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Effect of Some Stimulants and Irrigation Intervals on Growth and Volatile Oil Contents of Sage (*Salvia officinalis* L.) Plant

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ABSTRACT

The research was carried out in the practical domain of Aromatic and Medicinal Plants, Faculty of Agriculture, Mansoura University, during 2021–2022 and 2022–2023 seasons. The present study aimed to investigate the effect of foliar application of some stimulants (Chitosan, Glycine betaine, and potassium silicate) on some vegetative growth (plant height and leaves dry weight), essential oil percentage, essential oil content, and its constituents of sage plants under different irrigation interval conditions (plants irrigated every 3, 6, and 9 days). The results showed that irrigation of plants every 3 and 6 days was effective in increasing the productivity of plant height and leaf dry weight; however, essential oil percentage, essential oil content, and essential oil constituents of sage were highest during the 9-day irrigation interval. On the other hand, foliar application with potassium silicate was more effective than chitosan, and glycine betaine improved the productivity of vegetative growth, essential oil percentage, essential oil content, and its components of sage plant

Keywords: *Salvia officinalis,* Chitosan, Glycine betaine, potassium silicate, Essential oil

INTRODUCTION

Salvia officinalis, commonly known as sage, is a perennial, woody herbaceous plant native to the Mediterranean region. This remarkable plant has been treasured for centuries due to its culinary and medicinal properties, with its fragrant, gray-green leaves and delicate, purplish-blue flowers, sage is not only a beautiful addition to any garden, but also a versatile herb that offers numerous benefits. In the culinary world, sage is a staple herb that adds a distinctive flavor to a wide range of dishes. Apart from its culinary applications, sage is well-regarded for its medicinal value. Also, the leaves of the sage plant contain compounds known as polyphenols, which are powerful antioxidants. These antioxidants help protect the body's cells from damage caused by harmful free radicals, reducing the risk of chronic diseases such as heart disease and certain types of cancer.

Water availability is crucial for plant growth, and in regions with limited rainfall, farmers rely on irrigation systems. However, the timing and regularity of irrigation can impact plant growth. Long intervals without irrigation can cause water stress, leading to reduced plant growth and yield. It also affects the photosynthetic process, resulting in decreased carbohydrate production and wilted leaves. Proper irrigation intervals are essential for nutrient uptake, as water carries essential nutrients that plants need. Inadequate irrigation intervals can lead to nutrient deficiencies, hindering metabolic and physiological processes (AbdelKader *et al.*, 2014).

Chitosan, a biopolymer derived from crustacean and insect shells, has gained attention for its beneficial properties in agriculture. It enhances seed germination by stimulating root growth and improving water uptake and nutrient absorption. Chitosan also acts as a protective agent against pathogens, increasing plant resistance to diseases caused by fungi, bacteria, and viruses. It induces the production of defense-related enzymes, reducing the need for chemical pesticides and improving plant health. Additionally, chitosan acts as a chelating agent, enhancing the availability and uptake of essential nutrients like iron and zinc. Overall, chitosan improves plant growth and crop yield Bistgani *et al.*, 2023).

Glycine betaine, a quaternary ammonium compound found in plants, serves as a methyl donor and osmoprotectant, helping plants withstand osmotic stress and other challenges. It has been studied extensively for its positive effects on plant growth, yield, and productivity. Glycine betaine improves plant growth and stress tolerance by regulating osmotic balance, acting as a methyl donor, enhancing antioxidant defenses, and boosting photosynthetic efficiency. It plays a crucial role in water potential regulation, methylation reactions, and antioxidant production. Understanding its importance allows the development of strategies for crop production under unfavorable environmental conditions. (Ghorbani *et al.*, 2023)

Potassium silicate, composed of potassium oxide and silicon dioxide, is important for plant nutrition. It enhances a plant's defense mechanisms, providing resistance against environmental stresses like drought, disease, and insect infestations. This protection is known as induced systemic resistance (ISR), triggered by applying potassium silicate to the soil or as a foliar spray. The benefits of potassium silicate come from its ability to stimulate plant cell walls. When absorbed by plants, it strengthens and rigidifies cell walls, improving structural integrity. This makes plants more resistant to physical stress, reducing the risk of bending, lodging, or damage from strong winds or heavy fruits. (Waly *et al.*, 2020).

As a result, the current work attempted to investigate the effect of foliar application of some stimulants (Chitosan, Glycine betaine, and potassium silicate) on some vegetative

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growth (plant height and leaves dry weight), essential oil content, essential oil percentage and its constituents of sage plants under three irrigation interval conditions (plants irrigated every 3, 6, and 9 days).

MATERIALS AND METHODS

The research was executed out in the practical domain of Aromatic and Medicinal Plants, Faculty of Agriculture, Mansoura University, during 2021–2022 and 2022–2023 seasons. Aiming to investigate the effect of foliar application of some stimulants (Chitosan, Glycine betaine, and potassium silicate) on some vegetative growth (plant height, leaves dry weight) essential oil productivity of (*Salvia officinalis* L.) plants under three irrigation interval conditions (plants irrigated every 3, 6, and 9 days). Sage seedlings were planted on 1st November on rows 50 cm apart from each other, and the planting distance was 30 cm between plants in the same rows. The designated experimental zone was divided into plots measuring 1.8 x 2 meters, with three ridges in each plot. Each row comprised of 6 plants, resulting in a total of 18 plants per plot.

Samples of soil were gathered from a depth of 30 centimeters below the soil surface and were subsequently examined at the Soil Fertility Laboratory, which is a part of the Faculty of Agriculture at Mansoura University. The findings concerning the physical and chemical attributes of the soil are detailed in Table (A).

Table A. provides an analysis of the chemical and physical components of the soil in the experimental area.

The analysis	1st season	2nd season
Physical		
Sand %	27.30	27.79
Silt %	30.85	31.88
Clay %	38.57	38.48
Soil texture	Clay	Clay
Chemical		
pH	7.1	7.5
Organic matter %	1.75	1.92
Available nutrients		
N (mg / kg)	255	279
P (mg / kg)	24.3	26.7
K (mg / kg)	488	459
Fe (mg / kg)	4.33	4.12
Mn (mg / kg)	2.75	2.93

The irrigation intervals were varied at 3, 6, and 9-day intervals, while foliar application involved the use of Chitosan at a rate of 0.5 mg/l, Glycine betaine at a rate of 600 mg/l, and potassium silicate at a rate of 12 ml/l. The foliar application was performed on December 1st, with a one-month gap between each subsequent spraying. The experimental design employed a strip plot design with three replicates. Main plots were assigned for irrigation intervals of 3, 6, and 9 days, respectively. Sub-plots were designated for the foliar application treatments Control, Chitosan, Glycine betaine, and Potassium silicate.

Harvesting:

Sage plants were gathered biannually by trimming the above-ground sections of each plant (10 centimeters) just above the level of the soil. The initial trimming occurred on the first of March, coinciding with the onset of flowering, while the subsequent trimming took place four months after the initial one.

Data recorded:

In order to ascertain vegetative growth, including both plant height and leaves dry weight, a representative selection of six plants from every experimental unit was collected during two cuts in both seasons, specifically at the harvesting stage. Furthermore, the essential oil percentage in the dried leaf samples (100g) was determined by subjecting them to hydro distillation using modified Clevenger traps in **(Pharmacopoeia, 2000).** Also**,** the oil content of each plant was calculated by multiplying the oil percentage by the average leaf yield per plant, resulting in the measurements being expressed in milliliters per plant.

According to (Hoftman, 1967), an analysis was conducted on the essential oil components derived from the first batch of oil in the second season. This analysis utilized a GCV PYE Unicom Gas Liquid Chromatograph that was equipped with a flame ionization detector.

Statistical analysis:

The collected data underwent statistical analysis using the Analysis of Variance (ANOVA) method in a strip plot design. The treatment means were compared using the Least Significant Difference (L.S.D.) test at a significance level of 5%, following the prescribed methodology (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

1- Vegetative growth

Effect of irrigation intervals: -

Table (1) signifies that water stress has an impact on (Plant height and dry weight of leaves) of sage plants. growth and elongation were found to be more stimulated when plants were watered at intervals of 6 and 3 days, compared to a water stress interval of 9 days. The irrigation treatment with the most effective results was found to be a 6-day interval. It has been observed that moderate water stress can have an effect on various biochemical parameters, attributed to changes in the activities of hormones and enzymes. Abscisic acid, a plant hormone, is produced in the roots when the soil dries out, and it is transported to the shoot through the xylem via water flow. The purpose of its transportation is to regulate shoot physiology and limit stomata conductance (Kang and Zhang, 2004). It is a widely recognized fact that water is lost through transpiration, and carbon dioxide is taken in for photosynthesis through stomata. Therefore, any change in the opening of stomata will have an impact on stomatal conductance and the rate of photosynthesis. During the initial stages of water stress, reduced stomatal conductance hinders transpiration rate more than it reduces the concentration of CO_2 within the cells, which is the main driving force for photosynthesis. Benefit of irrigating with water stress at intervals of 6 days is that moderate deficit irrigation will maintain a favorable water status in the plants, while the roots on the dry side encourage the production of abscisic acid and decrease stomatal conductance (Saeed *et al.*, 2000). Nevertheless, during periods of significant water stress, the leaf water potential within mesophyll cells experiences a decline, leading to a heightened closure of stomata. Resulting from this process, the rate of photosynthesis becomes inhibited, a phenomenon commonly referred to as hydraulic signaling

(Taiz and Zeiger, 2002). other researchers. The findings confirm the conclusions reached by previous studies. (AbdelKader *et al.*, 2014; El-Leithy *et al.*, 2007; Massoud *et al.*, 2010; Massoud *et al.*, 2016; Sorkhi, 2020; Vosoughi *et al.*, 2019; Vosoughi *et al.*, 2018)

2- Effect Foliar applications: -

Table (1), showed that the application of Chitosan, Glycine betaine, and Potassium silicate via foliar spray the aforementioned phenomenon resulted in a substantial elevation in both the vertical extent of the plants and the amount of dried foliage per individual plant in comparison to the control group. In the control group, the plant height ranged from (33.4 to 62.1 cm). However, the application of chitosan resulted in heights ranging from (38.6 to 69.5 cm), glycine betaine application results ranged between (39.2 to 69.6 cm), The highest results were obtained through the treatment with potassium silicate, with heights ranging from (42.2 to 72.8 cm). Similarly, the dry weight of leaves in the control group varied from (90.4 to 99.1 g/plant), while chitosan application yielded weights ranging from (99.1 to 106.2 g/plant). Furthermore, glycine betaine application resulted in weights ranging from (98.3 to 107.2 g/plant), and the treatment with potassium silicate demonstrated the highest results, ranging from (130.2 to 145.1 g/plant). These findings coincide with those obtained from the table during both periods (Massoud *et al.*, 2016; Said-Al Ahl *et al.*, 2009; Seghatoleslami *et al.*, 2013; Waly *et al.*, 2020; Waly *et al.*, 2019)

3- Effect of the interaction treatments: -

Table 1 demonstrates that the interaction of irrigation intervals every 3, 6, and 9 days with various concentrations of chitosan, glycine betaine, and potassium silicate significantly enhanced plant height and dry leaf weights compared to the untreated control plants in both seasons. The most effective treatment was observed in plants irrigated every 6 days and sprayed with a concentration of 12 ml/l of potassium silicate, resulting in an increase in plant height ranging from 46.8 to 82.3 cm and dry leaf weight ranging from 155.1 to 166.3 g/plant in both cutting periods of the two seasons.

Table 1. Effect of irrigation intervals and foliar application of some stimulants on leaves dry weights (g/plant) of *Slavia officinalis* L. plant in the two cuts during (2021/2022 and 2022/2023) seasons.

Treatments		Plant height (cm)				Leaves dry weight (g/ plant)			
		1st seasons		2nd seasons		1st seasons		2nd seasons	
		1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Irrigation (days)									
3		65.2	36.4	67.1	38.4	100.2	102.3	97.7	104.6
6		74.9	44.6	76.2	46.1	144.6	160.5	151.3	155.4
9		54.7	31.2	56.6	34.9	98.2	90.4	105.3	90.5
L.S.D 5%		2.8	1.6	1.4	0.8	1.58	0.66	1.47	0.13
Foliar application									
Control		61.1	33.4	62.1	35.7	93.2	97.4	90.4	99.1
Chitosan (0.50 g/l)		67.7	38.6	69.5	38.9	99.1	105.6	100.2	106.2
Glycine betaine (600 mg/l)		68.1	39.2	69.6	42.3	101.5	107.2	98.3	105.3
Potassium silicate (12 ml/l)		71.8	42.2	72.8	45.7	134.3	140.7	130.2	145.1
L.S.D 5%		2.18	1.2	0.8	0.9	0.99	0.16	0.61	0.35
Interaction									
3 days	Control	58.8	32.1	59.2	37.3	91.1	92.5	96.4	98.7
	Chitosan	70.1	38.1	72.2	39.4	103.4	105.7	107.6	111.4
	Glycine betaine	69.0	40.2	70.5	40.3	102.4	106.4	104.5	110.3
	Potassium silicate	72.5	43.2	75.3	45.1	140.2	148.5	147.8	149.2
6 days	Control	72.5	41.3	73.0	42.2	123.1	125.3	124.1	129.2
	Chitosan (0.50 g/l)	77.3	43.9	78.2	46.3	142.3	145.7	145.7	148.6
	Glycine betaine (600 mg/l)	77.7	43.9	78.6	46.2	143.5	149.6	146.1	153.4
	Potassium silicate (12 ml/l)	80.2	46.8	82.3	50.3	155.1	165.4	162.8	166.3
9 days	Control	50.4	30.5	52.4	32.2	88.1	93.2	89.2	95.1
	Chitosan (0.50 g/l)	55.6	32.8	57.3	36.1	93.1	97.8	99.4	100.7
	Glycine betaine (600 mg/l)	57.3	33.8	59.2	37.5	99.1	100.5	104.3	102.4
	Potassium silicate (12 ml/l)	61.0	35.4	63.4	41.2	112.3	110.4	117.5	113.4
L.S.D 5%		3.8	1.9	1.5	1.6	1.72	0.29	1.05	0.61

Essential oil production

1- Effect of irrigation intervals: -

Based on the data provided in Table (2), there appears to be an upward trend in both the proportion of essential oil and its concentration per plant in the sage plant as the duration of irrigation intervals increased from 3 to 9 days. The highest values, 1.02% and 0.98% for essential oil percentage, and 1.04 ml/plant and 0.97 ml/plant for content, were obtained from an irrigation interval of 9 days during both seasons. Conversely, the irrigation interval of 3 days resulted can be observed in the samples with the smallest amounts of essential oil concentration, with values of 0.83% and 0.77%, and content, with 0.86 ml/plant and 0.75 ml/plant, during both seasons and two cuts. Khalid, (2006) who stated that water stress significantly affected the production of essential oil in *Ocimum sp.* plants, leading to an increase in the percentage of oil and its main constituents. This suggests that reducing water supply inhibits physiological activity, resulting in lower oil content. The insufficiency of water also led to a decrease in the size of leaves and the number of glands, although there was a slight increase in the density of glands. The variation in the content of essential oil can be attributed to the varying degrees of filling in the oil glands.

Among the irrigation intervals tested, the greatest essential oil concentration per plant were observed with an irrigation interval of 6 days, with values of 1.33 ml/plant, 1.38 ml/plant, and 1.41 ml/plant. The irrigation interval of 9 days followed with values of 1.00 ml/plant, 0.89 ml/plant, and 1.10 ml/plant. The lowest values were obtained with an irrigation interval of 3 days, with values of 0.83 ml/plant, 0.79 ml/plant, and 0.84 ml/plant during each respective season, respectively. These findings align with previous studies (Bahreininejad, 2013; Corell *et al.*, 2012; Ekren *et al.*, 2012; Rioba *et al.*, 2014; Wahby *et al.*, 2014)

2- Effect of Foliar applications: -

The data provided in Table (2) suggest that there was a gradual increase in the essential oil percentage and content per plant when foliar application was used with chitosan, glycine betaine, and potassium silicate treatments, as compared to the control group. In both seasons and the two cuts, the maximum oil percentage and content were found to be 1.00%, 0.94%, 1.02%, and 0.95%, and 1.34 ml/plant, 1.32 ml/plant, 1.33 ml/plant, and 1.38 ml/plant, respectively. The results were highest in plants sprayed with potassium silicate at a concentration of 12 ml/l, followed by plants treated with chitosan at 0.50 mg/l and glycine betaine at 600 mg/l. These treatments illustrated that a significant increase in essential oil percentage and content per plant when compared to the other treatments and the control plants. The use of stimulants in foliar application has been shown to positively influence plant growth., which aligns with previous findings (EL-Leithy *et al.*, 2018; Ghorbani *et al.*, 2023; Helaly *et al.*, 2018; Safikhan *et al.*, 2018; Safwat and Abdel Salam, 2022; Stasińska-Jakubas *et al.*, 2023; Vosoughi *et al.*, 2018; Waly *et al.*, 2020)

3- Effect of the interaction treatments: -

Table (2) demonstrate that the interaction among irrigation intervals of 3, 6, and 9 days and foliar application of chitosan, glycine betaine, and potassium silicate significantly increased the production of essential oil in sage plants compared to unsprayed plants in both cutting seasons. The most effective treatment was found to be plants are watered every 9 days and foliar with potassium silicate at a concentration of 12 ml/l, which resulted in the highest oil percentage (1.15%, 1.05%, 1.16%, and 1.09% respectively) in both cutting seasons. These findings stated that plants are watered every 6 days and foliar with potassium silicate at a concentration of 12 ml/l exhibited the greatest essential oil content (1.58 ml/plant, 1.64 ml/plant, 1.64 ml/plant, and 1.60 ml/plant respectively), when comparison to other treatments and control plants in both cutting seasons.

Table 2. Effect of irrigation intervals and foliar application of some stimulants on Essential oil percentage (%) and essential oil content (ml/plant) of *Slavia officinalis* L. plant in the two cuts during (2021/2022 and 2022/2023) seasons.

Treatments		Essential oil percentage (%)				Essential oil content (ml/plant)			
		1st seasons		2nd seasons		1st seasons		2nd seasons	
		1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
		Irrigation (days)							
3		0.83	0.77	0.86	0.75	0.83	0.79	0.84	0.78
6		0.92	0.86	0.93	0.85	1.33	1.38	1.41	1.32
9		1.02	0.98	1.04	0.97	1.00	0.89	1.10	0.88
L.S.D 5%		0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
		Foliar application							
Control		0.87	0.80	0.88	0.81	0.81	0.78	0.80	0.80
Chitosan (0.50 g/l)		0.91	0.87	0.93	0.86	0.90	0.92	0.93	0.91
Glycine betaine (600 mg/l)		0.92	0.87	0.95	0.85	0.93	0.93	0.93	0.90
Potassium silicate (12 ml/l)		1.00	0.94	1.02	0.95	1.34	1.32	1.33	1.38
L.S.D 5%		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		Interaction							
3 days	Control	0.84	0.78	0.87	0.77	0.77	0.72	0.84	0.76
	Chitosan	0.92	0.88	0.95	0.83	0.95	0.93	1.02	0.92
	Glycine betaine	0.97	0.93	0.98	0.90	0.99	0.99	1.02	0.99
	Potassium silicate	1.00	0.97	0.99	0.95	1.40	1.44	1.46	1.42
6 days	Control	0.88	0.81	0.89	0.81	1.08	1.01	1.10	1.05
	Chitosan (0.50 g/l)	0.94	0.92	0.95	0.89	1.34	1.34	1.38	1.32
	Glycine betaine (600 mg/l)	0.96	0.96	0.98	0.94	1.38	1.44	1.43	1.44
	Potassium silicate (12 ml/l)	1.02	0.99	1.01	0.96	1.58	1.64	1.64	1.60
9 days	Control	0.93	0.88	0.97	0.85	0.82	0.82	0.87	0.81
	Chitosan (0.50 g/l)	0.99	0.97	0.99	0.98	0.92	0.95	0.98	0.99
	Glycine betaine (600 mg/l)	0.95	0.94	0.96	0.96	0.94	0.94	1.00	0.98
	Potassium silicate (12 ml/l)	1.15	1.05	1.16	1.09	1.29	1.16	1.36	1.24
L.S.D 5%		0.01	0.002	0.007	0.009	0.01	0.01	0.01	0.01

Essential oil components of Sage plant: -

Table (3) and Fig. (1) show the GLC analysis of essential oil samples from the first harvest of the second season for plants that were irrigated every 3, 6, and 9 days and received foliar spray treatments of Chitosan (0.50 g/l), Glycine betaine (600 mg/l), and Potassium silicate (12 ml/l).

The researchers discovered 11 chemicals, including five oxygenated compounds (α-terpineole, 1.8-cineole, bornyl-acetate, borneole, and eugenol) and six hydrocarbon compounds (camphene, α and β-pinene, α-thujone, limonene, and -caryophyllene). These compounds accounted for 68.96% to 95.33% of the essential oil of sage plant. Among these, α-thujone, 1.8-cineole, and α-pinene were the most prominent components of sage oil. Notably, the plants irrigated every 9 days yielded the highest levels of these main components (23.88%, 13.40%, and 12.77%), which amounted to a total of 50.05%. Irrigation every 6 days resulted in the next highest levels of main components (22.14%, 11.88%, and 12.70%), totaling 46.72%.

Table 3. Essential oil components (%) as affected by irrigation intervals and the interaction treatments between irrigation every 9 days and foliar spray of some stimulants of *Salvia officinalis* L. plant in the 1st cut during the second season.

Components (%)	Irrigation intervals			Foliar applications with irrigation every 9 days		
	3 Days	6 Days	9 Days	Chitosan (0.50 g/l)	Glycine betaine (600 mg/l)	Potassium silicate (12 ml/l)
α -pinene	11.20	12.70	12.77	13.52	18.06	20.13
β -pinene	7.35	3.38	3.57	2.95	4.50	3.53
Camphene	2.82	2.41	2.59	1.48	2.25	2.17
Limonene	5.98	3.77	3.23	3.24	4.33	3.47
1.8-cineole	12.65	11.88	13.40	13.22	14.22	19.95
α -thujone	17.06	22.14	23.88	23.96	24.11	25.43
α -Terpineole	1.42	2.02	2.01	2.12	1.98	2.06
Borneol	0.99	1.95	2.01	2.02	0.86	2.03
Bornyl-acetate	6.72	7.66	8.35	15.02	13.9	5.82
Eugenol	2.24	6.44	5.72	7.00	5.80	6.52
β -Caryophyllene	0.53	3.12	4.22	5.33	1.64	4.22
Total component	68.96	77.47	81.75	89.86	91.65	95.33

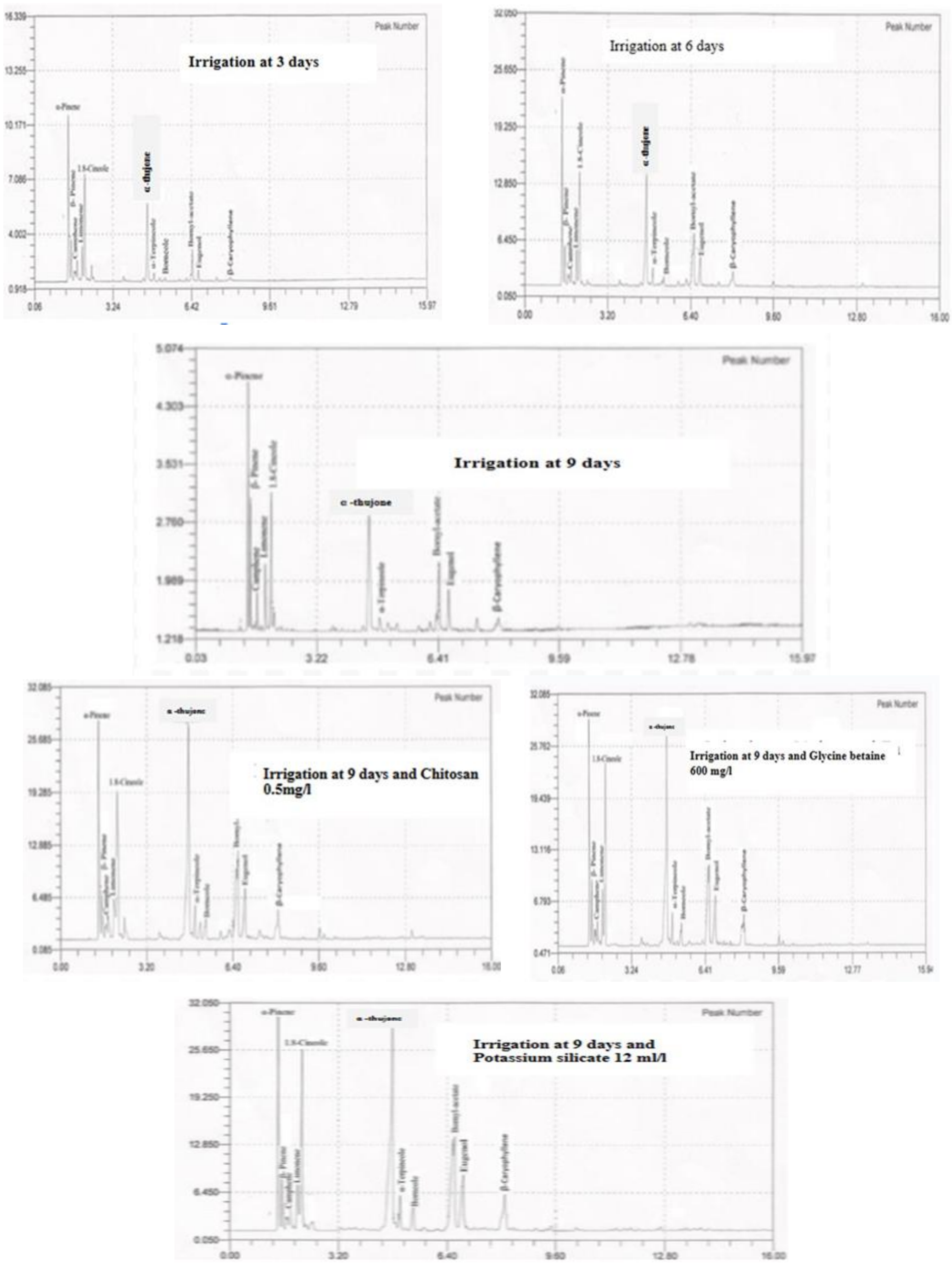

Fig. 1. G.L.C. of Sage essential oil components (%) as affected by irrigation intervals and the interaction treatments between irrigation every 9 days and foliar spray of some stimulants in the 1st cut during the second season.

On the other hand, the lowest value of 40.91% was observed with a 3-day irrigation interval. The results showed that increasing the irrigation period from 3 to 9 days led to an increased percentage of certain oil components, such as 1.8-cineole, α-pinene, α-thujone, borneol, α-terpineole, bornyl-acetate, caryophyllene, and eugenol. However, it resulted in a decrease in the percentage of other oil components, such as β-pinene, camphene, and limonene, when the second spray was applied one month after the first spraying. These findings were consistent with (AbdelKader *et al.*, 2014). Also, the volatile oil composition of sage was found to be influenced by different levels of irrigation. In Table 4, it was observed that the combination of irrigating every 9 days and foliar spray with Potassium silicate (12 ml/l) resulted in the highest percentages of α-thujone, 1.8-cineole, and α-pinene (25.43%, 19.95%, and 20.13% respectively), totaling 65.51%. Following this, the application of Glycine betaine (600 mg/l) yielded percentages of 24.11%, 14.22%, and 18.06%, amounting to 56.39% of the main components. Finally, using Chitosan (0.50 g/l) as a foliar spray resulted in percentages of 23.96%, 13.22%, and 13.52%, making up 50.70% of the main components, compared to the control with irrigation every 9 days. These changes in component percentages may be attributed to the effects of different fertilization treatments on the metabolism and enzymatic processes. Additionally, variations in climatic factors and the stage of plant development may also contribute to the observed differences. These findings are consistent with earlier studies. (Ali *et al.*, 2020; Alizadeh *et al.*, 2020; El-Kinany *et al.*, 2019; Stasińska-Jakubas *et al.*, 2023)

CONCLUSION

Based on the findings, the optimal treatment to achieve the highest concentration of volatile oil and its active components in the sage plant is through the application of potassium silicate at a rate of 12 ml/l during 9-day irrigation intervals.

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تأثير بعض منشطات النمو وفترات الري على نمو وإنتاج الزيت العطري ومكوناته لنبات المريمية

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الملخص

أجريت التجربة في حقل التجارب الخاص بالنباتات العطرية والطبية بكلية الزراعة جامعة المنصورة خلال الموسمين المتتاليين ٢٠٢١-٢٠٢٢ و٢٠٢٢-٢٠٢٣. تهدف الدراسة إلى معرفة تأثير الرش الورقي لبعض منشطات النمو مثل (الشيتوزان، الجلايسين بيتين، وسيليكات البوتاسيوم) على بعض صفات النمو الخضري (طول النبات والوزن الجاف للأوراق)، ونسبة الزيت العطري، ومحتوى الزيت العطري، والمكونات الفعالة الموجودة في الزيت الطيار لنبات المريمية (*Salvia officinalis*. L) تحت ظروف فترات الري المختلفة لنباتات تروى كل ٣، ٦، و ٩ أيام. أظهرت النتائج أن ري النباتات كل ٣ و٦ أيام كان فعالاً في طول النبات وزيادة إنتاجية الوزن الجاف للأوراق؛ ومع ذلك، كانت نسبة الزيت العطري ومحتوى الزيت العطري والمكونات الفعالة بالزيت للمريمية أعلى خلال فترة الري البالغة ٩ أيام.كان الرش الورقي بسليكات البوتاسيوم أكثر فعالية من الشيتوزان والجلايسين بيتين وأدى إلى تحسين إنتاجية النمو الخضري ونسبة الزيت العطري ومحتوى الزيت العطري والمكونات الفعالة بزيت نبات الميرمية . وبالتالي فان أفضل معاملة للحصول على اعلى نسبة من الزيت الطيار لنبات المريمية وكذلك المواد الفعالة به هي الرش بسليكات البوتاسيوم ١٢ مل/لتر خلال فترة الري ٩ أيام