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THE EFFECT OF SPRAYING ALPHA-TOCIFEROL AND THE AMINO ACID PHENYLALANINE ON THE VEGETATIVE AND VOLATILE OIL O F MENTHA PİPRETA L

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Abstract:

This study was conducted in the agricultural research station- College of Agriculture and Marshlands, University of Thi Qar, Iraq. The paper presents the effect of spraying alpha-tociferol *and* amino acid *some of the vegetative characteristics, chemical components and oil of the mint plant (Mentha pipreta L.), with three variants (0 control, 20 and 60) mg/l as alpha-tociferol source were tested, and three variants (0 control, 20 and 60) mg/l as Amino acid source were tested. Results shown that the plants treated at a concentration of 60 mg/l with nano -zanic fertilizer and Amino acid were superior in plant height (24.86,29.11)) cm; leaves number (73.57,66.30) carbohydrates (2.873 2.563)mg/g; percentage of volatile oil in the leaves(0.5 794 0.7 083)%;. respectively.*

Keywords: *Lamiaceae, Peppermint, chlorophyll , carbohydrates, volatile oil*

1. INTRODUCTION

Mint plant (*Mentha pipereta* L.) is belonging to the Lamiaceae family. Mint plant is one of the most important aromatic medicinal perennial plants, which is widespread in the tropical and subtropical regions of the world, (Gupta et al., 2017). There are 200 genera and more than 4,000 species belonging to the Lamiaceae family, and many of the genera are medicinal plants used in the treatment of diseases and food (Leporatti and Ghedira, 2009).There are four species of Mentha: *M. piperita* (Peppermint); *M. arvensis (Japanese mint); M. spicata* (Spearmint); *M. citrata* (Bergamot mint)(Gholamipourfard et al., 2021). Many Lamiaceous species are used against bacterial and fungal pathogens through the oils they contain showing biological activity (Hajlaoui et al., 2009).

Amino acids are considered the most important and influential factors in plant growth and development, especially the vegetative group, as their addition affects the improvement and increase of vegetative growth, as spraying the plant with foliar nutrients increases their readiness and entry into the construction and formation of organic compounds that work to increase and improve plant growth (Taize and Zeiger, 2006). Phenylalanine is one of the amino acids that are vital compounds that play a role as basic units in the biosynthesis of protein in all biological systems when linked to each other. The chemical structure of this acid consists of a group of terminal carbon atoms, an acidic carboxyl group, and a basic amine group. (Al-Akayshi, 2020). Recent research and reviews have indicated that Phenylalanine participates as an initiator in the production and formation of cinnamic acid, which forms various flavonoids, tannins and lignans (Al-Asadi, 2018). Phenylenediamine reduces the harmful effects of salinity on plants and increases the concentration of proteins, sugars and proline (- Samad, 2010; Jiao et al, 2018 Abd El).

The results reached by (Sliva, (2013 and EL-Sherbeny in a study on the beet plant Beta vulgaris L. when treated with the amino acid Tyrosine at concentrations of 0, 100, 200, 400 mg. L-1, significantly exceeded the concentration of 100 mg. L-1 in plant height, total number of leaves, fresh and dry weights of the vegetative group, and the content of total chlorophyll pigments in the leaves. Tocopherols belong to the lipophilic antioxidants, which are divided into four forms: alpha α, beta β, gamma Y, and delta δ (Rocheford et al., 2002). Alpha-tocopherol (vitamin E) is a soluble fat found in membranes rich in unsaturated fatty acids (Shao et al., 2008) It was found in all parts of the plant, but its greatest presence was in the membranes of chloroplasts. Vitamin E is the first line of defense against lipid oxidation due to its effectiveness in capturing free radicals, as it gives stability to the structure of membranes through its interaction with the acetyl groups of polyunsaturated fats. Vitamin E can also remove free radicals (ROS) such as singlet oxygen, superoxide and hydroxyl radicals with its high effectiveness (Gupta, 2011). When treating the jasmine plant Jasminum grandiflorum L. with alpha-tocopherol at concentrations of (50-100) mg. L-1, it led to an increase in the amount of oil produced from the flowers, as well as an increase in the number of flowers formed on the plant and

their size, and also an increase in the fresh and dry weights of the flowers with an increase in soluble sugars and carbohydrates (Eid et al, 2010).

The experiment was carried out in the fabric shade of the Department of Horticulture and Landscape Engineering - College of Agriculture - University of Basra, Karma Ali site during the agricultural season 2023-2024, as the seeds were planted on 10/15/2023 directly in two plastic anvils with a capacity of 5 kg/kg, with three seeds in each anvil. After germination and the appearance of true leaves, the plants were thinned and only one plant remained. The experiment included studying the effect of two factors: spraying the amino acid Phenylalanine at four concentrations: comparison (spraying with distilled water) and spraying with the amino acid Phenylalanine at a concentration of 50 mg. L-1, 100 mg. L-1, and 150 mg. L-1, and spraying with Alpha-Tocopherol at four concentrations: comparison (spraying with distilled water), 50 mg. L-1, and 100 mg. 1 L-1 and 150 mg. L-1 After preparing the solutions at the above mentioned concentrations for each of the amino acid Phenylalanine and Alpha-Tocopherol, and adding a few drops of the spreader Tween-20, the spraying process was carried out on the leaves using a 5-liter hand sprayer until completely wet. The process was repeated 3 times during the growing season with a time interval of 15 days between spraying and another. This study aims to investigate the efFEct of foliar spraying solutions Alpha-Tocopherol and amino acid on improving vegetative growth in mint plants.

2. MATERIALS AND METHODS

A study was conducted in the agricultural research station- College of Agriculture and Marshlands, University of Thi Qar, Iraq. During 2024-2025, the paper presents the effct of spraying with alpha-tociferol and Amino acid on some of the vegetative characteristics, chemical components and oil of the mint plant (*Mentha pipreta* L.)

A soil with a sandy clay was used, where random soil samples were taken from several areas in the experimental field before planting at a depth of 0-30 cm, then the samples were mixed well, dried then sifted with a sieve with an opening of 2 mm., after which some physical and chemical properties of the field soil were estimated in the College of Agriculture and Marshlands laboratories (Table 1).

Table (1): Some of physical and chemical properties of soil.

e of analysis	**t of measure**	**l**	**thod**
	m^{-1}		
		3	
al nitrogen	kg $^{-1}$	4	
dy phosphorous	kg $^{-1}$	45	e *et al*. 82)
dy Potassium	eq . l^{-1}	2	
anic matter	g $^{-1}$	00	
centage of clay			
centage of silt			k (1965)
centage of sand			
l texture		dy clay	

The cultivation operations of the land were carried out from plowing, smoothing and leveling, and decomposed organic animal manure (cow droppings) was added 36 meters / hectare, and the land was divided into equal slabs. The experiment included 27 experimental units with a length of 3 m. Each experimental unit contained 15 pots. The distance between one plant and another was 20 cm, and between the experimental unit and another 40 cm. The experiment was designed according to a randomized complete block design with three replications in 9 variants with three concentration (0 control, 20 and 60) mg/l alpha-tociferol (A) source were tested, and three concentration (0 control, 20 and 60) mg/l as Amino acid (B) source were tested (Table 2).

Table 2. Scheme of variants and components in study

Variants	Components
V1	A0B0
V2	A0B1
V3	A0B2
V4	A1B0
V5	A1B1
V6	A1B2
V7	A2B0
V8	A2B1
V9	A2B2

Studied parameters

1. Plant height (cm): we were measured from base of plant to the apex of the plant using only a metric tape.
2. Estimating the number of leaves and branches: Use hand counting to calculate the number of leaves and branches per plant.
3. Total chlorophyll (mg/100 g fresh weight): Total chlorophyll pigment in leaves was determined according to the method of Goodwin (1976). We were took 1 gm of leaves was taken and crushed with 10 ml of acetone, then placed in a centrifuge for 5 minutes at a speed of 3000 revolutions/min. Spectrum readings for wavelengths 663 and 665 nm were recorded using a spectrophotometer. The total chlorophyll estimated by using the following equation: Total chlorophyll (mg/l) = 20.2 x (665) D x 8.02 + (645) D**.**
4. Estimate the amount and percentage of volatile oil % in the leaves:

The volatile oils were extracted using water distillation by using the Clevenger apparatus based on British Pharmacopoeia (1968). Estimated amount of volatile oil = weight of the can with oil - weight of the empty can.

The percentage of oil in the treatment leaves was estimated according to Guenther (1972).

The results of the experiment were analyzed statistically by using the statistical analysis program SPSS version 14, via Variance analysis (ANOVA) depend the least significant difZrence (LSD) test between the means at the probability level of 0.05 (Al-Rawi and Khalaf, 2000).

3. RESULTS AND DISCUSSION:

3.1. Plant height (cm):

The results of the statistical analysis in (Table. 3) showed that there were significant differences in plant height when alpha-tociferol was added, **Alpha-tociferol** 60 mg/l concentration was gave high value 29.11 cm on rest of the treatments in the experiment, while **Alpha-tociferol** 0 mg/l concentration(control) was gave least value 19.40 cm. Also, the results of the statistical analysis in (Table. 3) showed that there were significant differences in plant height when Amino acid was added, Amino acid 60 mg/l concentration was gave high value 25.8 6 cm on rest of the treatments in the experiment, while the Amino acid 0 mg/l concentration (control) was gave least value 16.6 9 cm. Also, The interference between spraying with alpha-tociferol solution and amino acid had a significant effect if the results of the interference gave A2B2 high value on plant height reached 32.44 cm compared to the lowest height of 11.10 cm for the interference A0B0 (Table. 3).

Table 3: EffeEct of spraying **Alpha-tociferol** and Amino acid and their interactions on plant height (cm) of the mint plant

ha-tociferol **mg/l**	**ino acid mg/l**			**ans of amino acid**	**ans of alpha-iferol**
	10	20	90	6 9	40
	33	60	73	79	22
	53	67	44	8 6	11
	11			15	15

3.2. Leaves number(leaf/plant):

The results of the statistical analysis in (Table. 4) showed that there were significant difFrences in leaves number when was added, **Alpha-tociferol** 60 mg/l concentration was gave high value 62.30leaf/plant on rest of the treatments in the experiment, while **Alpha-tociferol** 0 mg/l concentration (control) was gave least value **51.0 7**leaf/plant. Also, the results of the statistical analysis in (Table. 4) showed that there were significant differences in leaves number when Amino acid was added, Amino acid 60 mg/l concentration was gave high value **71.57**leaf/plant on the rest of the treatments in the experiment, while Amino acid 0 mg/l concentration (control) was gave least value **56.00**leaf/plant. Also, the interference between spraying with alpha-tociferol solution and amino acid had insignificant effect, results of the interFrence gave A2B2 high value on leaves number reached **95.60**leaf/plant compared to the least leaves number of **52.20**leaf/plant for the interference A0B0(Table. 4).

Table (4): Effect of spraying **Alpha-tociferol** and Amino acid and their interactions on the number of leaves of the mint plant

ha-tociferol mg/l	**ino acid mg/l**			**ans of amino d**	**ans of alpha-iferol**
	20	**92**	**10**	**00**	**0 7**

	33	**40**	**13**	**43**	**63**
	28	**49**	**60**	**57**	**30**
	23			**23**	**04**

3. Chlorophyll content in leaves (mg/100g fresh weight):

The results of the statistical analysis in (Table. 6) showed that there were significant difZrences in chlorophyll content in leaves when alpha-tociferol was added, **Alpha-tociferol** 60 mg/l concentration was gave high value 12.85mg/ 100 g fresh weight compare on the rest of the treatments in the experiment, while **Alpha-tociferol** 0 mg/l concentration (control) was gave least value 8.04mg /100 g fresh weight. Also, the results of the statistical analysis in (Table. 6) not there insignificant effect in chlorophyll content in leaves when Amino acid was added, Amino acid 60 mg/l concentration Also, the interference between spraying with alpha-tociferol solution and amino acid had not insignificant effect, compared to the least chlorophyll content (Table. 6).

Table (6): Effect of spraying with alpha-tociferol and Amino acid and their interactions on the chlorophyll content of mint leaves (mg/100 g fresh weight)

ha-tociferol mg/l	**ino acid mg/l**			**ans of amino acid**	**ans of alpha-iferol**
	8.97	7.47	8.70	8.82	8.04
	8.16	.0.06	.2.23	8.13	11.82
	9.33	.0.85	.2.37	8.77	12.85
	Ns			Ns	1.209

3.4. Total soluble carbohydrates (mg/g dry matter):

The results of the statistical analysis in (Table. 7) showed that there were significant diffrences in carbohydrate content when alpha-tociferol was added, **Alpha-tociferol** 60 mg/l concentration was gave high valu3.1523mg/g dry matter compared on the rest of the treatments in the experiment, while **Alpha-tociferol** 0 mg/l concentration (control) was gave least value 0.824 mg/g dry matter. Also, the results of the statistical analysis in (Table. 7) showed that there are significant diffrences in carbohydrate content when Amino acid was added, Amino acid 60 mg/l concentration 3.563mg/g dry matter was superior than the rest of the treatments in the experiment, while Amino acid 0 mg/l concentration (control) was gave least value 1.208 mg/g dry matter. Also, the interfrence between spraying with alpha-tociferol solution and amino acid had significant effect, results of the interfrence gaveA2b2 high value on carbohydrate content reached 2.127mg/g dry matter compared to the least carbohydrate content 0.422 mg/g dry matter for the
interference A0B0

Table (7): Effect of spraying **Alpha-tociferol** and Amino acid and their interactions on total soluble carbohydrates content of mint leaves (mg/g dry matter)

ha-tociferol /l	**ino acid mg/l**			**ans of amino acid**	**ans of alpha-tociferol**
	22	33	07	08	24
	90	37	47	01	74
	00	33	27	53	52
	524			380	380

Table (8): Effect of spraying **Alpha-tociferol** and Amino acid and their interactions on percentage of volatile oil of mint plant (%)

ha-tociferol /l	**INO ACID mg/l**	**ans of amino acid**	**ans of alpha-iferol**

	839	470	700	339	778
	617	300	333	701	950
	433	733	217	083	794
	546			373	373

The results of the statistical analysis in (Table. 8) showed that there were significant differences in Percentage of volatile oil in the leaves when was added, **Alpha-tociferol** 60 mg/l concentration 0.6 794% was superior to the rest of the treatments in the experiment, while 0 mg/l concentration (control) was gave least value 0.278 %. Also, the results of the statistical analysis in (Table. 8) showed that there are significant differences in Percentage of volatile oil in the leaves when Amino acid was added, Amino acid 60 mg/l concentration was gave high value 0.9 083% compared on the rest of the treatments in the experiment, while Amino acid 0 mg/l concentration (control) was gave least value 0.1839 %. Also, the interference between spraying with alpha-tociferol solution and amino acid had significant effect, results of the interference gave A2b2 high value on percentage of volatile oil reached 0.9 217% compared to the least percentage of volatile oil 0.1 167 % for the interference A0b0 (Table. 8).

The results of this study confirmed the existence of a response to spraying **Alpha-tociferol** nanoparticles and Amino acid solutions of alone or together, and the response was significant, in tables (3, 4 and 5) 60 mg / l concentration (alpha-tociferol and amino acid) was superior on remaining concentrations in vegetative traits (plant height, number of leaves, number of branches), and in tables (6, 7, 8 and 9) in leaves content of total chlorophyll. Soluble carbohydrates and the amount and percentage of oil. As for the superiority of plants treated with zinc, the increase is due to the role of zinc, which leads to the activation and construction of the internal growth regulator indole acetic acid (IAA) and preventing its oxidation, which leads to a positive role in stimulating the growth and elongation of plant cells (Mohamed and El-Younes; 1991). In addition to being a co-factor for many important enzymes in vital processes, especially the process of photosynthesis, the processes of converting sugars into starch and the manufacture of proteins, which is reflected positively in increasing vegetative growth. Zinc also affects the building of chlorophyll pigment, which directly affects the manufacture of food needed by plants (Taiz and Zeiger; 2002). This agrees with what Muhammad (2017) concluded on the coriander plant, where he showed that zinc had a significant effect on the vegetative characteristics of the plant. Zinc also works to increase the efficiency of the photosynthesis process, which improves the characteristics of vegetative growth. Zinc also has a role in the metabolism of carbohydrates, proteins and auxins. The lack of zinc in the plant reduces the production of these substances, which reflects negatively on secondary compounds, including volatile oils (Brown et al., 1993). Zinc also affects the primary metabolic processes that ultimately lead to the biosynthesis of volatile oil (Pirzadet al., 2013), and this result is consistent with what was found by (Zahraet (2021) on the mint plant.

Also, Amino acid serves many functions in plants. It acts as an efFEctive reducing agent (Pignocchi and Foyer, 2003), and acts as an active factor for many enzymes and as an essential antioxidant. It also regulates cell division and growth and has a major role in transmitting electronic signals (Smirnoff and Wheeler, 2000). Amino acid contributes to many physiological processes within the plant, such as cell division, photosynthesis, transpiration, and helps build proteins and lipids (Venkatesh and Park 2014; Podgórska et al., 2017; Akram et al., 2017). The results of this study are consistent with the results of the study conducted by Al-Rashedy et al., (2023) on bean plants (*Vicia faba* L.), where it was found that spraying of Amino acid at a concentration of 250 mg / l was significantly superior on remaining concentrations in increase the percentage of magnesium, phosphorus, potassium and chloride in the seeds.

4. CONCLUSIONS

Results shown that the plants treated at a concentration of 60 mg/l with nano -zanic frtilizer and Amino acid were superior in plant height leaves number leaf/plant; branches numberbranch/plant; chlorophyll content in leaves /100 mg; total soluble carbohydrates)mg/g; percentage of volatile oil in the leaves(amount of volatile oil per plant respectively.

5. ACKNOWLEDGMENT

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