fruit setting (%) was by taking the average of the data recorded in two different periods—first on the 47th day after transplanting and the second on the 64th day after transplanting. Its calculation continued by dividing the total number of fruits emerged from every truss by the total number of flowers. The number of fruits and total yield entailed measurement from the net plot area of 1.05 m^2 by summing up the values obtained from seven consecutive harvests.

Chlorophyll pigments of leaves

Chlorophyll a and b content measurement occurred during the incipience of flowering by crushing 0.25 g of leaf sample in 2 mL of 80% acetone, then filtering samples through Whatman filter paper and completing the final volume to 25 mL (Ali *et al.,* 2021). The chlorophyll content determination followed the method used by Najafzadeh and Safari (2022). They used 80% acetone solvent for extracting chlorophyll, and measuring the absorbance at wavelengths of 645 and 663 nanometers (nm), the values' expression in mg g^{-1} of fresh weight used the following equations:

$$Ch-a=\frac{[12.7(Abs663)-2.69Abs(645)]\times V}{1000\times W}$$

$$Ch-b=\frac{[22.9(Abs663)-4.68(Abs645)]\times V}{1000\times W}$$

Where V and W were the volume of solvent and weight of leaf tissue.

Carotenoids

Both beta-carotene and lycopene evaluation used the technique reported by Fernandes *et al.* (2022). The fruit samples of 500 mg sustained vigorous shaking with 10 mL of acetone/hexane mixture (4:6, v/v) for 1 min before being filtered through Whatman 4 filter paper. Finally, the absorbance was measured at 453, 505, 645, and 663 nm, with the content of carotenoids (β-carotene and lycopene) obtained using the following equations and expressed in mg per 100 g of fresh weight (FW).

$$\beta - Carotene(mg/100ml) = 0.216 \times Abs663 - 1.22 \times Abs645 - 0.304 \times Abs505 + 0.452 \times Abs453$$

$$Lycopene(mg/100ml) = -0.0458 \times Abs663 + 0.204 \times Abs645 - 0.304 \times Abs505 + 0.452 \times Abs453$$

Statistical analysis

All the recorded data on growth, fruit yield, and bioactive compounds underwent the analysis of variance (ANOVA) by Genstat software (2011 version) at a 5% level of significance, with the mean comparison and separation succeeding by applying the critical difference or least significant difference values.

RESULTS AND DISCUSSION

Plant height

The effect of the biostimulant Albit-BR on plant height reached a measurement during the incipience of harvesting and appeared to be significant ($P < 0.05$). The tallest plant height (77.67 cm) was evident in non-treated Malets plants, followed by Talisman plants (74.67 cm) treated by 2.5 L/ha, and the lowest value (48 cm) came from non-treated Fonaric plants. Upon comparing the effect of the biostimulant in the respective cultivars, significant increases in plant height prevailed solely in the Talisman and Fonaric cultivars (Table 1). In the cultivar Talisman, the biostimulant (2.5 L/ha) application resulted in the highest significant increase (8.2%), whereas in the Fonaric cultivar, the biostimulant (50 L/ha) led to the maximum significant increase in plant height (12.5%) as compared with their respective control treatments. Similar to the findings of the current study, the application of natural plant growth biostimulants (Kelpak, Companion 2-3-2, and Kelpak plus Companion) resulted in a notable enhancement of plant height in tomato (Abd-El-Samad *et al*., 2019). In agreement with the results of this study, Yakob and Sabirovich (2025) also found the meaningful effect of Albit-BR biostimulant on the plant height of tomato plants.

Leaf area

The biostimulant Albit-BR's effect emerged to be significant on the leaf area of tomato plants (Table 1, Figure 1). The largest leaf area (136.8 cm^2) resulted in the Fonaric cultivar treated with 2.5 L/ha, followed by the same cultivar treated with 0.1 L/ha (127 cm^2). However, the smallest value (68.17 cm^2) occurred in the Revansh cultivar under the biostimulant of 10 L/ha. The highest leaf area increment was remarkable in both the Revansh (30.9%) and Malets (25.3%) treated with the biostimulant (2.5 L/ha) as compared with their control counterparts. In addition to these, treating the Talisman cultivar with the biostimulant Albit-BR at 1.0 L/ha and 2.5 L/ha showed the ultimate significant increases in leaf area at 21.1% and 21.3%, respectively, compared with the control. Thus, the broadest leaf area obtained was at the 2.5 L/ha treatment in all four tomato cultivars.

The noteworthy effect of the biostimulant in the presented study could refer to the rich nitrogen composition provided by the biostimulant Albit-BR. These results were greatly analogous to the previous findings of Abdelkader *et al.* (2021). They reported a substantial increase in the leaf area of tomato plants by treating them with biostimulants, Rutfarmmaxifol and Radifarm, as both contained essential nitrogenous compounds like amino acids and peptides that improve growth traits. Contrary to this study's results, Turan *et al*. (2023) reported the biostimulants containing plant growth-promoting rhizobacteria (PGPR) tend to decrease the leaf area of tomato plants by 50%.

Chlorophyll a content of leaves

Tomato cultivars treated with the biostimulant Albit-BR revealed significant differences for chlorophyll a (Table 1). The highest value (1.37 mg/g) manifested from the Fonaric cultivar treated by the biostimulant Albit-BR at 5 and 50 L/ha levels, followed by the Talisman cultivar under the biostimulant of 10 L/ha (1.33 mg/g). Meanwhile, the lowest value of chlorophyll a (0.79 mg/g) arose from the

Table 1. Effect of biostimulant Albit-BR on the growth traits and chlorophyll contents of four tomato cultivars.

Tomato cultivars	Albit-BR (L/ha^{-1})	Plant height (cm)	Leaf area (cm^2)	Chl. A (mg/g)	Chl. B (mg/g)	Total Chl. (mg/g)
Malets	Control	77.67	100.17	0.96	0.50	1.46
	0.1	72.33	113.67	1.04	0.54	1.58
	0.5	70.67	102.83	1.02	0.38	1.40
	1	68.67	102.50	1.13	0.59	1.71
	2.5	74.00	125.50	1.26	0.66	1.92
	5	73.67	110.00	1.21	0.80	2.01
	10	69.67	102.83	1.05	0.58	1.63
	50	71.00	100.33	1.02	0.49	1.51
Revansh	Control	60.33	86.83	0.79	0.40	1.19
	0.1	59.33	102.83	1.02	0.49	1.51
	0.5	56.33	81.33	0.94	0.49	1.43
	1	56.33	90.17	1.11	0.66	1.77
	2.5	64.33	113.67	1.19	0.52	1.70
	5	62.00	91.67	1.04	0.66	1.70
	10	60.67	68.17	1.15	0.72	1.87
	50	60.00	75.67	1.12	0.54	1.66
Talisman	Control	69.00	85.33	0.95	0.46	1.41
	0.1	73.33	91.83	1.20	0.54	1.74
	0.5	70.00	79.67	1.15	0.43	1.58
	1	71.00	103.33	1.21	0.78	1.99
	2.5	74.67	103.50	1.32	0.73	2.04
	5	71.00	94.33	1.21	0.72	1.93
	10	73.67	82.33	1.33	0.87	2.20
	50	72.00	87.50	1.26	0.75	2.00
Fonaric	Control	48.00	97.83	1.08	0.64	1.72
	0.1	53.33	127.33	1.05	0.63	1.68
	0.5	50.33	105.83	1.15	0.49	1.63
	1	52.33	117.00	1.10	0.58	1.68
	2.5	52.00	136.83	1.29	0.69	1.98
	5	52.67	112.83	1.37	0.86	2.23
	10	50.33	114.50	1.19	0.69	1.88
	50	54.00	109.67	1.37	0.96	2.33
$LSD_{0.05}$		5.133	14.83	0.2445	0.2861	0.5057
SEM		1.816	5.246	0.0865	0.1012	0.1789
CV%		4.90	9.00	13.20	28.30	17.70

*LSD: Least significant difference, SEM: Standard error of means, CV: Coefficient of variance.

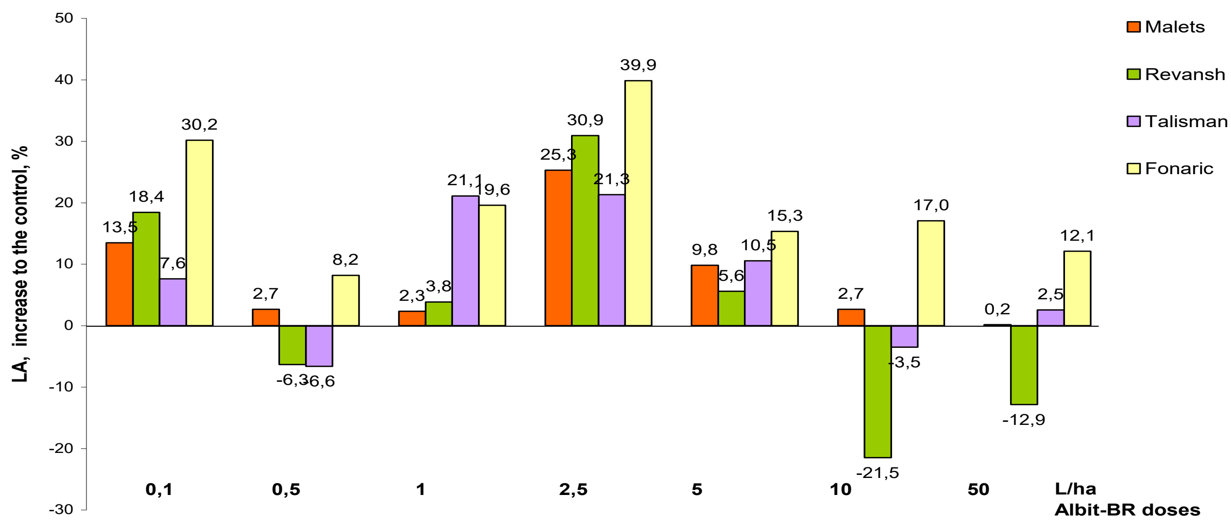

Figure 1. Effect of Albit-BR on the leaf area (LA) of four tomato cultivars.

Revansh control plants. In cultivars Revansh and Malets, plants treated with Albit-BR (2.5 L/ha) showed considerable increases (50.6% and 31.3%, respectively) compared with the untreated plants. For both the Revansh and Talisman cultivars, all the variants displayed increased values compared with their control. In accordance with the results of the presented study, the *Crataegus oxyacantha* extract (20 mg/L) significantly increased the chlorophyll a content in salt-stressed tomato plants (Naboulsi *et al.,* 2022).

Chlorophyll b content of leaves

Application of the biostimulant Albit-BR tends to have a notable effect on the chlorophyll b content of tomato cultivars (Table 1). The highest chlorophyll b (0.96 mg/g) resulted from the Fonaric cultivar treated with the biostimulant Albit-BR (50 L/ha), followed by the Talisman cultivar treated with 10 L/ha (0.87 mg/g). The lowest value (0.38 mg/g) emerged from Malets plants under the biostimulant of 0.5 L/ha. As compared with the non-treated plants, all the highest values of chlorophyll b for each cultivar appeared to be significantly superior, showing increases of 89.1%, 60%, 80%, and 50% for the Talisman, Malets, Revansh, and Fonaric cultivars, respectively. Moreover, the cultivar Talisman had a higher chlorophyll b content (0.78 mg/g) with the Albit-BR of 1 L/ha and was 69.6% higher than the control treatment. The rise in chlorophyll content could possibly be due to the abiotic resistance capacity of the biostimulant Albit-BR. The latest results about the outstanding impact of the biostimulant Albit-BR proved to be in line with the findings of Naboulsi *et al.* (2022). They reported *Crataegus oxyacantha* extract (20 mg/L) significantly boosted the chlorophyll b content in salt-stressed tomato plants.

Total chlorophyll content of leaves

The effect of biostimulant Albit-BR on the total chlorophyll content of the various tomato cultivars was evidently significant (Table 1, Figure 2). The highest total chlorophyll content of tomato leaves (2.33 mg/g) was prevalent in the Fonaric cultivar treated with the biostimulant (50 L/ha), followed by the same cultivar with the biostimulant of 5 L/ha (2.23 mg/g). However, the lowest value (1.19 mg/g) resulted in the control plants of the Revansh cultivar. In the Malets cultivar, plants with Albit-BR (5 L/ha) produced the leaves with the highest total chlorophyll content (2.01 mg/g), showing a 37.7% increase over the control. The tomato cultivar Revansh with Albit-BR (1 to 10 L/ha) produced noticeably higher values

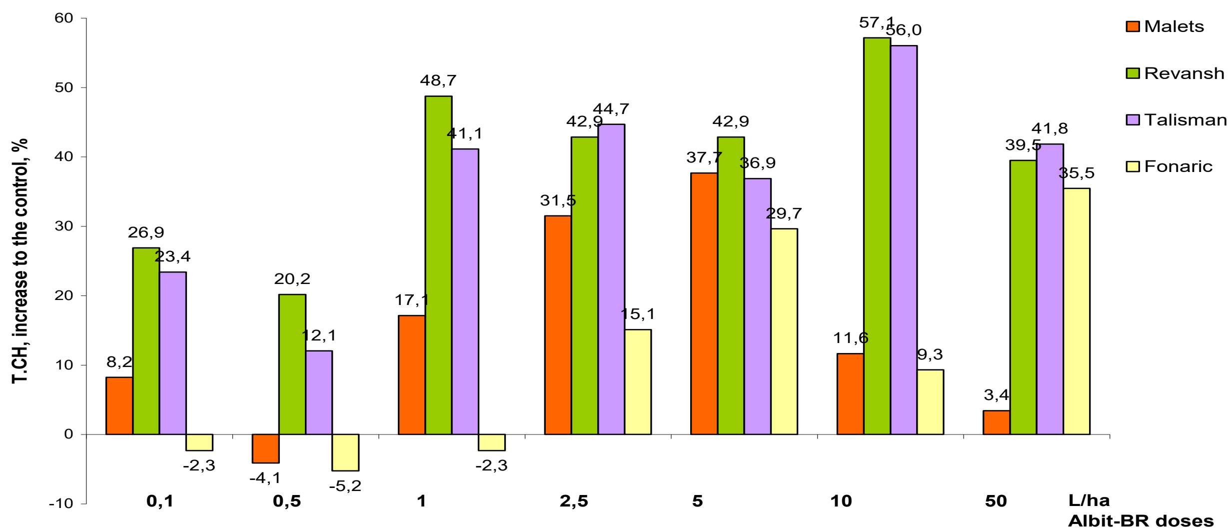

Figure 2. Effect of Albit-BR on the total chlorophyll content (T.CH) of leaves of four tomato cultivars.

of total chlorophyll than the untreated plants. The maximum total chlorophyll content of Revansh (1.87 mg/g) appeared in plants treated with Albit-BR (10 L/ha) and revealed a 57.1% increase over the control. With a 36.9% to 56.0% rise over the control, the higher values of total chlorophyll content in the Talisman cultivar occurred in the variants using Albit-BR (1 to 50 L/ha) (1.93−2.2 mg/g) than in the control (1.41 mg/g). The premier total chlorophyll content difference (35.5%) was evident between 50 L/ha and the control in the Fonaric cultivar. Thus, the increased total chlorophyll content in tomato leaves manifested in the variants with higher doses of the biostimulant Albit-BR (1 L/ha and above). This increase was possibly due to the bioactive compound, such as glycinebetaine, with the ability to inhibit the chlorophyll degradation (Latique *et al.,* 2021). In accordance with the study findings, Abbas and Akladious (2013) reported that plant-based biostimulants and seaweed extracts often increase the color of leaves by stimulating chlorophyll biosynthesis and reducing its degradation.

Fruit setting

The results showed significant differences in the fruit-setting percentage of the studied tomato cultivars (Table 2). However, while considering each cultivar separately, none of the seven different doses of the biostimulant Albit-BR demonstrated a noteworthy effect on the fruit setting. The highest fruit setting (79.37%) appeared in the Malets cultivar with the biostimulant (50 L/ha), followed by the same cultivar treated with 5 L/ha (77.15%). Meanwhile, the lowest value (50.1%) resulted from the Fonaric cultivar treated with 0.5 L/ha of Albit-BR. Nevertheless, the maximum values of fruit setting exceeding the control (with 3% to 8%) were evident in variants of the cultivar Malets treated with Albit-BR (50 L/ha), the cultivar Talisman with a dose of 10 L/ha, and the cultivar Fonaric treated with 0.1, 5, and 50 L/ha. Likewise, the cultivar Revansh revealed the highest fruit setting in the control treatment (65.35%). Similarly, Yakob and Gins (2025) found that the Albit-BR biostimulant has no significant contribution to the fruit setting of tomato plants. However, Zlotnikov (2021) reported a notable improvement of the fruit-setting capacity with the Albit-BR biostimulant.

The number of fruits per plant

For the number of fruits per plant, the tomato cultivars with different doses of Albit-BR revealed significant differences (Table 2). The highest number of fruits per plant (56.20) was evident in the cultivar Malets with Albit-BR (2.5 L/ha), followed by the same cultivar with Albit-BR of 1 L/ha (52.63), while the lowest value (11.80) came from the cultivar Fonaric with Albit-BR (50 L/ha). In the cultivar Malets, with an initially high number of fruits in the control (43.9), the Albit-BR application has gradually shown an increased number of fruits per plant (28.0%, 19.9%, and 18.1%) with doses of 2.5, 1, and 0.5 L/ha, respectively, versus the control treatment. In the cultivar Revansh, all the variants, except 10 and 50 L/ha, displayed a substantial rise in fruits per plant (31.8% to 46.2%) compared with the control. Here, the most fruits (37.42) emerged for the cultivar Revansh with Albit-BR (2.5 L/ha), with a 46.2% increase over the control, followed by the cultivar Talisman with Albit-BR (2.5 L/ha) at 32.45 fruits per plant and a 33.1% increase over the control. The cultivar Fonaric with the control had the lowest fruit number (13.55). Overall, the greatest effect resulted in the application of Albit-BR (0.1, 1, and 2.5 L/ha) by producing 37.3%, 24.9%, and 53.2% more fruits per plant than the control. The biostimulant enhanced the available nitrogen in soil at the early stages of plant growth, promoting the tomato plants' growth with increased leaf area, chlorophyll content, and, eventually, positively affecting tomato fruits. These results were consistent with the previous findings of Shewangizaw *et al.* (2024).

Total fruit yield

As per the findings of the current experiment, application of the biostimulant Albit-BR showed a significant effect on the total fruit yield in all four tomato cultivars (Table 2, Figure 3). The highest total fruit yield (96.76 t/ha, with a 20.5% increase over the control) was evident in the cultivar Malets with Albit-BR (2.5 L/ha), followed by cultivar Malets with 5 L/ha (88.35 t/ha, with a 10% increase over the control). The lowest yield per hectare resulted from the Fonaric cultivar with 50 L/ha (41.04 t/ha). In the cultivar Revansh, a considerable rise in the total fruit yield appeared with the application of Albit-BR at 0.1 L/ha (80.09 t/ha), 2.5 L/ha (79.86 t/ha), and 1 L/ha (73.80 t/ha), with 35.1%, 34.7%, and 24.5% increases over the control, respectively. The cultivar Talisman with Albit-BR (0.1 and 2.5 L/ha) produced remarkably higher total fruit yields of 73.43 and 79.29 t/ha, respectively, with a 21.8% to 31.5% increase over the control treatment. The cultivar Fonaric revealed a noteworthy improvement in yielding potential when treated with Albit-BR of 0.1 L/ha (57.69 t/ha) and 2.5 L/ha (59.33 t/ha), with a 38% and 42% increase over the control. Thus, the cultivar Malets with Albit-BR (2.5 L/ha) produced the maximum total fruit yield (96.76 t/ha) compared with other variants of the same cultivar and other cultivars. It is a fact that plants with more chlorophyll also produce the higher crop yield (Paul, 2021; Zhou *et al.,* 2022; Croce *et al*., 2024). The boost in total fruit yield with an application of Albit-BR was partly ascribable to the positive effect of the biostimulant in increasing the accumulation of antioxidant compounds, allowing a decrease in plant stress sensitivity (Bulgari *et al.,* 2019). Abdelkader *et al.* (2021) also witnessed an increase in the productivity of tomato fruits with the treatment of different biostimulants (Rutfarmmaxifol and Radifarm), which matched well with these current experimental results.

Lycopene content

Results showed a significant effect existed with the biostimulant Albit-BR on the fruit lycopene content in tomato cultivars (Table 2, Figure 4). The highest lycopene content of fruits (23.02 mg/100 g) came from the Malets cultivar with Albit-BR (5 L/ha), followed by the Telecman cultivar under the Albit-BR 2.5 L/ha (20.07 mg/100 g). The lowest value (11.87 mg/100 g) emerged from Revansh plants treated with 0.5 L/ha of the biostimulant. Albit-BR had a considerable effect on lycopene content in tomato fruits in cultivars Fonaric, Talisman, and Malets, where lycopene content increased by 56.5%–81.5% over the control. However, the cultivar Revansh with Albit-BR application resulted in a decrease in its lycopene content of up to 26.4% over the control. Malets plants treated with Albit-BR (5 L/ha) provided a

Table 2. Effect of Albit-BR on fruit setting, yield components, and fruit quality traits of four tomato cultivars.

Cultivars	Albit-BR (L/ha)	Fruit setting (%)	Fruits plant^{-1}	Total fruit yield (t/ha)	Lycopene (mg/100 g)	Beta Carotene (mg/100 g)
Malets	Control	77.08	43.90	80.33	12.68	1.94
	0.1	74.28	48.47	86.99	12.52	1.85
	0.5	74.82	51.83	81.51	13.28	1.88
	1	74.75	52.63	83.84	12.25	1.83
	2.5	76.37	56.20	96.76	12.05	1.74
	5	77.15	49.83	88.35	23.02	4.24
	10	72.00	41.22	78.62	13.37	2.03
	50	79.37	41.22	70.38	15.17	2.54
Revansh	Control	65.35	25.59	59.28	16.13	2.78
	0.1	57.63	34.76	80.09	12.08	1.88
	0.5	56.72	33.50	71.82	11.87	1.71
	1	59.15	33.42	73.80	12.37	1.81
	2.5	53.05	37.42	79.86	12.37	1.91
	5	56.35	33.74	68.60	12.20	1.97
	10	59.73	32.77	68.43	13.13	1.98
	50	64.98	26.70	60.78	12.77	1.92
Talisman	Control	59.83	24.38	60.30	12.50	1.77
	0.1	61.15	29.55	73.43	12.47	1.83
	0.5	58.63	27.42	66.30	12.93	1.91
	1	60.27	29.08	63.42	13.05	1.94
	2.5	61.53	32.45	79.29	20.07	3.47
	5	60.37	29.33	71.97	12.93	1.86
	10	61.95	29.00	65.91	17.42	2.12
	50	59.42	26.67	56.88	12.70	1.85
Fonaric	Control	56.72	13.55	41.79	11.92	1.86
	0.1	61.23	18.61	57.69	18.65	3.31
	0.5	50.10	16.14	47.48	11.93	1.80
	1	55.40	16.93	49.01	15.72	2.85
	2.5	56.07	20.76	59.33	13.78	2.28
	5	60.75	15.95	53.03	13.28	1.97
	10	53.15	14.30	47.91	17.88	3.18
	50	60.77	11.80	41.04	13.17	1.97
$LSD_{0.05}$		9.411	7.501	12.691	3.736	0.8331
SEM		3.329	2.653	4.489	1.321	0.2947
CV%		9.2	14.7	11.5	16.4	23.3

*LSD: Least significant difference, SEM: Standard error of means, CV: Coefficient of variance.

sizable increase of lycopene content (81.5%) over the control. In the cultivar Talisman, the plants treated with Albit-BR (2.5 L/ha) displayed an increment of 60.6% compared with non-treated plants. The cultivar Fonaric with Albit-BR (0.1 L/ha) showed a substantial increase in lycopene content (56.5%) versus the control. Such a significant increase in the lycopene content could refer to the rich sulfate composition of the Albit-BR biostimulant, which has a close association with the rise in lycopene content (Mzibra *et al.,* 2021).

Beta-carotene content

Beta-carotene contents of the tomato cultivars incurred considerable influences from Albit-BR application (Table 2, Figure 5). Overall, the tomato cultivar Malets treated with Albit-BR (5 L/ha) produced fruits with the highest beta-carotene content (4.24 mg/100 g), with a 118.6% increase over the control. Following it was the cultivar Talisman treated with 2.5 L/ha (3.47 mg/100 g), with a 96% rise over the control, and the cultivar Fonaric with 0.1 L/ha (3.31 mg/100 g), with a 78% increase over the control. However, the lowest beta-carotene content (1.71 mg/100 g) resulted from the cultivar Revansh treated with Albit-BR (0.5 L/ha). Non-treated plants of the cultivar Revansh resulted in the remarkably highest beta-carotene content (2.78 mg/100 g), indicating the nonsignificant effect of Albit-BR. The substantial increase in beta-carotene could be because of the varied genetic makeup of the tomato cultivars and the effect of the biostimulant on nutrient absorption and tolerance to abiotic stresses (Kocira *et al.*, 2020). The presented results also tend to correspond with the findings of Abdelkader *et al.* (2021), who reported a noteworthy increase in the carotenoid content in tomato plants treated with the biostimulant Radifarm.

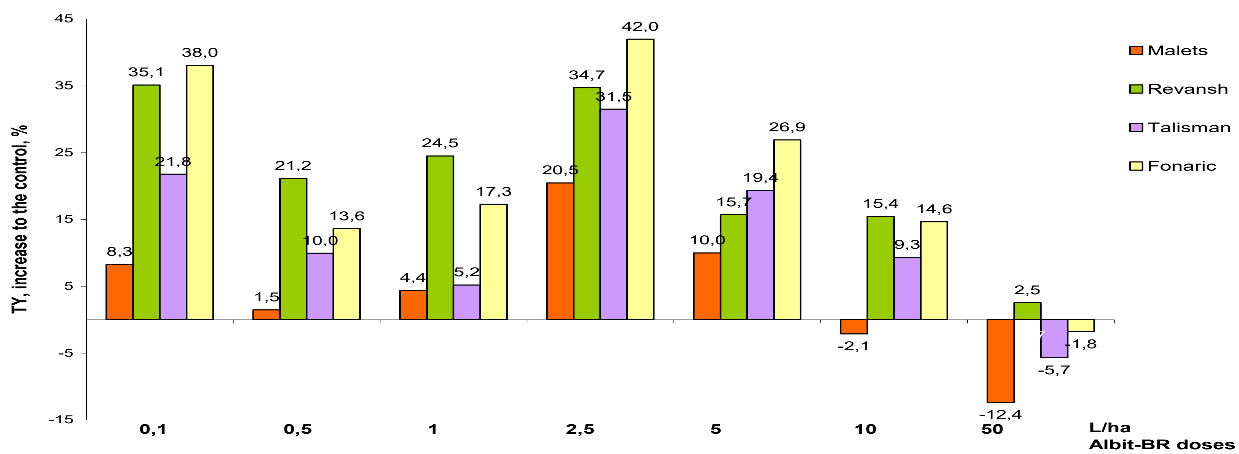

Figure 3. Effect of Albit-BR on total fruit yield (TY) of four tomato cultivars.

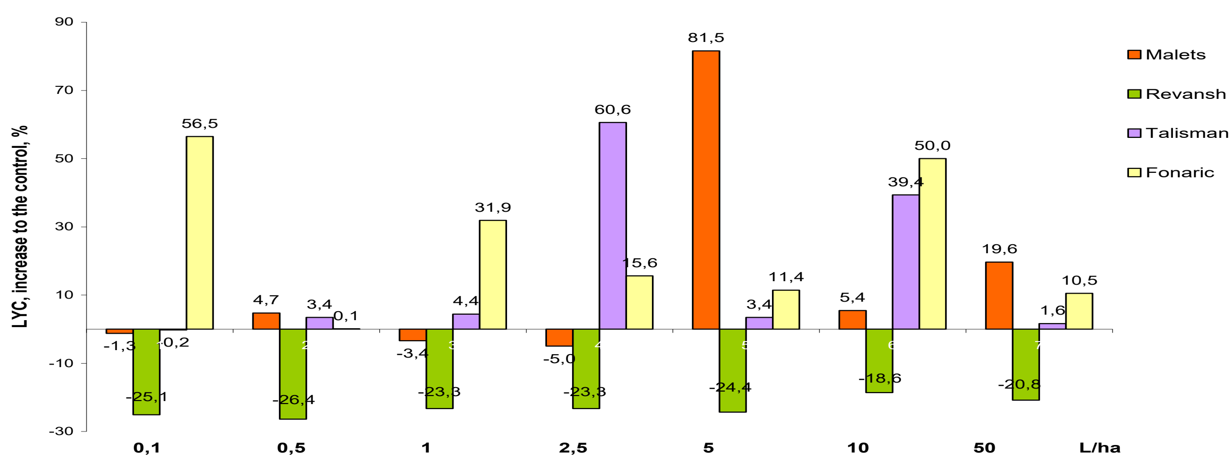

Figure 4. Effect of Albit-BR on lycopene content (LYC) of four tomato cultivars.

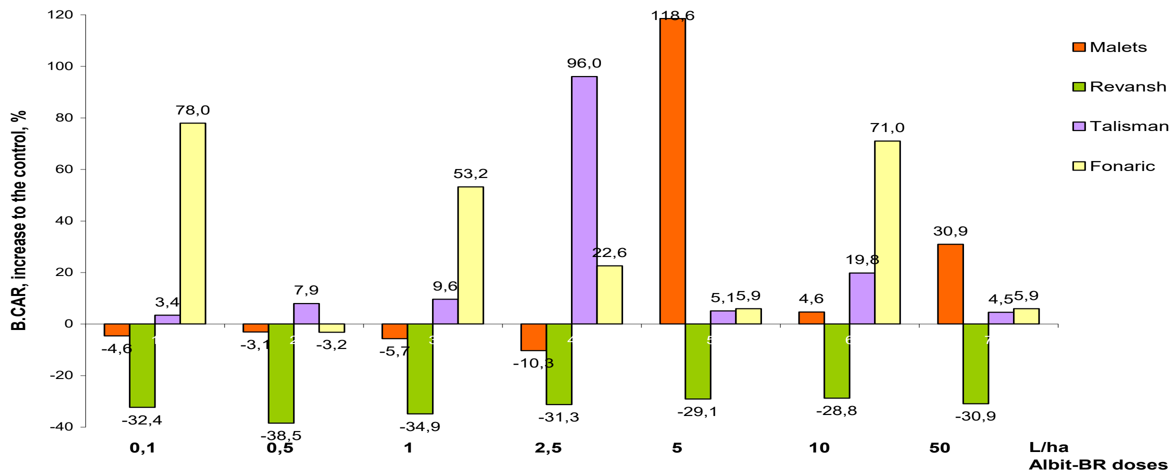

Figure 5. Effect of Albit-BR on beta-carotene content (BCAR) of four tomato cultivars.

CONCLUSIONS

Results revealed the effect of the biostimulant (Albit-BR) on the tomato cultivars proved significant for all the parameters under study. In cultivars Malets, Talisman, and Fonaric, notable impacts of the biostimulant were evident in yield, beta-carotene, and lycopene. However, the effect of the biostimulant was insignificant in the Revansh cultivar for the carotenoids. The cultivar Malets recorded the highest total fruit yield (96.76 t/ha) when treated with Albit-BR at 2.5 L/ha and the maximum beta-carotene (4.24 mg/100 g) and lycopene (23.02 mg/100 g) when treating the plants with Albit-BR (5 L/ha). Regarding the total chlorophyll and chlorophyll a and b contents, the effect of Albit-BR also emerged to be significant in all the cultivars. Therefore, the aforementioned biostimulant could be effective at doses of 2.5 to 5 L/ha to improve the tomato production and quality parameters.

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