

Impact of Growth Regulators and Light Intensity on the Yield and Steviol Glycosides Content of Stevia (*Stevia rebaudiana* Bertoni)

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Abstract: The field experiment was conducted at the agricultural research station of the College of Agricultural Engineering Sciences, University of Baghdad, during the 2022 growing season. The study aimed to assess the impact of growth regulators, including Gibberellin (GA₃) and Goltar Super (Paclobutrazol 25%), on the growth and yield of *Stevia rebaudiana* Bertoni, with an emphasis on leaf production and sweetness content. The experiment was conducted under two light - intensity conditions to evaluate the plant's response to these variables. The results revealed that plants attained their maximum height under E2 (92.67 cm); in contrast, plants cultivated in open field conditions demonstrated superior performance in terms of dry weight, leaf weight, and overall yield, registering 171.1 g, 101.7 g per plant, and 6.77 tons per hectare, respectively. Furthermore, plants treated with GA₃ at 400 mg L⁻¹ and 200 mg L⁻¹ exhibited the greatest heights, reaching 87.85 cm and 84.83 cm, respectively. The highest dry weight (172.0 g) was recorded in plants treated with GA₃ at 200 mg L⁻¹, while the maximum leaf weight and yield were observed with Goltar at 1000 mg L⁻¹ (88.6 g per plant and 5.89 tons per hectare) and GA₃ at 200 mg L⁻¹ (87.7 g per plant and 5.83 tons per hectare), respectively. However, none of the treatments led to significant differences in the percentages of Sativoside or Rebaudioside.

Keywords: growth regulators, lighting intensity, *Stevia rebaudiana*, Abiotic stress.

Introduction

The sugar leaf plant (*Stevia rebaudiana* Bertoni), is a perennial herbal species of the Asteraceae (Composite) family. Stevia is a short-day plant; the flower is a minimal size with

a white color, a broad root system, and fragile stems bearing leaves (3-4 cm long) lanceolate and serrated (Alahmad, 2018). Black fertile Seeds propagate stevia plants, stem cuttings, and micropropagation (Khalil *et al.*, 2014). Native to Paraguay, Argentina, and Brazil. It thrives in

tropical and subtropical regions, making it an ideal candidate for cultivation in these climates. The leaves of *Stevia rebaudiana* are renowned for their extraordinary sweetness, up to 300 times of sucrose sweetness. This high level of sweetness is attributed to the plant's rich content of glucoside sweeteners, particularly Stevioside and Rebaudioside, another major sweetening compound (Al Taweel *et al.*, 2021). *Stevia*, is highly suitable for diabetics, individuals with obesity, and those aiming to manage their weight, as it provides intense sweetness without any caloric contribution (Arumugam *et al.*, 2020; Patel & Navale, 2024; Yadav *et al.*, 2011). Goyal & Goyal (2010) also highlight that, despite its intense sweetness, *Stevia* does not contribute to caloric intake. Additionally, *Stevia rebaudiana* contains flavonoids and phenolic compounds that impart antioxidant properties, helping to mitigate oxidative stress (Kashan & Al-Taweel, 2024). Both genetic factors and agricultural practices, such as the application of plant growth regulators, influence the growth and productivity of *Stevia* plants. (Al Taweel *et al.*, 2020). Reducing the use of chemical fertilizers is possible by implementing environmentally friendly smart farming technology like growth regulators and foliar fertilizer interactions. Okbagabir *et al.*, (2024). The type of regulator, whether a stimulant or an inhibitor, the used concentration, application timing of application all play significant roles in determining the outcome of plant growth (Al-Khafaji, 2014). Hayssam *et al.*, (2012) discovered that applying gibberellin to *Hibiscus sabdariffa* L. reduced the inhibitory effect of NaCl on growth attributes and photosynthetic pigments by inducing the enzymes CA activity and enhancing RWC markedly increased plant

height, leaf area, and dry leaf weight. Similarly, Moreover, Matos (2020) demonstrated that applying gibberellin at different concentrations to *Spondias tuberosa* promoted root system development and increased seedling growth, particularly regarding leaf area and stem weight. These findings align with Atteya *et al.*, (2018), who reported that applying of a combination of 75 ppm ZnSO₄ and 150 ppm GA₃ significantly improved the traits in *Simmondsia chinensis* plants, the increasing chlorophyll content. In a study by Pan *et al.*, (2010), the impact of various growth regulators on the accumulation of alkaloids (Vindoline, Vinblastine, and Catharanthine) in *Catharanthus roseus* was investigated. The researchers observed that applying growth regulators, such as abscisic acid (ABA) and GA₃, hurt the accumulation of all three alkaloids. On the other hand, the treatment with CCC (Chlormequat chloride) had an increased accumulation of Vinblastine with reduced levels of Vindoline and Catharanthine. Furthermore, plant growth regulators have been found to enhance the production of Steviol glycosides, especially under water stress conditions. Karimi *et al.*, (2019) reported that applying Paclobutrazol significantly improved the synthesis of Steviol glycosides in stressed plants. When *Hyoscyamus niger* was treated with Alar (2000 and 3000 mg L⁻¹), Al Amrani *et al.*, (2021) observed an increase in chlorophyll content, while MC (1000 and 500 mg L⁻¹) produced the highest weight and dry yield of leaves. Additionally, the spraying with MC (1000 mg L⁻¹) and Alar (1000 mg L⁻¹) increased the content of Scopolamine. In another study, Osman *et al.* (2014) found that the application of 3500 mg L⁻¹ CCC to *Solidago canadensis* reduced plant height while enhancing the plans

total leaf area and fresh and dry weights. Arampatzis *et al.*, (2019) similarly found that applying growth regulators led to a reduction in plant height, with no significant effect on overall plant biomass, chlorophyll content, or silymarin content. Aziz & Al-Taweel (2020) utilized growth retardants to improve pre-acclimatization treatments in the in-vitro propagation of *Stevia* plants. By applying Alar (B9; succinic acid 2,2-dimethylhydrazide) and Cycocel (CCC; chloroethyl trimethyl ammonium chloride) in the culture medium, they investigated their impact on root system development and post-acclimatization of rooted plantlets. Their findings demonstrated that growth retardants increased the survival percentage of plants during acclimatization under greenhouse conditions. This protocol could be valuable for producing true-to-type *Stevia* plants, for medicinal and commercial use. Singh *et al.*, (2008) reported uncreased levels of linalool and linalyl acetate in *Salvia sclarea* L. plants when treated with 80 $\mu\text{L L}^{-1}$ Paclobutrazol. These findings emphasize the role of light intensity in plant development and performance. Each plant species has unique light intensity requirements, directly influencing growth and productivity. In the case of *Salvia sclarea*, Kumar *et al.*, (2013) observed a notable reduction in biomass and oil yield with an increase in shade intensity (0%, 25%, 50%, and 75%) compared to full sunlight. Likewise Reza *et al.*, (2018) confirmed the increase of *Salvia officinalis* L shading. Beyond 30% caused A reduction in plant growth and an increase in chlorophyll and carotenoid levels at lower light intensities. Nutrient application and light intensity are important abiotic factors affecting plant growth and development. Hamad *et al.*,

(2020). In studies on peppermint and *Stevia*, Malik & Almrani (2023), and Kashan & Al-Taweel (2024) found that plants grown in the open field conditions exhibited better growth characteristics and produced more secondary metabolites than those grown under shade. De Souza *et al.*, (2020) observed that increasing light intensity positively influenced biomass production and soluble sugar content in *Mentha arvensis*. Likewise, Thakur *et al.*, (2019) found that *Rosa damascena* Mill plants grown in open fields mulched with black polyethylene had the highest concentrations of citronellol and transgeraniol. However, plants grown under 50% shade were taller but produced fewer branches. Fadil *et al.*, (2016) reported similar findings in *Myrtus communis* L., where *sun-exposed* plants had shorter heights, smaller leaves, and thicker leaves than those grown under shaded conditions. Saran *et. al.*, (2021) also noted a negative effect of shading on the yield of fresh and dry leaves, as well as on stem dry weight and the compound methyl eugenol in *Ocimum tenuiflorum* L. compared to control plants.

In conclusion, the literature underscores the significant influence of environmental factors, particularly light intensity and the use of plant growth regulators, on the growth and productivity of various plant species.

The current study aimed to know the effect of the interaction between light intensity and spraying with growth regulators on the yield of *stevia* leaves and their sweetener content.

Material & Methods

A field experiment was conducted in the growing season of 2022 (March) at an agricultural station affiliated with the College of Agricultural Engineering Sciences, University of Baghdad. The experimental design involved five replicates for each treatment, with five experimental units subjected to 50% shading immediately after planting; in contrast, the remaining units were left in an open field with full sunlight exposure. Plant part used: leaves. soil texture: silty clay loam. Regardless of shading conditions, growth regulators were applied in the early morning across all experimental units, regardless of shading conditions.

Treatment

Goltar Super was applied at two concentrations (1000 mg L⁻¹ and 2000 mg L⁻¹), and Gibberellin (GA₃) was administered at two concentrations (200 mg L⁻¹ and 400 mg L⁻¹), with the control group receiving distilled water. The plants were harvested, 90 days after the planting (Khshan & Al-Taweel, 2023).

Parameter

Several growth parameters were measured, including plant height (cm), the number of primary branches per plant, and dry chlorophyll content in the leaves (SPAD units), dry weight of the plant (g), dry leaf weight (g per plant), and total dry yield (tons per hectare). The dry leaf yield was calculated based on a planting density of 166,000 plants per hectare (Khshan & Al-Taweel 2023).

Samples preparing for HPLC analysis

The leaves were carefully separated from the stems, dried at ambient room temperature (25–30°C) for 72 hours, and stored in perforated paper bags for further analysis. The drying process was meticulously managed to ensure uniformity, with the leaves being turned daily while kept in a shaded area until a consistent dry weight was reached (Al Amrani *et al.*, 2018). After drying, the leaves were finely ground using an electric grinder (Silver Crest), and the resulting powder from each treatment was stored in airtight polyethylene bags. These samples were refrigerated at 5°C to maintain their integrity for subsequent High-Performance Liquid Chromatography (HPLC) analysis.

HPLC protocol

The aqueous extraction method, and the quantification of Sativoside and Rebaudioside-A content in the *Stevia* leaves, were performed following the protocols described by Khshan & Al-Taweel (2023). High-Performance Liquid Chromatography (HPLC) was utilized to quantify Steviol glycosides, specifically Sativoside and Rebaudioside-A, in the samples. The analysis followed a modified version of the protocol provided in the technical bulletin by Thermo-Fisher (LC-SteviolGlycosides-AN70285-EN AN-241), with adjustments to the mobile phase. Calibration standards for the analysis were prepared by dissolving Rebaudioside-A and Sativoside standards, both sourced from Sigma-Aldrich, at a concentration of 1000 mg L⁻¹. For sample preparation, 5 mg of powdered *Stevia* leaf extract was dissolved in 25 ml of distilled water, followed by thorough mixing in a shaking water bath to ensure complete dissolution. The solution was filtered

through Whatman filter paper (0.4 mm pore size). A 10-microliter aliquot of the filtrate was injected into the HPLC system for analysis. The procedure began with the injection of standard solutions of Sativoside and Rebaudioside-A. The retention times and areas under the curve for the standards and samples were recorded. of

Sativoside and Rebaudioside-A were quantified according to the separation parameters provided in Table 1. The concentrations of these glycosides in the Stevia samples were calculated using the formula provided by (Khshan & Al-Taweel 2023).

$$\text{Conc. in the sample (\%)} = \frac{\text{Standard sample conc.} \times \text{Sample peak area}}{\text{Standard Peak Area}} \times \text{No. of dilutions}$$

Table (1): The separation conditions to estimate sweeteners (Stevioside and Rebaudioside) using HPLC.

Conditions of dismissal	
Mobile phase separation conditions / V	20/80/20 Acetonitrile / 10 mm ammonium format, PH =3 with HCl acid
separation Temperature	40 °C
sample size	M 110
Mobile Phase flow speed	0.5 ml/min
detector type	UV model SPD-20A set 210 nm
Separation column	mixed-Mode WAX-1 separation column
company and Model	Shimadzu 10 AV-LC

Experiment design and statistical analysis

We used Randomized Complete Block Design (RCBD) for the experiment design and the GenStat program for the statistical analysis (3 replicates x 10 treatments =30 expr. Units). L.S.D. was used to compare the 2 averages at a probability level of 0.05 (Steel & Torrie., 1997).

Results & Discussion

The findings presented in Table 2 indicate a pronounced influence of environmental factors, specifically light intensity, on plant height. E2 plants reached a height of 92.67 cm, significantly taller than plants grown in E1, which achieved a height of 55.57 cm. The application of growth regulators also obtained notable differences in plant performance. Plants treated with GA₃ at 400 mg L⁻¹ and 200 mg L⁻¹

exhibited heights of 87.85 cm and 84.83 cm, respectively. However, regarding the number of branches, no statistically significant differences were observed between the different lighting conditions or among the growth regulator treatments. Nevertheless, a significant effect of interaction between treatments was noted. The highest number of branches per plant (6.50) was observed in plants treated with Goltar Super at 1000 mg L⁻¹, showing no significant difference compared to the control in the open field. In contrast, the lowest branch numbers (4.40 and 4.47 branches per plant) were recorded in plants treated with GA₃ at 400 mg L⁻¹ in the open field and Goltar Super at 1000 mg L⁻¹ under 50% shading. As for chlorophyll content, the results, as shown in the table, did not reveal any

significant variation among the treatments. Table 3 highlights a significant difference in dry weight across the various conditions. Plants cultivated in the open field exhibited a substantially higher dry weight (171.1 g) than plants grown under shading, which recorded a dry weight of 138.0 g. When analyzing the effect of growth regulators, the highest dry weight was observed in GA₃-treated plants at concentrations of 200 mg L⁻¹ and 400 mg L⁻¹, which recorded 172.0 g and 162.0 g, respectively. In contrast, plants treated with Goltar Super at 2000 mg L⁻¹ and control group plants exhibited lower dry weights of 140.7 g and 145.4 g, respectively. The

interaction effects between growth regulators and environmental conditions further underscore the significant influence of these variables on plant biomass. The highest dry weights (176.2 g, 176.1 g, and 170.8 g) were recorded for plants treated with GA₃ at 200 mg L⁻¹ and 400 mg L⁻¹, and Goltar Super at 1000 mg L⁻¹, in the open field. On the other hand, plants treated with Goltar Super at 1000 mg L⁻¹ and control treatments under shaded conditions exhibited the lowest dry weights, at 118.1 g and 121.7 g, respectively.

Table (2): Effect of lighting intensity and growth regulators on plant height (cm), branches number, and total chlorophyll (SPAD) of *Stevia* plant.

growth regulator (mg L ⁻¹)	Plant height (cm)			Branches number (plant ⁻¹)			Chlorophyll total (SPAD)		
	light intensity			light intensity			light intensity		
	E1	E2	Average	E1	E2	Average	E1	E2	Average
Control	52.40	93.70	73.05	6.30	4.97	5.63	46.00	46.56	46.28
GA ₃ (200)	60.90	108.75	84.82	5.20	5.70	5.45	45.89	44.36	45.12
GA ₃ (400)	69.30	106.40	87.85	4.40	6.25	5.32	45.84	46.98	46.41
Goltar S. (1000)	48.00	78.00	63.00	6.50	4.47	5.48	47.54	42.34	44.94
Goltar S. (2000)	47.25	76.50	61.87	5.20	5.22	5.21	44.38	42.24	43.31
L. S. D	N. S			1.93			N. S		
Average	55.57	92.67		5.52	5.325		45.93	44.50	
L. S. D	5.502			N. S			N. S		

These results emphasize the critical role of environmental conditions and growth regulator treatments in optimizing plant growth and biomass accumulation.

The leaf yield of *Stevia* is of significant economic value due to its high concentration of

sweetening compounds. As shown in Table 3, substantial differences were observed in the characteristics of the plants, particularly in terms of maximum leaf weight and yield per hectare. Plants cultivated in an open field achieved a maximum leaf weight of 101.7 g per plant and a

6.773 tons per hectare yield. In contrast, plants grown under 50% shading produced a lower leaf weight of 63.3 g per plant and a yield of 4.215 tons per hectare. The application of growth regulators also had a marked impact on yield. Treated plants with Goltar Super (at 1000 mg L⁻¹) and GA₃ (at 200 mg L⁻¹) resulted in significantly higher leaf weights (88.6 g and 87.7 g per plant, respectively) and yields (5.89 and

5.83 tons per hectare, respectively), compared to the control plants, which yielded 74.9 g per plant and 4.98 tons per hectare. These results underscore the effectiveness of growth regulators in enhancing leaf production and overall yield, particularly in open-field conditions.

Table (3): Effects of light intensity and growth regulator on the plant dry weight (gm), leaves weight (gm plant⁻¹) and leaves yield (ton ha⁻¹) of the Stevia plant.

growth regulator (mg L ⁻¹)	plant's dry weight (gm)			leaves weight) gm plant ⁻¹)			leaves yield (ton h ⁻¹)		
	light intensity		Average	light intensity		Average	light intensity		Average
	E1	E2		E1	E2		E1	E2	
Control	169.1	121.7	145.4	97.9	51.9	74.9	6.51	3.45	4.98
GA ₃ (200)	176.2	167.9	172.0	101.7	73.6	87.7	6.76	4.90	5.83
GA ₃ (400)	176.1	147.9	162.0	95.7	60.8	78.2	6.37	4.04	5.20
Goltar S. (1000)	170.8	134.6	152.7	104.0	73.1	88.6	6.93	4.86	5.89
Goltar S. (2000)	163.2	118.1	140.7	109.3	57.2	83.3	7.28	3.81	5.54
L.S.D	13.45			18.59			1.23		
Average	171.1	138.0		101.7	63.3		6.773	4.215	
LS.D	15.43		8.51	23.76		9.46	1.58		0.63

Regarding the number of branches, no statistically significant differences were observed between the different lighting conditions or among the growth regulator treatments. Nevertheless, a significant effect of interaction was noted between treatments. The highest number of branches per plant (6.50) was observed in plants treated with Goltar Super at 2000 mg L⁻¹, showing no significant deviation from the control in the open field. In contrast, the

lowest branch numbers (4.40 and 4.47 branches per plant) were recorded in plants treated with GA₃ at 400 mg L⁻¹ in the open field and Goltar Super at 1000 mg L⁻¹ under 50% shading. Regarding the Steviol glycoside content in the leaves, the data presented in Table 4 indicate that certain treatments the sweetener percentages (as shown in Figures 1 and 2). Table 3 highlights a significant difference in dry weight across the various conditions. Plants cultivated in the open field exhibited a higher dry weight (171.1 g) than

those grown under shading, which recorded a dry weight of 138.0 g. When analyzing the effect of growth regulators, the highest dry weight was observed in plants treated with GA₃ at concentrations of 200 mg L⁻¹ and 400 mg L⁻¹, resulted in dry weights of 172.0 g and 162.0 g, respectively. In contrast, plants treated with Goltar Super at 2000 mg L⁻¹ and those in the control group exhibited lower dry weights of

140.7 g and 145.4 g, respectively. The interaction effects between growth regulators and environmental conditions further underscore the considerable influence of these variables on plant biomass. Additionally, Table 3 reveals that all treatments resulted in an increase in leaf yield (economic yield), with Goltar Super (1000 mg L⁻¹) and GA₃ (200 mg L⁻¹).

Table (4): Effect of light intensity and growth regulators on the percentage of Stevioside, Rebaudioside and Stev. + Reb content in the leaves of Stevia plant.

Growth regulator (mg L ⁻¹)	Stevioside %			Rebaudioside %			Stev. + Reb. %		
	light intensity			light intensity			light intensity		
	E1	E2	Average	E1	E2	Average	E1	E2	Average
Control	15.41	14.44	14.92	2.37	2.19	2.28	17.79	16.64	17.21
GA ₃ (200)	14.63	15.32	14.97	2.01	2.43	2.22	16.64	17.75	17.20
GA ₃ (400)	16.62	13.99	15.30	2.31	2.05	2.18	18.93	16.05	17.49
Goltar (1000)	14.04	15.58	14.80	2.09	2.29	2.19	16.12	17.87	17.00
Goltar (2000)	17.96	14.05	16.00	2.37	2.20	2.28	20.33	16.25	18.29
L.S.D	N.S			N.S			N.S		
Average	15.73	14.68		2.23	2.23		7.96	16.91	
LS.D	N.S.			N.S.			N.S.		

Discussion

The plant exhibited notable differences across various characteristics, including branch number, dry weight, leaf weight, and yield, except for plant height. Additionally, improvements were observed in the percentage of Sativoside, while the Rebaudioside levels were kept without any decline. Due to the lack of light, Stem elongation is one of the adaptation methods for plants in shaded environments is stem elongation (Kumer *et al.*, 2013; Fadil *et al.*,

2016). This elongation is triggered by changes in the phytochrome system, which plays a role in photosynthesis. When light is plentiful, the phytochrome absorbs red light it converts it from an inactive form (Pr) to an active form (Prf), which influences cell elongation, enabling plant to reach the light and enhance the photosynthetic efficiency (Taiz & Zeiger, 2006). Conversely, in shaded environments, the reduced exposure to far-red light triggers an increase in gibberellin production, stimulating plant height as the plant

stretches to access lighter. The open-field environment significantly impacted dry weight, leaf weight, and overall yield, as illustrated in Table 3. Plants grown in the open field exhibited considerable increases in these traits due to the abundance of radiation, which enhanced the rate of photosynthesis and growth, causing an increase in metabolic activity and the accumulation of dry matter, unlike plants grown in shaded conditions. Zervoudakis *et al.*, (2012) similarly found that shaded conditions can limit photosynthesis, transpiration, and stomatal conductance, depending on the plant type and the shading level. While some plants can photosynthesize effectively under moderate shade, Stevia plants in the open field benefitted from higher levels of radiation, leading to an increased concentration of photosynthetic products, including glycoside sweeteners such as Sativoside, which are rich in sugar. Tables 2, 3, and 4 show that the plant's response to growth regulators varied based on the type of regulator. The Applying of gibberellin (GA₃) at 400 mg L⁻¹ and 200 mg L⁻¹ resulted in the greatest increase in plant height. This effect can be attributed to stimulating the enzyme xyloglucan endotransglucosylase, which breaks the bonds between cellulose and hemicellulose in the plant cell walls. This process increases cell wall elasticity and enables cell expansion. Gibberellins may also activate other hormones such as, auxins, Brussino steroids, and cytokinins, which contribute to increased plant height and dry weight by facilitating nutrient absorption (Matos *et al.*, 2020; Murugan *et al.*, 2020).

Regarding the leaf weight and yield, treatments with Goltar Super (1000 mg L⁻¹) and GA₃ (200 mg L⁻¹) promoted the high sweetener content and enhanced the yield. Numerous environmental and hormonal factors determine the plant's response to growth regulators, and these responses can vary depending on the concentration of the regulator, the stage of application, and the plant species (Al-Khafaji, 2014). Hormonal balance is critical in directing and distributing nutrients to various plant organs. According to Singh *et al.*, (2008), growth regulators also affect the activity of key enzymes, such as catalase and peroxidase, which play crucial roles in plant metabolism. These enzymes contribute to increased biomass accumulation and overall productivity, as highlighted by (Al Amrani *et al.*, 2021). Significant increases in the leaf yield were observed without causing a noticeable reduction in the sweetener percentages (Table 4). In other words, the enhanced leaf yield observed with these treatments does not come at the cost of reducing the Steviol glycoside content. This finding is particularly noteworthy, as it addresses a common concern in agricultural production wherein a decline in qualitative traits, such as the concentration of desired compounds, often accompanies an increase in quantitative yield. In this case, the increase in leaf yield was achieved without compromising the sweetener quality, which is a crucial factor for maintaining Stevia crops economic and commercial value. This balance between higher yield and consistent sweetener content highlights the effectiveness of the growth regulators used in the current study.

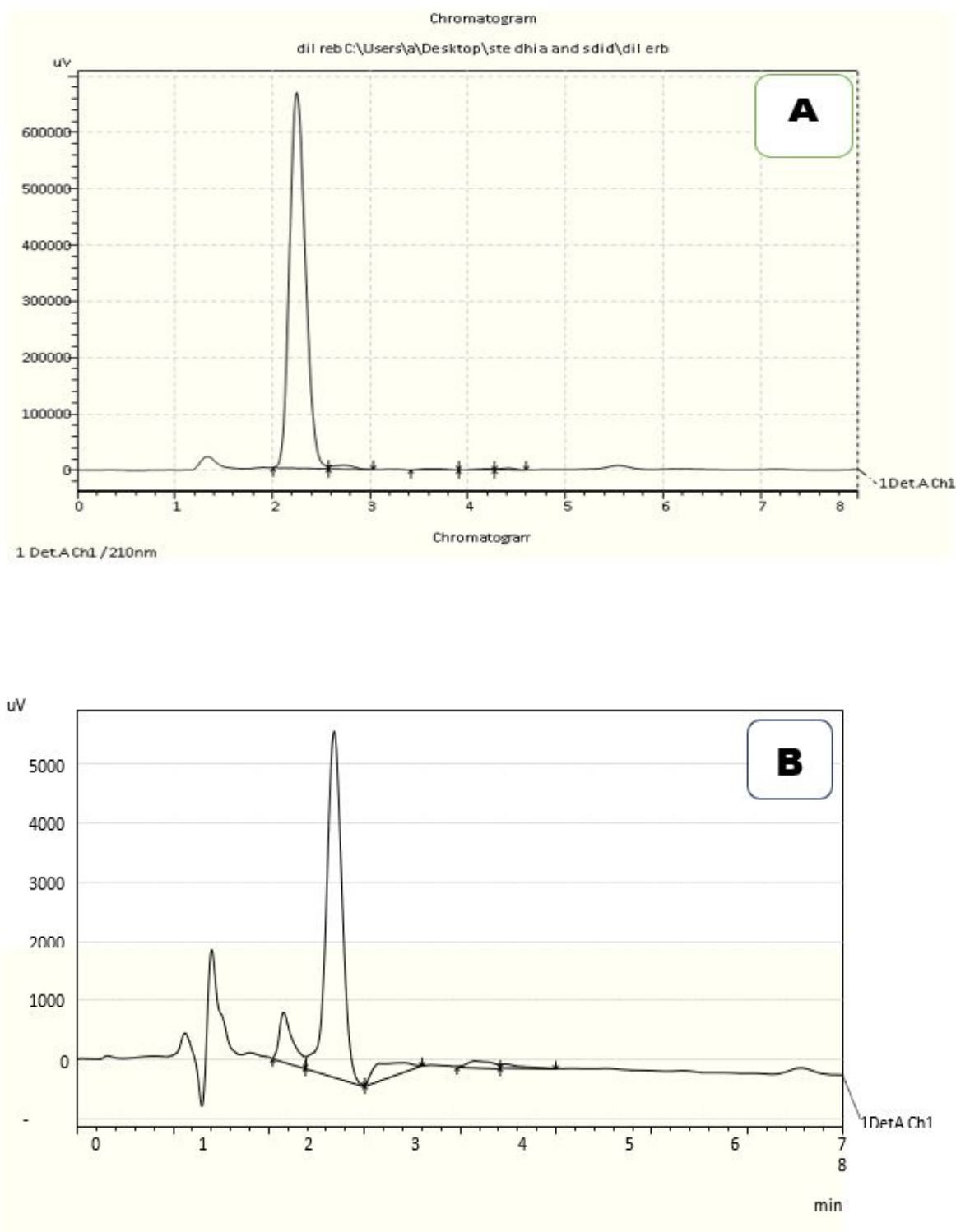


Fig. (1): HPLC chromatograms in leaves of *Stevia rebaudiana* Bertoni of A-Rebaudioside and B-Sativoside standards.

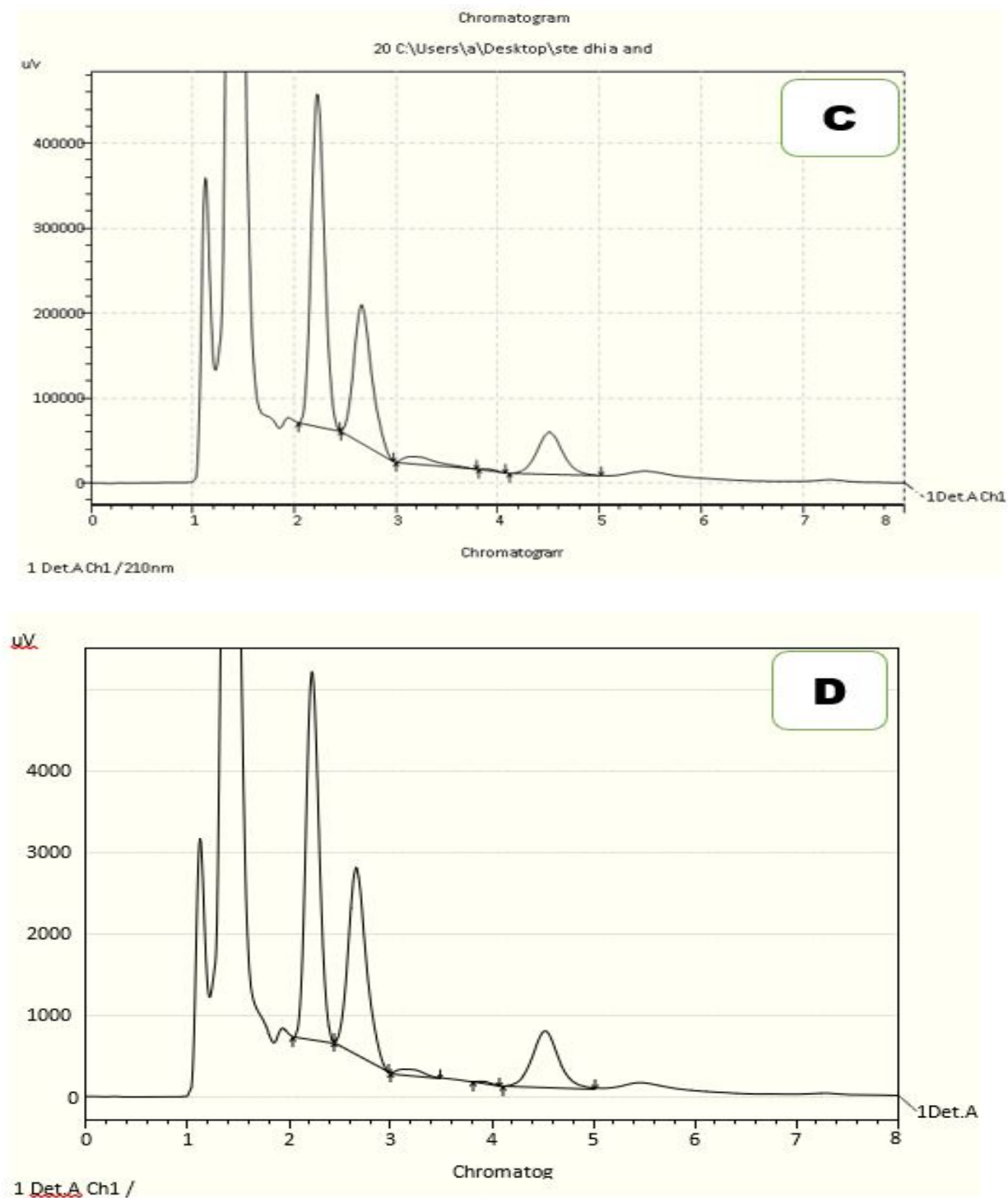


Fig. (2): HPLC chromatograms of sweeteners in leaves of *Stevia rebaudiana* Berton, C- Control and D-superior treatment (Goltar super 1000 mg L⁻¹)

Conclusion

Based on the conclusion of the current study, the open field environment in the study region is suitable for the growth and yield of stevia leaves while keeping their sweetener content, which can be done at a reasonable cost. Also, Spraying Goltar super (1000 mg L⁻¹) and GA₃ (200 mg L⁻¹) have a role in maximizing the yield of economically important leaves in open field conditions (100% sunlight). The findings offered valuable insights into the effects of growth regulators and shading on *Stevia* yield and quality, with important implications for optimizing strategies in commercial production.

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Contributions of authors

H.A.A. & S.K.A. Participated in implementing the field experiment, measuring the characteristics, and statistical analysis. D. F. A. Estimated the sweeteners by HPLC.

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Conflicts of interest

The authors declare no conflict of interest, financial or otherwise.

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تأثير منظمات النمو وشدة الإضاءة في الحاصل ومحتوى كلايكوسيدات الستيفول لنبات الستيفيا (*Stevia rebaudiana* Bertoni)

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المستخلص: أجريت تجربة حقلية في محطة البحوث الزراعية التابعة لكلية علوم الهندسة الزراعية جامعة بغداد خلال موسم النمو 2022. هدفت الدراسة إلى تقييم تأثير منظمات النمو، تضمنت الجبرلين (GA3) وسوبركولتار (باكلوبوترازول 25%) في نمو وإنتاجية نبات الستيفيا (*Stevia rebaudiana* Bertoni) من الأوراق ومحتواها من المحليات. نفذت التجربة تحت ظروف شدة إضاءة مختلفة لتقييم استجابة النبات لهذه المتغيرات. أظهرت النتائج أن النباتات وصلت إلى أقصى ارتفاعاً لها تحت شدة إضاءة (50%) E2 (92.67 سم)، في المقابل أظهرت النباتات المزروعة في ظروف الحقل المفتوح أداءً متفوقاً من حيث الوزن الجاف ووزن الأوراق والإنتاج الكلي للأوراق، إذ سجلت 171.1 غم و 101.7 غم نبات¹⁻ و 6.77 طن هـ¹⁻ على التوالي. علاوة على ذلك، أظهرت النباتات المعاملة بالجبرلين (تركيز 400 ملغم لتر¹⁻ و 200 ملغم لتر¹⁻) أعلى ارتفاعاً، إذ بلغت 87.85 سم و 84.83 سم على التوالي. سجل أعلى وزن جاف (172.0 غم) عند النباتات المعاملة بالجبرلين (200 ملغم لتر¹⁻)، في حين لوحظ أن أعلى وزن وحاصل للأوراق عند المعاملة بالكولتار تركيز 1000 ملغم لتر¹⁻ (88.6 غم نبات¹⁻ و 5.89 طن هـ¹⁻) وعند المعاملة بالجبرلين تركيز 200 ملغم لتر¹⁻ (87.7 غم نبات¹⁻ و 5.83 طن هـ¹⁻)، على التوالي. ولم تؤد أي من المعاملات إلى اختلافات معنوية في نسب الستيفوسايد أو الريبوديوسايد.

الكلمات المفتاحية: منظمات نمو، شدة إضاءة، *Stevia rebaudiana*، الشد اللاحيوي