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EFFECT OF ADDITION COW MANURE AND SPRAYING WITH TRIACONTANOL ON THE GROWTH AND YIELD OF OLIVE TREES CV. KHASTAWI

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Abstract

Olive trees suffer from many problems, the most prominent of which is low yield and alternating fruiting due to poor nutrition and environmental problems such as high temperatures and intense solar radiation. This study occurred in a private olive orchard within the Ramadi Jazeera area through 2022 growth phase for assessing their impacts when adding cow manure at levels of (0, 5, 10 kg tree^{-1}) and applying the growth regulator Triacontanol using levels containing (0, 10, 20 mg L^{-1}) on the growth as well as yield of 12-year-old Khastawi olive trees. The experiment used a factorial design with two components based on the Randomized Complete Block Design (RCBD) and included three replicates. Findings indicated the significant advantage for the therapy involving the addition of cow manure at a rate of 10 kg per tree in terms of branch length increment, leaf count increase area of leaves, proportion of dry substance within leaves, chlorophyll concentration in leaves, carbohydrate content in branches, fruit shape parameters, average fruit weight, total yield, dry matter percentage in fruits, and oil content estimation. When growth regulators were used along with Triacontanol spraying with amount of 20 mg L^{-1}, there had been a noticeable increase within branch length, leaf counting, leaf area, and the proportion of dry stuff.

The concentration of chlorophyll in the leaves, quantity of carbohydrates in the branches, fruit form parameters, average fruit weight, and overall yield. Proportion of dry matter in fruits and calculation of oil content. The interaction treatment, which included the application of 10 kg of cow dung per tree and the spraying of growing regulation by using dose of 20 mg L^{-1}, significantly influenced the majority of those examined features.

Keywords: Olives, Cow Manure, Triacontanol, Yield.

تأثير إضافة مخلفات الابقار ورش Triacontanol في نمو وحاصل أشجار الزيتون صنف خستاوي

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الخلاصة

تعاني أشجار الزيتون من مشاكل عديدة لعل ابرزها انخفاض الحاصل وتبادل الحمل نتيجة ضعف التغذية والمشاكل البيئية من ارتفاع درجات الحرارة وشدة الاشعاع الشمسي، نفذت التجربة في بستان الزيتون الخاص في منطقة جزيرة الرمادي خلال موسم النمو 2022 لمعرفة تأثير اضافة مخلفات الابقار بالمستويات (0، 5، 10 كغم شجرة$^{-1}$) والرش بمنظم النمو الترايكونتانول بتركيز (0، 10، 20 ملغم لتر$^{-1}$) في نمو وحاصل اشجار الزيتون صنف خستاوي، بعمر 12 سنة، وكانت التجربة عاملية بعاملين وفق تصميم القطاعات العشوائية الكاملة RCBD وبثلاث مكررات، أظهرت النتائج التفوق المعنوي لمعاملة اضافة مخلفات الابقار H2 بمستوى 10 كغم شجرة$^{-1}$ في معدل الزيادة في طول الافرع ومعدل الزيادة في عدد الاوراق ومساحة الورقة ونسبة المادة الجافة في الاوراق ومحتوى الاوراق من الكلوروفيل ومحتوى الافرع من الكربوهيدرات ومعامل شكل الثمرة ومعدل وزن الثمرة والحاصل الكلي والنسبة المئوية للمادة الجافة في الثمار والنسبة المئوية للزيت، كما اظهرت استخدام منظمات النمو عند اجراء الرش الترايكونتانول T2 بمقدار 20 ملغم لتر$^{-1}$ تحسن معنوي ملحوظ عند معدل الزيادة في اطوال الافرع ومعدل الزيادة في عدد الاوراق ومساحة الورقة ونسبة المادة الجافة في الاوراق ومحتوى الاوراق من الكلوروفيل ومحتوى الافرع من الكربوهيدرات ومعامل شكل الثمرة ومعدل وزن الثمرة والحاصل الكلي والنسبة المئوية للمادة الجافة في

الثمار والنسبة المئوية للزيت، كما كان للتداخل لمعاملة التداخل H2T2 (اضافة مخلفات الابقار بمستوى 10 كغم شجرة$^{-1}$+ رش منظم النمو بتركيز 20ملغم لتر$^{-1}$) بين العاملين الاثر المعنوي في معظم الصفات المدروسة.

كلمات مفتاحية: الزيتون، مخلفات الابقار، الترايكونتانول، الحاصل.

Introduction

Olea europaea L., known as the olive tree, belongs to the Oleaceae family, which comprises thirty genera, including Olea. This evergreen species thrives in subtropical regions and is extensively cultivated in central and northern areas of Iraq (13). There are more than 40 varieties are distributed in these regions, with the Khastawi, Ashrasi, and Bashiqi varieties being the most significant (21).

Fertilization is crucial for enhancing the growth and output of olive trees, particularly organic fertilization, Organic fertilization significantly nourishes fruit trees by supplying critical nutrients throughout their growth stages. It enhances the plant's capability to survive environmental and climatic fluctuations while reducing its need on chemical fertilizers. Organic fertilizers enhance soil fertility and augment its chemical, physical, and biological features, positively influencing vegetative growth characteristics and thus elevating tree production (12 and 29). Fertilizing olive trees is crucial due to its inclusion of essential amino acids and minerals required for development. The use of organic fertilizers enhances biodiversity, and the proliferation of organisms in the soils promotes decomposing to organic material and enhancing the quality of soil properties (5 and 20).

Plant growth regulators are crucial in enhancing and controlling plant growth as they influence numerous physiological mechanisms that govern the growth and developmental stages of plants. A key compound in this context is triacontanol, the plant's waxy layer contains by nature the growth regulator. It enhances the characteristics of green tissue, improves photosynthesis, regulates stomatal opening and closing, and increases the levels of carbohydrates, amino acids, and sugars in the plant, thereby facilitating soil nutrient uptake. Notably, it remains effective at low concentrations (3 and 28). Dash (14) demonstrated that the application of a TRIA growing regulation with an amount of 5 mg L^{-1} on mango trees significantly enhanced the quantity of leaves with chlorophyll as well as carbohydrates was compared with the control treatment. Enhancing the food status of trees fortifies their resilience against many external and internal causes; hence Enhancing the development of vegetative characteristics, demonstrated through increases in yield. The review was thereafter directed with determination. The review focused on the impact of cow manure on the development regulator Triacontanol, specifically in relation to the enhancement and augmentation of dietary yield (2). Therefore, the current study was carried out to determined the important of adding cow fertilizer and spraying with growth regulator (Triacontanol) in promoting the growing and productivity of olive trees.

Materials and Methods

A research project was conducted in a private olive orchard in the Jazeera AL-Ramadi region during the growing season from 1\3\2022 to 10\11\2022 to assess the effects of incorporating cow manure at levels of 0, 5, and 10 kg tree^{-1}, designated as H0, H1, and H2, respectively in 1/3/2022. Additionally, the study evaluated the impact of spraying the growth regulator Triacontanol at concentrations of 0, 10, and 20 mg L^{-1}, represented as T0, T1, and T2, respectively sprayed on 5\3, 5\4 and 5\5, on the growth and yield of olive trees of the Cv. Khastawi variety. At the age of 12, their vegetative development exhibited maximal homogeneity. Administrative tasks were conducted for each tree included in the study, encompassing irrigation and pruning. A container with a capacity of 100 liters was utilized, incorporating drops of liquid soap as a surfactant to diminish surface tension and ensure adherence to the leaves. The spraying procedure was executed promptly in the morning until complete saturation was achieved. Soil samples from the plantation were collected for the analysis of various chemical and physical properties (Table 1). A multifactorial study utilizing a randomized complete block design (RCBD) with three replications was conducted. The results were statistically analyzed using the Genestate program, and the means were compared using the least significant difference (LSD) test at a significance level of 0.05 (7).

Table 1: Several chemically as well as physically characteristics for orchard soil.

Attributes	Values	Measurement units
N	124	mg kg^{-1}
P	7.89	
K	228.41	
O.M.	0.325	%
PH	7.69	----
EC	1.12	ds m^{-1}
Clay	14	g kg^{-1} Soil
Silt	498	
Sand	488	
Soil texture	Sandy Loam	

Studied Traits:

Increment in branch length (cm): Measurements were recorded at the commencement of the test using a measuring tape, and then remeasured at the conclusion of the trial; the variance between these measurements indicates the increase in branch length.

leaf plant^{-1}: The estimates made before to and during the experiment indicate that the disparity between them reflects the rates of leaf growth.

Leaf area (cm^2): ascertained by using the fourth and fifth leaves from the apex of the branch at the conclusion of the experiment, in accordance with the methodology (8). The equation is as follows:

Leaf area = 0.785 x Leaf length x Leaf width

Dry matter in the leafe (%): The leaves were desiccated using an electric oven as per the methodology outlined by Al-Sahhaf (9).

Content of total Chlorophyll in leaves (mg 100 g^{-1} fresh weight): It was estimated using Goodwin's methodology (16).

Content of Carbohydrate in branches (%): The amount of carbohydrates in branches was assessed following Joslyn (22).

Fruit shape prameter: The measurement was obtained by dividing the length of the fruit by its diameter, as per the methodology described by (15 and 17).

Fruit weight (g): A exact electronic scale was used to find the average weight of 20 fruits that were picked at random during the harvest (6).

Total yield (kg tree-^{1}): The fruits from each tree were collected and weighed in 10\11\2022 (27).

Fruits dry weight (%): The calculation was performed using the accompanying (18): Percentage of dry matter in fruits = (dry weight / wet weight) × 100

Percentage of oil estimation (%): The oil percentage is estimated using the technique outlined by A.O.A.C. (1).

Results and Discussion

Increment in Branch length (cm): The results of the quantitative evaluation presented in Table 2 indicate significant disparities among the cow manure expansion treatments, with treatment (H2) exhibiting the most rapid growth rate, reaching 7.83 cm, while the correlation using H0 recorded the lowest growth rate at 6.07 cm. Regarding the application of showering agents with the growth regulator Triacontanol, significant disparities were observed among the means; the T2 treatment exhibited the highest growth rate, reaching 8.00 cm, whilst the controlled T0 treatment showed the least growth rate at 6.12 cm. Regarding the interaction between the treatments involving cow manure, crucial changes in the means were noticed among those applying the growth regulator Triacontanol. The H2T2 treatment exhibited the highest growth rate at 10.33 cm, whereas the H0T0 treatment recorded the lowest growth rate at 5.54 cm.

Table 2: Impact of cow dung application and Triacontanol spray, together with their interaction, on the rate of branch length increase (cm).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	5.54	6.00	6.67	6.07
H_1	6.33	6.33	7.00	6.56
H_2	6.50	6.67	10.33	7.83
Mean (T)	6.12	6.33	8.00	
LSD 0.05	$LSD_{0.05}H=0.91$	$LSD_{0.05}T=0.91$	$LSD_{0.05}H\times T=1.57$	

The H2 experiment documented a significant rate of 9.18 leaves per plant, while the control treatment H0 exhibited the lowest rate of 7.27 leaves per plant. The use of the growth regulator Triacontanol on the plants resulted in a positive effect on leaf production, with trial T2 exhibiting a significantly higher rate of 9.42 leaves per plant, while the control treatment H0 given the smallest rate of 7.33 leaves per plant. Regarding the interaction between the two review elements, significant disparities were seen across the treatments, with the H2T2 treatment exhibiting the highest rate of 11.85

leaves per plant, whilst the H0T0 treatment recorded the lowest rate of 6.60 leaves per plant (Table 3).

Table 3: Impact of cow manure application and Triacontanol spraying, as well as their interaction, on the rate of leaf increase (leaves plant^{-1}).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	6.60	7.20	8.00	7.27
H_1	7.60	7.60	8.40	7.87
H_2	7.80	7.90	11.85	9.18
Mean (T)	7.33	7.57	9.42	
LSD 0.05	$LSD_{0.05}$H= 1.00	$LSD_{0.05}$T= 1.00	$LSD_{0.05}$H×T= 1.74	

Leaf area (cm^2): The H2 treatment demonstrated the biggest increase at 7.57 cm^2, while the correlation management intervention (H0) recorded a lesser increase of 5.83 cm^2. Regarding the development controller administering medications, significant disparities were seen between the averages, with the T2 treatment exhibiting the highest rate of 7.37 cm^2, whilst the control treatment T0 were having a smallest rate of 6.03 cm^2. An interaction between cow manure expansion treatments and growth regulator spraying treatments significantly influenced leaf area, with the H2T2 treatment achieving the highest rate of 9.64 cm^2, whilst the lowest was observed with the H0T0 treatment at 5.44 cm^2.

Table 4: Impact of cow dung application and Triacontanol spraying, together with their interaction, on leaf area (cm^2).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	5.44	5.94	6.11	5.83
H_1	6.18	6.25	6.36	6.27
H_2	6.46	6.60	9.64	7.57
Mean (T)	6.03	6.26	7.37	
LSD 0.05	$LSD_{0.05}$H= **0.76**	$LSD_{0.05}$T= **0.76**	$LSD_{0.05}$H×T= **1.31**	

Dry matter in the leaves (%): The findings in Table 5 demonstrate that the application of cow dung to olive trees considerably influenced the amount of dry matter in the leaves. Therapy H2 exhibited the highest percentage at 68.27%, while the control therapy H0 recorded the lowest proportion at 60.59%.

The impacts of grow regulator-treated foliar sprays indicated that treatment T2 attained a height percentage of 68.64%, whereas the comparator treatment (T0) recorded the lowest percentage of 61.08%.

Concerning the interaction between cow manure addition therapies and growth regulator spraying treatments, there are no significant differences between the two average increases in the percentage of dry matter inside each leaf.

Table 5: Impact of cow manure application and Triacontanol growth regulator spraying, as well as their interaction, on leaf dry matter percentage (%).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	57.88	61.07	65.83	60.59
H_1	64.24	67.93	66.38	66.19
H_2	64.12	67.00	73.70	68.27
Mean (T)	61.08	65.33	68.64	
LSD 0.05	$LSD_{0.05}$H= **3.74**	$LSD_{0.05}$T= **3.74**	$LSD_{0.05}$H×T= **NS**	

Content of Chlorophyll in leaf (mg $100g^{-1}$ fresh weight): The results of the factual analysis presented in Table 6 indicate significant disparities among the cow manure treatment applications. The H2 treatment exhibited the highest rate of 50.0 mg $100g^{-1}$ fresh weight, whereas the lowest rate of 36.7 mg $100g^{-1}$ fresh weight was observed in the control treatment H0. Regarding the foliar spraying treatments with the growth regulator Triacontanol, they significantly influenced the chlorophyll content of the leaves, with the T2 treatment reporting the highest rate of 50.7 mg $100g^{-1}$ fresh weight, while the lowest rate of 34.1 mg 100 g^{-1} fresh weight was recorded in the control treatment T0. Concerning the interaction between the two experimental factors, substantial differences were noted among the means, as the H2T2 treatment recorded the highest rate of 65.1 mg $100g^{-1}$ fresh weight, while the lowest rate of 26.8 mg $100g^{-1}$ fresh weight was found in the H0T0 treatment.

Table 6: Impact of cow dung application and Triacontanol spraying, as well as their interaction, on chlorophyll content in leaves (mg $100g^{-1}$ fresh weight).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	26.8	39.3	43.9	36.7
H_1	33.3	42.4	43.2	39.6
H_2	42.2	42.7	65.1	50.0
Mean (T)	34.1	41.5	50.7	
LSD 0.05	$LSD_{0.05}$H= **5.76**	$LSD_{0.05}$T= **5.76**	$LSD_{0.05}$H×T= **9.97**	

Content of Carbohydrate in branches (%): The results from the quantitative analysis presented in Table 7 indicated significant differences among the cow manure application treatments, with treatment H2 achieving the highest rate of 7.83%, while the control treatment (H0) recorded the lowest rate of 6.37%.

Regarding the foliar splash treatments, all significantly influenced the carbohydrate content of the branches, with treatment T2 exhibiting the highest percentage at 8.03%, while the control treatment (T0) displayed the lowest at 5.97%.

Regarding the communication coefficients between the two review elements, significant disparities were seen in the means, with treatment H2T2 exhibiting the highest rate at 9.67%, while treatment H0T0 displayed the lowest rate at 4.67%.

Table 7: Impact of cow dung application and Triacontanol growth regulator spraying, as well as their interaction, on carbohydrate content in branches (%).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	4.67	7.10	7.33	6.37
H_1	6.57	6.63	7.10	6.77
H_2	6.67	7.17	9.67	7.83
Mean (T)	5.97	6.97	8.03	
LSD 0.05	$LSD_{0.05}H$= **0.89**	$LSD_{0.05}T$= **0.89**	$LSD_{0.05}H\times T$= **1.55**	

Fruit shape parameter: The results presented in Table 8 indicate significant disparities among the treatments involving cow manure, with treatment H2 achieving the highest rate of 1.518, whereas the control treatment H0 exhibited the lowest rate of 1.215. In terms of the application of growth regulators, a beneficial effect was observed, as treatment T2 attained the highest rate of 1.486, in contrast to the control treatment T0, which recorded the lowest rate of 1.266. Furthermore, the interaction between the study factors revealed significant differences, with treatment H2T2 reaching the highest rate of 1.617, while treatment H0T0 recorded the lowest rate of 1.051.

Table 8: Impact of cow dung application and Triacontanol spraying, as well as their interaction, on the fruit form parameter content.

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	1.051	1.261	1.333	1.215
H_1	1.253	1.391	1.508	1.384
H_2	1.495	1.442	1.617	1.518
Mean (T)	1.266	1.365	1.486	
LSD 0.05	$LSD_{0.05}H$= **0.050**	$LSD_{0.05}T$= **0.050**	$LSD_{0.05}H\times T$= **0.086**	

Fruit weight (g): The results of the empirical analysis in Table 9 indicated significant disparities among the treatments using bovine waste, with the H2 treatment exhibiting the highest rate of 4.14g, whilst the H0 treatment shown the lowest rate of 3.39g. The application of the development controller significantly influenced the average weight of the fruit, with the T2 treatment yielding the highest weight at 4.06 g, whilst the control treatment (T0) recorded the lowest weight at 3.53 g. Regarding the interaction between cow manure and the application of the growth regulator Triacontanol, the H2T2 treatment exhibited the highest rate at 4.56g, while the H0T0 treatment shown the lowest rate at 3.20 g.

Table 9: Impact of cow dung application and Triacontanol spraying, together with their interaction, on fruit weight (g).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	3.20	3.40	3.59	3.39
H_1	3.38	3.73	4.04	3.72
H_2	4.01	3.87	4.56	4.14
Mean (T)	3.53	3.67	4.06	
LSD 0.05	$LSD_{0.05}H$= **0.06**	$LSD_{0.05}T$= **0.06**	$LSD_{0.05}H\times T$= **0.11**	

Total yield (kg $tree^{-1}$): The results of the empirical analysis presented in Table 10 indicate that the incorporation of bovine manure significantly influenced the total yield, with the H2 treatment achieving the highest yield of 15.87 kg $tree^{-1}$, whereas the control treatment H0 yielded the lowest at 12.80 kg $tree^{-1}$. Regarding the foliar application of the growth regulator Triacontanol, substantial differences were observed among the treatments, as T2 recorded the highest yield of 15.54 kg $tree^{-1}$, while T0 yielded the lowest at 13.32 kg $tree^{-1}$. Concerning the interaction between the two experimental factors, notable disparities were evident in the average total yields, with the H2T2 treatment attaining the highest yield of 16.87 kg $tree^{-1}$, in contrast to the H0T0 treatment, which recorded the lowest yield of 11.14 kg $tree^{-1}$.

Table 10: Impact of cow manure application and Triacontanol growth regulator spraying, along with their interaction, on total yield (kg $tree^{-1}$)

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	11.14	13.26	14.00	12.80
H_1	13.18	14.57	15.77	14.51
H_2	15.63	15.10	16.87	15.87
Mean (T)	13.32	14.31	15.54	
LSD 0.05	$LSD_{0.05}$H= **0.50**	$LSD_{0.05}$T= **0.50**		$LSD_{0.05}$H×T= **0.87**

Percentage of dry matter in fruits (%): The findings of Table 11 demonstrate that there are substantial variations between the treatments of adding cow dung, as treatment H2 recorded the highest rate of 25.39% while the comparison treatment H0 recorded the lowest rate of 20.58%. As for spraying with growth regulators, it had a favorable impact, as treatment T2 recorded the greatest rate of 24.88% while the comparative treatment T0 recorded the lowest rate of 21.36%. The interaction among the study components revealed substantial variations, with treatment H2T2 achieving the maximum rate of 27.00%, whilst treatment H0T0 attained the lowest rate of 17.97%.

Table 11: Impact of incorporating cow manure and applying the growth regulator Triacontanol, as well as their interaction, on the percentage of dry matter in fruits (%).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	17.97	21.39	22.40	20.58
H_1	21.09	23.33	25.23	23.22
H_2	25.02	24.16	27.00	25.39
Mean (T)	21.36	22.96	24.88	
LSD 0.05	$LSD_{0.05}$H= **0.81**	$LSD_{0.05}$T= **0.81**		$LSD_{0.05}$H×T= **1.41**

Percentage of oil (%): The statistical analysis results presented in Table 12 reveal significant disparities among the treatments involving cow manure, with treatment H2 achieving the highest percentage of 16.93%, whereas the control treatment H0 exhibited the lowest percentage of 13.66%. Furthermore, notable differences were observed among the treatments utilizing growth regulators, where treatment T2 attained the highest percentage of 16.59%, in contrast to the control treatment T0, which recorded the lowest percentage of 14.21%. Regarding the interaction between the study factors, significant differences were evident in the oil percentage, with treatment H2T2 yielding the highest percentage of 18.00%, while treatment H0T0 displayed the lowest percentage of 11.89%.

Table 12: Impact of incorporating cow dung and applying the growth regulator Triacontanol, as well as their interaction, on oil percentage (%).

Cow Manure (H)	Growth Regulator Triacontanol			Mean (H)
	T_0	T_1	T_2	
H_0	11.89	14.15	14.93	13.66
H_1	14.06	15.55	16.82	15.48
H_2	16.68	16.11	18.00	16.93
Mean (T)	14.21	15.27	16.59	
LSD 0.05	$LSD_{0.05}$H= **0.54**	$LSD_{0.05}$T= **0.54**	T=**0.93**×$LSD_{0.05}$H	

The results shown in Tables 2 through 12 indicate a significant enhancement in vegetative growth characteristics and yield with the addition of cow manure. The rationale for the increase may be attributed to cow manure and the organic compounds and nutrients it encompasses, including potassium, which plays a crucial role in photosynthesis, the transport of its products, and the enhancement of carbohydrate production in the branches (4). Conversely, the rationale for the increase may stem from the role of organic matter, which seeks to lower soil pH and enhance the availability of essential nutrients for plants, such as nitrogen, phosphorous, and potassium. It becomes evident that natural matter plays a crucial role in the raw materials and energy required to form new tissues within the plant's structure, while also contributing in other ways. It significantly enhanced microbial activity in the soil and increased protein efficacy, resulting in accelerated vegetative growth rates, as seen by the elongation of branches (Table 2) (10). The rationale for the increase may be attributed to the role of organic fertilizers in enhancing the availability of soil nutrients, such as nitrogen, by elevating soil acidity, which resulted in an increase in chlorophyll content in the leaves (Table 6). This, in turn, led to an enhancement in the photosynthetic process, an increase in starch synthesis, their transport and accumulation in the branches, and a rise in leaf area and dry matter content (Tables 4 and 5) (24). This aligns with the findings of (19 and 23).

Regarding the application of the growth regulator Triacontanol at a concentration of 20 mg L^{-1}, there was a significant enhancement in the vegetative growth characteristics and yield of olive plants. The increase in chlorophyll concentration in the leaves (Table 6) may be attributed to the role of the growth regulator Triacontanol, which influences protein synthesis, amino acids, and photosynthesis (26). The rationale for the increase may stem from the role of the development controller in enhancing the leaf area (Table 4) and its chlorophyll concentration (Table 6), resulting in an augmentation of the photosynthetic process and, consequently, an increase in the sugars produced and stored in the branches (Table 7) (11). Conversely, the rationale for the increase may be attributed to the role of the growth regulator in activating the Rubisco enzyme, which aims to enhance photosynthesis, protein synthesis, and the accumulation of amino acids and carbohydrates, in addition to the growth regulator's function in augmenting the size and quantity of chloroplasts, essential for chlorophyll production, thereby contributing to the rise in carbohydrates. This is evidenced by the increase in leaf area (Table 4), dry weight of leaves (Table 5), and chlorophyll concentration (25). This aligns with Tayah's (30) findings about the use of the growth regulator Triacontanol on pear seedlings, and is compatible with Dash's (14) research on mango trees.

Conclusions

The application of cow dung to olive trees at a rate of 10 kg per tree enhanced vegetative growth characteristics and carbohydrate content in the branches, resulting in increased tree output. The growth regulator at 20 mg L^{-1} positively influenced vegetative growth metrics and enhanced the nutritional quality of the trees. This resulted in an enhancement of the findings' quantity, and the outcomes of the bilateral interaction among the research components aligned with the effects of the individual treatments.

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The authors declare no conflict of interest.

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