

The Effect of the Organic Nutrient Disper Himifer GS and Spraying with Tryptophan on the Vegetative Growth Traits and Medicinal Active Compounds of the Plant Rosmary (*Rosmarinus officinalis*)

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Abstract. A field experiment was conducted in a plastic greenhouse covered with Saran at the College of Agriculture and Marshes, University of Dhi Qar, during the winter season of 2024–2025, using one-year-old rosemary plants (*Salvia rosmarinus*). The study aimed to investigate the effects of foliar application of Disper Humifer GS at 0, 2, and 4 g L⁻¹ and tryptophan at 0, 25, and 50 mg L⁻¹, individually and in combination, on vegetative growth, essential oil content, and some active compounds. The experiment was conducted as a factorial experiment using a Completely Randomized Design with three replicates. Treatments were applied as three foliar sprays at 15-day intervals, and means were compared using the Least Significant Difference test at $P \leq 0.05$. The results showed that Disper Humifer GS at 4 g L⁻¹ significantly increased most vegetative growth characteristics, recording 64.67 cm plant height, 5.394 branches plant⁻¹, 240.78 leaves plant⁻¹, 48 g dry weight, 12.27 mg 100 g⁻¹ fresh weight chlorophyll, and 5.900 g 100 g⁻¹ fresh weight carbohydrates. It also produced the highest essential oil percentage (1.651%) and increased Cymene, Linalool, and Camphene concentrations.

Tryptophan at 50 mg L⁻¹ recorded the highest values for most growth characteristics, including plant height (76.78 cm), branches (6.46 plant⁻¹), leaves (253.442 plant⁻¹), dry weight (53.78 g), chlorophyll (13.30 mg 100 g⁻¹), and carbohydrates (30 mg 100 g⁻¹), with essential oil reaching 1.558%. The interaction treatment of 4 g L⁻¹ Disper Humifer GS + 50 mg L⁻¹ tryptophan (A2B2) significantly improved most traits, achieving 79 cm plant height, 7 branches plant⁻¹, 259 leaves plant⁻¹, 1.723% essential oil, and the highest Camphene and Linalool concentrations.

Keywords: organic nutrient, Disper Humifer, tryptophan, plant rosemary, *Rosmarinus officinalis*.

1. INTRODUCTION

Rosemary (*Salvia rosmarinus* L.) Rosemary is a perennial evergreen shrub that belongs to the family Lamiaceae. The Mediterranean Basin and Southern Europe are its native habitats. While the plant grows wild in the latter regions[1], it has also spread to most countries around the world, with France, Spain, and Tunisia being prominent producers of oil derived from this plant. Rosemary is highly esteemed for its nutritional and medicinal value and has been used since ancient times to improve memory. The plant's leaves and oil are commonly used in the food industry to impart flavors, with the former also being used to extend the shelf life of perishable foods through volatile compounds and afford the [4,5] leaves antimicrobial and antioxidant properties [2,3]. The oil is also commonly used in the cosmetic and pharmaceutical industries to produce soaps, creams, lotions, and perfumes due to their delicate scent. The leaves and flower buds contain essential oils as an active chemical component, with borneol, camphene, camphor, and cineole being prominent compounds. Additionally, the leaves also contain flavonoids, tannins, rosmarinic acid, diterpenes, and rosemarcine. Organic materials are commonly used to replace mineral fertilizers and provide the vital nutrients that plants require for optimal growth [6]. Fertilizers contain alkaline substances and organic materials that can increase the acidity of agricultural soils, as well as increase the content of organic matter, improve soil physical properties, increase the ability of soil to retain water and nutrient resources, and improve soil aeration and drainage. Moreover, microbial organisms in fertilizers can promote soil microbial activity, improve soil biological activity, and enhance soil fertility and yield. Therefore, fertilizers must be reasonably managed to maintain soil fertility and ecological balance. Feleafel and Mirdad monitored the effect of three concentrations of humic acid [7] with NPK fertilizer on the tomato plant; they found that the effect of 1500 mg/L humic acid concentration significantly increased the leaf area to 6259.7 cm² and the plant leaves to 76.6 leaves/plant. Besides, they mentioned that spraying the plants with the amino acid tryptophan increased the plant content from essential oil [8].

Kazemi monitored the response of the tomato plant to concentration of humic acid in terms of increasing the plant height as it reached 118.45 cm, as well as the total chlorophyll, which reached 22.41 mg/100 g. Al-Azawi found an outstanding effect of the humic acid treatment when he applied it on the cucumber plant in the greenhouse to increase the height of the plant, which reached 153.50 cm and leaves to 95.3 leaves/plant and the leaf area to 75.97 dm²/plant, in addition to chlorophyll, which was 181.78 mg/100 g in the leaves [10]. Tryptophan is considered one of the essential amino acids. It is essential for humans and animals because it is the products of protein biosynthesis in all living things, and after it is consumed, it converted to metabolites important thereof: serotonin, melatonin, kynurenic acid, and niacin.

Tryptophan is also known as b-3-indolacrylic acid or b-3-indolacryloylalanine, as it is the only amino acid that contains an indole ring. Mahdi and Hussein showed an outstanding effect of 50 mg/l of this amino acid in increasing the vegetative growth of Canadian

goldenrod *Solidago* in plant height, number of branches, and leaf area. methodology This research aimed to investigate the effect of organic feeding and the amino acid on the vegetative growth of rosemary *Salvia rosmarinus* and its content of the active compounds. The following hypothesis was formulated: There be a significant effect of the application of and the amino acid on the vegetative growth of rosemary plants [11]. To test this hypothesis, the researchers planned the following experiment.

2. MATERIALS AND METHODS

2.1. MATERIALS

The experiment was conducted in a plastic greenhouse covered with Saran, affiliated with the Department of Horticulture and Landscape Engineering at the College of Agriculture and Marshes / Dhi Qar University for the 2023–2024 season. Rosemary seedlings were selected after being obtained from private nurseries in Dhi Qar Governorate, ensuring that the seedlings were as uniform in size and vegetative growth as possible. The seedlings were transferred to large pots (24 cm in diameter and 26 cm in height, with a capacity of 10 kg) filled with soil and peat moss at a ratio of 1:3 to provide suitable natural conditions for the plants as much as possible, with ongoing care operations (irrigation, weeding, pest control). Samples of the growing medium were taken before starting the experiment for laboratory testing, as shown in Table (1).

Table 1: Chemical and Physical Properties of the Soil Used in the Experiment

Property	Unit of Measurement	Value
Ph		7.4
EC	ds.m ⁻¹	2.49
Texture	Silty loam	
Sand	mg L ⁻¹	18.70
Silt	mg L ⁻¹	35.14
Clay	mg L ⁻¹	47.15
N (Nitrogen)	mg L ⁻¹	25.88
P (Phosphorus)	mg L ⁻¹	6.57
K (Potassium)	mg L ⁻¹	118.96

Study Treatments

The study included a factorial experiment with two factors: **The first factor:** Disper

Humifer GS (an organic nutrient) with control treatment (spraying with only distilled water) at concentrations of (2 g/L and 4 g/L). This product is manufactured by Al-Khadra Company for Fertilizer Production in Iran and was used in morning sprays until complete wetting, with an average of three sprays on the leaves on the dates of November 1, November 15, and December 1, 2024. **The second factor:** The amino acid tryptophan, represented by three levels (0, 25, and 50 mg/L). The spraying was done in three applications with two weeks between each spray, with the first spray on November 10, 2024. The plants were sprayed with the applied concentrations until complete wetting using a backpack sprayer.

Studied Traits: Plant Height (cm/plant): The height of the plants was measured at the end of the experiment using a measuring tape from the soil surface to the highest growing tip of the plant at the conclusion of the experiment, **Number of Branches (branches/plant):** The number of branches connected to the main stem was counted at the end of the experiment from the first branch near the soil surface to the top at the conclusion of the experiment, **Number of Leaves (leaves/plant):** The total number of leaves on the plants was calculated at the end of the experiment by counting the number of leaves on one branch and multiplying it by the number of branches (number of leaves per branch * number of branches) at the end of the experiment, **Total Chlorophyll Content:** The total chlorophyll content in the leaves was estimated using the method of Zaehring et al. (1974). This involved taking 0.5 g of fresh leaves, crushing it with 10 mL of 80% acetone, and measuring it with a spectrophotometer at wavelengths of 645 and 663 nanometers, **Total Carbohydrates Estimation:** The total carbohydrate content was estimated using the method of Hedge and Hofreiter (1962), measured at a wavelength of 490 nm with a spectrophotometer, **Percentage of Oil Estimation:** A sample of 100 g of plant leaves was weighed after being completely air-dried, and then the extraction process was carried out using a Clevenger apparatus for light oil. The final weight of the extracted oil was calculated using a sensitive balance with four decimal places (Kevreson, 2009), **Estimation of Active Compounds in Leaves:** The analysis was conducted in the laboratories of the Ministry of Science and Technology / Environmental and Water Directorate using a Shimadzu 2010 gas chromatography device (of Japanese origin) with a Flame Ionization Detector (FID). The active compounds camphene, cymene, and linalool were identified using gas chromatography. **Statistical Design and Treatments Used** The experiment was conducted as a factorial experiment using a Randomized Complete Block Design (R.C.B.D) with three replications, where three seedlings represented one experimental unit. This design aimed to illustrate the effects of the study factors: the first factor being the organic nutrient Disper Humifer GS at three concentrations (0, 2, and 4 g/L), and the second factor being the amino acid tryptophan (denoted as A) at three levels (0, 25, and 50 mg/L) (Al-Rawi and Khalaf Allah, 2000). The data were statistically analyzed using Genstat software (2007), and the means were tested using the Least Significant Differences Test (L.S.D) at a probability level of 0.05.

3. RESULTS AND DISCUSSION

3.1. RESULTS

Plant Height (cm) table (2) shows that there were significant differences among all treatments of the organic nutrient, with the 4 g/L treatment yielding the highest average height of 64.67cm, while the lowest value was recorded in the control treatment at 54.00cm. The results in table (2) indicate a highly significant effect of tryptophan on the average plant height, with treatment B2 recording the highest average at 76.78cm compared to the control treatment, which yielded the lowest value of 40.00cm (B0). Furthermore, the interaction between the organic nutrient Disper Humifer GS and tryptophan had a significant effect on the values, with the plants treated with A2B2 achieving the highest height of 79.00cm compared to the lowest height resulting from the control treatment A0B0, which was 33cm.

Table 2 : Effect of the Organic Nutrient Disper Humifer GS and Tryptophan and Their Interactions on Plant Height (cm) of Rosemary

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	33.00	40.00	47.00	54.00
A1	53.67	60.67	68.00	58.89
A2	75.33	76.00	79.00	64.67
Average Tryptophan Acid	40.00	60.78	76.78	
LSD	0.05			
	1.382	1.382		2.393

Number of Branches (Branches per Plant) table (3) shows that the differences were significant among all organic nutrient treatments. The treatment of 4 g per liter resulted in the highest average of 5.394 branches per plant, while the lowest value was recorded in the control treatment at 4.286 branches per plant. There is a highly significant effect of tryptophan acid on the number of plant branches, with treatment B2 recording the highest average of 6.463 branches per plant, while the control treatment yielded the lowest average of 3.211 branches per plant. The results of the interaction between the experimental factors, as shown in table (3), indicated that the combination of (4g per liter of organic nutrient and 50 mg per liter) achieved the highest number of branches, reaching 7.000 branches per plant, with a significant difference from the other combinations. Conversely, the lowest value for the number of branches was recorded at 2.300 branches per plant in the control treatment.

Table 3 : Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Number of Branches (Branches per Plant) for Rosemary Plants

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	2.300	3.300	4.033	4.286
A1	4.700	4.833	5.150	4.889
A2	5.857	6.533	7.000	5.394
Average Tryptophan Acid	3.211	4.894	6.463	
LSD	0.05			
	0.1466	0.1466	0.2538	

Number of Leaves (Leaves per Plant) table (4) shows that the differences were significant among all treatments. The treatment of 4 g per liter resulted in the highest average of 240.78 leaves per plant, while the lowest average was recorded in the control treatment at 232.0 leaves per plant. There is a highly significant effect of tryptophan acid on the increase in the number of plant leaves, with the treatment of 50 mg per liter recording the highest value of 253.442 leaves per plant, followed by the treatment of 25mg per liter, which gave 235.11 leaves per plant. This differs significantly from the control treatment, which yielded the lowest value of 235.11 leaves per plant. The results of the interaction between the experimental factors indicated that there is a significant effect on the average increase in the number of plant leaves. The interaction A2B2 produced the highest number of leaves, reaching 259 leaves per plant, compared to the lowest number of leaves resulting from A0B0.

Table 4: Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Number of Leaves (Leaves per Plant) for Rosemary Plants

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	218.00	221.33	219.33	232.00
A1	227.33	234.00	244.00	235.33
A2	250.67	250.67	259.00	240.78
Average Tryptophan	219.56	235.11	253.44	

Acid			
LSD	0.05		
2.354	2.354	2.354	

Dry Weight of Leaves (g) The results in table (5) indicate significant differences in the dry weight of leaves among the study factors. Notably, treatment A2 showed a significant advantage, recording the highest value of 48.00 g compared to treatment A0, which recorded the lowest value of 41.89g. There are also significant differences in this trait among the tryptophan amino acid treatments, with B2 achieving the highest dry weight at 53.78g compared to the control B0, which recorded the lowest dry weight of 34.56g. However, the interaction of factors did not show a significant difference for this trait.

Table 5 : Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Dry Weight (g) of Plants

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	32.67	33.00	38.00	41.89
A1	42.67	47.33	48.00	44.44
A2	50.33	53.00	58.00	48.00
Average Tryptophan Acid	34.56	46.00	53.78	
LSD	0.05			
2.175	2.175	2.175	N. S	

Total Chlorophyll Content in Leaves (mg per 100 g Fresh Weight) The results in table (6) indicate significant differences in total chlorophyll content among all organic nutrient treatments. The treatment of 4 g per liter resulted in the highest average of 12.275mg per 100g of fresh weight, while the lowest values were recorded in the control treatment at 10.77mg per 100g of fresh weight. There is a highly significant effect of tryptophan acid on the chlorophyll content in leaves, with treatment B2 recording the highest average (13.30mg) per 100g of fresh weight, followed by treatment B1, which yielded 11.00mg per 100g of fresh weight, significantly differing from the control treatment B0, which recorded the lowest value of 9.67mg per 100g of fresh weight. Meanwhile, the interaction between the experimental factors did not show a significant effect on this trait.

Table 6: Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Total Chlorophyll Content in Leaves (mg per 100 g Fresh Weight) of Rosemary Leaves

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	8.77	9.70	10.53	10.77
A1	10.60	10.90	11.50	10.93
A2	12.93	12.20	14.77	12.27
Average Tryptophan Acid	9.67	11.00	13.30	
LSD	0.05			
	0.839	0.839		N.S

Carbohydrate Content in Leaves (mg per 100 g Fresh Weight)

The results in Table (7) indicate significant differences in carbohydrate content among all organic nutrient treatments. The treatment A2 produced the highest average of 5.900mg per 100 g of fresh weight, while the lowest values were recorded in the control treatment at 4.723mg per 100g of fresh weight. Tryptophan acid had a highly significant effect on the carbohydrate content in leaves, with the treatment of 50mg per liter recording the highest value (5.900mg) per 100g of fresh weight, followed by the treatment of 25mg per liter, which yielded 11.00mg per 100g of fresh weight, significantly differing from the control treatment that recorded the lowest value of 4.268mg per 100g of fresh weight. The results of the interaction between the experimental factors showed a significant effect, with the interaction A2B2 giving the highest value of 7.300 compared to the lowest value obtained from the control plants A0B0, which was 3.603.

Table 7: Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on Carbohydrates in Rosemary Leaves (mg per 100 g Fresh Weight)

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	3.603	4.133	5.067	4.723
A1	6.000	6.033	5.333	5.333
A2	4.567	5.833	7.300	5.900
Average Tryptophan Acid	4.268	5.789	5.900	
LSD	0.05			
	0.4383	0.4383		0.7592

Percentage of Oil (%) The results in table (8) indicate significant differences among all treatments. The treatment with the organic nutrient at 4g per liter yielded the highest average of 1.651%, while the lowest values were recorded in the control treatment at 1.424%. The results in table 6 show that there is a highly significant effect of tryptophan acid on the oil quantity. The treatment of 50 mg per liter recorded the highest value of 1.558%, followed by the treatment of 25mg per liter, which yielded 1.539%—both significantly differing from the control treatment that recorded the lowest value of 1.391%. The results of the interaction between the experimental factors, as shown in table (6), indicated that the combination of (4g per liter and 50mg per liter) achieved the highest value for oil quantity at 71.723%, with a significant difference from the other combinations. Conversely, the lowest value for oil quantity was recorded at 1.320% in the control treatment.

Table 8: Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Percentage of Essential Oil in Rosemary Leaves

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	1.320	1.490	1.463	1.424
A1	1.293	1.457	1.487	1.412
A2	1.560	1.670	1.723	1.651
Average	1.558	1.539	1.391	

Tryptophan Acid				
LSD	0.05			
	0.0630	0.0630		0.1091

Cymene Content in Leaves (mg per g Plant) The results in table (9) indicate significant differences among all treatments. The treatment A2 produced the highest average of 7.211mg per g of plant, while the lowest values were recorded in the control treatment at 4.017mg per g of plant. There is a highly significant effect of tryptophan acid on the Cymene compound, with treatment B2 recording the highest value of 6.158mg, followed by treatment B1, which yielded 5.567mg per g of plant—both significantly differing from the control treatment that recorded the lowest value of 4.770mg per g of plant. However, the interaction between the organic nutrient Disper Humifer GS and tryptophan acid did not show a significant effect on the Cymene values.

Table 9: Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Cymene Content in Leaves (mg per g Plant)

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	3.477	4.133	4.440	4.017
A1	4.267	5.533	6.000	5.267
A2	6.567	7.033	8.033	7.211
Average Tryptophan Acid	6.158	5.567	4.770	
LSD	0.05			
A=	B=		A*B=N.S	

Linalool Content in Leaves (mg per g Plant) The results in table (10) indicate significant differences among all treatments. The treatment A2 produced the highest average of 20.944 mg per g of plant, while the lowest values were recorded in the control treatment A0 at 16.067 mg per g of plant. There is a highly significant effect of the tryptophan acid treatment on the Linalool compound, with treatment B2 recording the highest value of 18.844mg per g of plant, followed by treatment B1, which yielded 19.309mg per g of plant—both significantly differing from the control treatment that recorded the lowest value of 17.156mg per g of plant. The results of the interaction between the experimental factors showed that the combination (A2B2) achieved the highest average of Linalool at 22.467mg per g of plant, with a significant difference from the other combinations. Conversely, the lowest average for Linalool was recorded in the control treatment at 15.700mg per g of plant.

Table 10 : Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Linalool Content in Leaves (mg per g Plant)

Disper Humifer GS	Concentrations of Tryptophan Acid			Average Disper Humifer GS
	B0	B1	B2	
A0	15.700	16.533	15.967	16.067
A1	16.267	17.333	18.100	17.233
A2	19.500	20.867	22.467	20.944
Average Tryptophan Acid	18.844	18.244	17.156	
LSD	0.05			
A=0.4084		B=0.4084		A*B=0.7074

Camphene Content in Leaves (mg per g Plant) The results in table (11) indicate significant differences among all organic nutrient treatments. The treatment A2 recorded the highest value of 7.98mg per g of plant, compared to the lowest average obtained from the control plants A0, which was 3.61mg per g of plant. There is a highly significant effect of tryptophan acid on the Camphene compound, with treatment B2 recording a value of 6.52mg per g of plant, compared to the lowest value produced by the control treatment, which yielded 5.30mg per g of plant. However, the interaction did not show any significant differences.

Table 11: Effect of Organic Nutrient Disper Humifer GS, Tryptophan Acid, and Their Interactions on the Camphene Content in Leaves (mg per g Plant)

Disper	Concentrations of Tryptophan Acid	Average
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3.2.

Humifer GS	B0	B1	B2	Disper Humifer GS
A0	3.50	3.33	4.00	3.61
A1	5.73	6.60	6.52	6.28
A2	6.67	8.23	9.03	7.98
Average Tryptophan Acid	6.52	6.06	5.30	
LSD	0.05			
A=0.619	B=0.619		A*B=N.S	

DISCUSSION

The results from Tables (2, 3, 4, 5, 6, and 7) indicate that the increase in vegetative and chemical growth traits can be attributed to the organic nutrient, which relies on the plant's growth, development, and health. Factors such as the quality of raw materials (like seeds and seedlings), soil moisture, availability of nutrients, water and nutrient absorption, and photosynthesis under optimal light and temperature conditions play significant roles. The addition of biochar to the soil or growth medium at appropriate rates can improve germination rates, affect certain plant hormones, enhance photosynthesis, and boost the rates and qualities of photosynthetic pigments, thereby improving the characteristics of leaf gas exchange [13]. These results align with findings by [14] who reported an increase in chlorophyll content in the ornamental plant *Centaurea cyanus* L. In our study, we observed superiority in plant height and leaf number, which corresponds to the findings of [15] who reported improvements in growth traits for the ornamental plant *Alpinia zerumbet* when using organic materials. This could also be attributed to the direct positive effects on plants concerning the increase in available mineral nutrients, in addition to the presence of growth-promoting substances ([16]. These factors assist plants in respiration, stimulate growth, and increase the number of branches, leaf area, and chlorophyll content. This result is consistent with findings by [5], who conducted a study on two plant species, *Petunia* and *Pelargonium*, to evaluate the effects of a mixture of biochar and worm castings on vegetative growth. Additionally, it aligned with the findings of [15] in their study on various ornamental plant species. The results from Tables (2, 3, 4, 5, 6, and 7) indicate that the increase in vegetative and chemical growth traits due to the application of the amino acid tryptophan is attributed to its positive role in plant growth, leading to an increase in cell divisions. Additionally, it contributes to the production and formation of secondary metabolic compounds and plays an important role in tissue formation [16]. Tryptophan also enhances various biochemical processes by affecting plant growth, differentiation, and the ability to absorb nutrients and water. Furthermore, foliar application of tryptophan improves the growth and productivity of different plant species. These results are consistent with the findings of [11] who conducted a study on *Spathiphyllum*.

wallisii to assess the effects of foliar treatments with tryptophan. Additionally, the results align with those of [16] in their study on *Polianthes tuberosa* regarding the effects of foliar application of tryptophan. The results from Tables (7, 8, 9, 10, and 11) showed an increase in the concentrations of active compounds in *Chrysanthemum* due to the addition of certain organic materials. This can be attributed to the fact that organic fertilizers provide sufficient nutrients in the soil to meet the plant's needs [17]. There is also a close relationship between the levels of macronutrients in the soil (i.e., nitrogen, phosphorus, and potassium) and the levels of phenolics, flavonoids, and active compounds [5]. The addition of organic fertilizers significantly enhances the synthesis of phenolics, flavonoids, and the content of active compounds (This is because organic nutrients are organic materials that help improve the physical and chemical properties of the soil and increase its ability to retain water and nutrients [18]). Moreover, the role of organic materials is attributed to their content of essential macro and micronutrients, which improve plant growth due to their richness in potassium, sodium, chloride, sodium nitrate, calcium, and magnesium [11]. Consequently, this increases the active compounds in the plant, represented by Gallic Acid, Rutin, Quercetin, Kaempferol, and Apigenin. These results are consistent with findings by [16]. The results from Figures (7, 8, 9, 10, and 11) showed an increase in the concentrations of active compounds in *Chrysanthemum* due to the addition of the amino acid tryptophan. This can be attributed to amino acids, which stimulate physiological and chemical processes in plants (Furthermore, amino acids used as plant growth stimulants positively affect crop quality, with tryptophan being one of the important biostimulants that enhance plant productivity). This enhancement is due to tryptophan's ability to improve various biochemical processes by influencing plant growth, differentiation, and the capacity to absorb nutrients and water (14). These results are consistent with the findings), who reported that spraying a mixture of amino acids (Aminol Forte) on *Aloe vera* L. had positive effect [13]. [15]

4. CONCLUSIONS

The concentration of 4g per liter of the organic nutrient Disper Humifer GS excelled in all vegetative and chemical traits, as well as in oil content and active compounds. Similarly, the concentration of 50 mg per liter of tryptophan acid showed superiority in all vegetative and chemical traits, the percentage of oil, and active compounds. However, the dual interaction A2B2 demonstrated significant superiority in most vegetative traits, except for the dry weight of the vegetative mass, chlorophyll content, and the active compounds Cymene and Camphene.

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