Plant Archives Vol. 19, Supplement 1, 2019 pp. 8-17 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

THE EFFICIENCY OF MARINE ALGAE, LOCAL FRESH WATER ALGAE AND GIBBERELLIC ACID, AND THEIR INTERACTION IN SOME OF THE GROWTH AND YIELD CHARACTERISTICS AND ACTIVE COMPOUNDS OF THE *ANETHUM GRAVEOLENS* L. PLANT

Roa'a Muthna Dawood and Maher Zaki Faisal Al Shammari
Department of Biology, College of Education for Pure Sciences (Ibn Al-Haitham),
University of Baghdad, Baghdad, Iraq
Email: sayf_sr@yahoo.com

Abstract

A field experiment was conducted on the botanical garden belonging to the Department of biology, College of Education for Pure Science (Ibn Al-Haitham, University of Baghdad for the growth season 2017-2018on dill plant. The experiment was performed as a working experience according to Randomized Complete Blocks Design (RCBD). The experiment involved three factors, the first factor is the extraction of the local freshwater algae at three levels (0, 50, 100) mg.L^{-1}, and the second marine algae extraction at three levels (0, 50, 100) mg.L^{-1}, and the third gibberellin (GA3) at four levels (0, 25, 50, 75) mg. L^{-1} and by three replicates. The results indicated that the application of freshwater algae extractat concentration of 100 mg.L^{-1}, marine algae extract at concentration of 50 mg.L^{-1} and gibberellin at concentration of 50 mg.L^{-1}as well as the interaction between them was significantly in all the growth characteristics which represented stem diameter, number of vegetative plant branches and proportion of carbohydrates and protein. As for active compounds, the application treatments at different concentrations showed significant interaction, the concentrations of freshwater algae extract at 50 mg.L^{-1}, marine algae extract at 100 mg.$L^{-1}$and GA3at 75 mg.L^{-1}gave the higher percentage of interaction in proportion of Limonene and Myristin.

***Key words*:** Dill, Algae extracts, gibberellin, active compounds.

Introduction

Medicinal plants are considered to be multi-use crops, either directly or indirectly forms, by extracting active compounds and their uses in the pharmaceutical industry, food industries, perfumes, cosmetics, soap, and as form cereals, plants or medicinal herbs and aromatic (Ibrahim, 2010). *Anethum graveolens* L. is one of Apiaceae family (Al-Kateb, 1988). Its original country is the Mediterranean region, south and east Europe, and central and south Asia (Kaur and Arora, 2010).

It is annual or biennial plants, has a taproot like a carrot, the plant is an erect its length ranged from 70-120 cm,pinnate compound leaf, divided into linear parts, the stem are glabrous succulent, the flowers are full yellow with compound umbel Inflorescences (Gautam *et al*., 2013 ; Brown and Deni, 2001). It is an aromatic herb that has been used for more than five thousand years to treat indigestion and flatulence, tonic for the secretion of milk, lowers cholesterol, anti-convulsion, while the seeds act to strengthen the stomach and enhance the appetite (Zargari, 1996).

Algae are plant-like organisms that belong to Protista kingdom and perform photosynthesis because of contain chlorophyll A (Al-Saadi and Suleiman, 2006). It is used as organic or bio-fertilizer. The use of marine algae extracts has generated a lot of attention and has become the new system of agricultural production because of the growing interest in the environment and the emphasis on clean agriculture and considered as non-toxic extracts by their biological nature and environmentally friendly and do not leave any residues on plant or soil as well as considered as organic sources used in agricultural production, which are partially complementary to fertilizers and improve and increase the efficiency of fertilizers and thus reduce production costs (Khan *et al*., 2009). Marine algae extracts contain many elements, such as phosphorus, nitrogen, sodium, calcium, iron, magnesium, and copper. Additionally, extracts contain nutrients that work with more than one group of growth stimuli such as cytokines, auxins and proteins. Amino acids that improve the condition of vegetative growth thus improve vegetative growth and increase the yield and quality of vegetation (Osman *et al*., 2010).

The gibberellin is a plant growth regulators synthesis in different parts of the plant, especially the newest parts (meristematic apex, new leaves, immature seeds). There are now more than 136 types of known, but a few of them have effects physiological is important within the plant. The gibberellin is one of the most important plant hormones in fungi and higher plants, and it has important role in the development and germination of seeds and in the control of dormancy, and has an effect on the elongation of the plant branches by increasing the elongation and expansion of cells. It can be found in high concentrations at developing apex of stem, particularly in the precursor of leaves, roots and

fruits. GA3 affects on the hemicellulose fibre distribution system of cell walls, reduces their hardness, increases their flexibility and softness, and facilitates the expansion and elongation of cells (Hartman *et al*., 2002; Iraki *et al*., 1989). The physiological effects of GA3 are attributed tothe controlling on the enzymatic activity and activated metabolic processes such as increasing carbohydrates, division and elongation of cells, breaking hibernate, increasing or reducing the hold of fruits and maturity and delaying the flowering (Al-Khafagy, 2014).

Materials and Methods

A field experiment was carried out in the plant garden belonging to the Department of Biology, College of Education for Pure Sciences (Ibn Al-Haitham), University of Baghdad during the growth season 2017-201. The experiment was carried out in accordance with Randomized Complete Blocks Design (RCBD). The seeds of dill were planted in 23-10-2017 and the fertilizer was added neutral NPK-20. The plant was cultivated with straight lines the distance between each line and the other is 20 cm, the single experimental unit contains three lines, and the distance between the plant and the other is 10 cm. All agricultural operations were carried out to serve the crop from the hoeing, weeding and irrigation with three replicate, a single repeater (36) experimental units which the correlation coefficients were distributed to the studied treatments. The studied treatments included freshwater algae extract that extracted by the Harbone (1984) method and the marine algae extract at three levels and the gibberellin by four levels.

The following characteristics have been studied:

- **Stem diameter (mm):** stem diameter is measured for (3) random plants of each experimental unit at an altitude of 5 cm from the surface of the experiment using Verner caliper.
- **Number of plant branches (branch.plant^{-1}):** The number of vegetable branches has been calculated for 3 random plants per unit of experimentation.
- **Estimation of carbohydrate proportion (%) in vegetative total:** carbohydrate proportion is estimated in the vegetative total of the digestive sample according to Herbert *et al*.(1971) method.
- **Estimation of protein proportion (%) in vegetative total:** the protein proportion in the vegetative total was estimated according to the Vopyan (1984) method.
- Estimation of the proportion of active compounds in the dill plant using high-performance liquid chromatography (H.P.L.C): The active compounds were diagnosed by AOAC (1995) method.

Results and Discussion

Stem diameter (mm)

The results of the table (1) indicate that there is a difference in the mean stem diameter, the treated plants was exceeded at concentration of 100 mg.L^{-1} freshwater algae extract with the highest mean of 8.46 mm and an increased rate (14.95%) compared to the treatment of control.

The treatment of marine algae extracts was also exceeded at concentration of 50 mg. L^{-1} and gave the highest mean stem diameter 8.37 mm and an increased rate 10.42% compared to the plants of control.

The reason for the increase in stem diameter is due to the biotic processes that occur in the plant, such as the formation of amino acids, proteins and enzymes that stimulate the increase of cellular divisions and cell elongation, thus increasing tissue growth; which leads to increased activity of the cambium layer, that in turn given when divided this increase in stem diameter (Al-Sahaf, 1989). Substances similar to auxins are increasing in plants treated with marine algae extracts (Khan *et al*., 2009). Their content may lead to the essential nutrients of growth such as nitrogen, phosphorus, potassium, amino and organic acids, and vitamins, which have a wide range of effect on biological plant activities (Osman *et al*., 2010).Thus increase their uptake by plants, reflecting positively the increased vegetative growth(Karim *et al*. 2012; Mohammad and Al-Sareeh, 2016).

The treatment of gibberellin (GA3) go on better at concentration of 50 mg.L^{-1} by giving it the highest mean stem diameter of 8.71 mm and an increased rate 22.33% compared to the plants of control. The increase in the stem diameter at application of GA3 due to the stimulating physiological role to increase cell division, elongation and expansion, which was caused by increased vegetative growth of plant, and thus increases stem diameter (Abdul, 1987; Abdul-Abbas *et al*., 2015; Al-Jabouri, 2017). Duel interaction had appeared significant interaction between the extraction of the freshwater algae and the marine algae extract in the mean stem diameter. A concentration 100 mg.L^{-1} of freshwater algae extract and 50 mg.L^{-1} of marine algae extract achieved highest value of interaction 9.72 mm and increased rate (51.17%) compared to the plants of control. The duel interaction between the extraction of the freshwater algae and GA3 was a significant interaction. The two concentrations 50 and 100 mg.L^{-1}of freshwater algae extract and 50 mg.L^{-1} of GA3 gave the highest value of interaction 8.83 and 8.93 mm

respectively and an increased rate (44.99 and 46.63%) respectively compared to the control plants that valued to 6.09 mm. The duel interaction between the marine algae extract and GA3 also showed a significant interaction in the characteristic of the stem diameter.The concentration 50 mg.L^{-1} of marine algae extract and 50 mg.L^{-1} of GA3 has recorded the highest value of interaction 9.30 mm and increased rate (36.16%) compared to the plants of control. The triple interaction between the study treatments was a significant in the diameter of the stem. The treated plants with concentration 100 mg.$L^{-1}$of freshwater algae extract, 0 and 50 mg.L^{-1} marine algae extract, 25 and 50 mg.$L^{-1}$of GA3 gave highest values of interaction 10.08, 10.16 and 10.34 mm respectively and an increased rate (75.61, 77.00 and 80.34%) respectively compared to the plants of control.

Table 1 : Effect of application of freshwater, marine algae extracts and GA3 hormone and their interaction in stem diameter (mm) of dill.

Freshwater algae extract (R) mg.L^{-1}	Marine algae extract (S) mg.L^{-1}	Concentration of GA3 mg.L^{-1}				Mean of duel interaction R×S
		0	25	50	75	
0	0	5.74	6.70	7.01	6.30	6.43
	50	6.15	7.07	8.43	8.18	7.46
	100	6.39	7.81	9.67	8.85	8.18
50	0	6.49	7.29	8.01	6.82	7.15
	50	7.08	8.15	9.13	7.42	7.94
	100	7.82	9.18	9.35	8.38	8.68
100	0	8.25	9.44	10.16	8.71	9.14
	50	8.97	10.08	10.34	9.49	9.72
	100	7.23	6.53	6.30	5.97	6.51
LSD 0.05		0.28				0.14
Duel interaction R × GA_3						
Freshwater algae extract (S) mg.L^{-1}		Concentration of GA3 mg.L^{-1}				Mean
		0	25	50	75	
0		6.09	7.19	8.37	7.78	7.36
50		7.13	8.21	8.83	7.54	7.93
100		8.15	8.68	8.93	8.06	8.46
LSD 0.05		0.16				0.08
Duel interaction S × GA_3						
Marine algae extract (S) mg.L^{-1}		Concentration of GA3 mg.L^{-1}				Mean
		0	25	50	75	
0		6.83	7.81	8.39	7.28	7.58
50		7.40	8.43	9.30	8.37	8.37
100		7.15	7.84	8.44	7.74	7.79
LSD 0.05		0.16				0.08
Mean		7.12	8.03	8.71	7.79	
LS D 0.05		0.09				

Number of plant branches (branch. plant^{-1})

The results of the table (2) showed significant differences in the mean number of plant branches. The treated plant with concentration 100 mg.L^{-1} of freshwater algae extract exceeded with the best mean reached to 15.33 branch. Plant^{-1} and an increased rate (14.57%) compared to the plants of control.

The treatment of marine algae extracts has also surpassed at concentration of 50 mg.L^{-1} by giving it the highest mean number of plant branches 15.19 branch. plant^{-1} with an increased rate (10.31%) compared to the plants of control. The reason for increasing the number of vegetative branches is due to the role of algae extracts that work on provide part of the nitrogen needs of the plant and contribute to the synthesis of protein within it as a result of containing free amino acids and improve the efficiency of the photosynthesis in the leaf (Abdul-Muttalib, 2011). As well as the fact that cytokines helps in the transmission of nutrients from the roots and directed them into vegetative growth and leaves (Mohammad *et al*., 1991; Kadhem, 2012; Al-Mohammedi *et al*. 2014). As for the treatment of GA3 application, a concentration of 50 mg.L^{-1}gave the highest number of plant branches reached 15.78 branch.plant^{-1} and an increased rate (21.76%) compared to the plants of control. The increase in the number of plant branches is due to the effect of the GA3because its stimulation of increase cell division and elongation and encourage plant growth (Mohamed and Al-Yonis, 1991;Mousa*et al*., 2001;Vanisree*etal*., 2004), thus increasing the number of vegetative branches of plant(Reda *et al*., 2010). While duel interaction had appeared significant interaction between the extraction of the freshwater and the marine algae in the mean number of plant branches, where the concentration of

100 mg.L^{-1} of freshwater algae extract and 50 mg.L^{-1} marine algae extract recorded the highest mean of interaction 17.58 branch.plant^{-1} with an increased rate 49.87% compared to the plants of control. The duel interaction between the extractions of the freshwaterand marine algae were significantly interaction. The concentrations of 50 and 100 mg.L^{-1} of freshwater algae extract and 50 mg.L^{-1} of GA3 has the highest value of interaction 15.98 and 16.19 branch.plant^{-1} respectively and by an increased rate (43.83 and 45.72%) respectively compared to the plants of control. The due linteraction between the marine algae extract and GA3 also showed a significant interaction in the characteristic of number of plant branches. The concentrations50 mg.L^{-1} of marine algae extract and 50 mg.L^{-1} GA3 has recorded the highest value of interaction 16.84 branch.plant^{-1} with an increased rate (35.59%) compared to the plants of control. In the triple interaction between the study treatments, this interaction was a significant in the characteristicnumber of plant branches.The treated plants withconcentration 100 mg.L^{-1} of freshwater algae extract, 0 and 50 mg.$L^{-1}$of marine algae extract, 25 and 50 mg.L^{-1} of GA3 surpass and gave the highest values of interaction 18.21, 18.36 and 18.71 branch.plant^{-1}respectively with an increased rate (47.09, 75.53, 78.87%) respectively compared to the plants of control.

Table 2: Effect of application of freshwater, marine algae extracts and GA3 hormone and their interaction in mean number of dill plant branches (branch.plant^{-1}).

Freshwater algae extract (R) mg.L^{-1}	Marine algae extract (S) mg.L^{-1}	Concentration of GA_3 mg.L^{-1}				Mean of duel interaction R×S
		0	25	50	75	
0	0	10.46	12.20	12.78	11.48	11.73
	50	11.21	12.90	15.30	14.84	13.57
	100	11.66	14.19	17.47	16.04	14.84
50	0	11.85	13.29	14.53	12.42	13.02
	50	12.91	14.79	16.50	13.51	14.43
	100	14.21	16.60	16.91	15.21	15.73
100	0	14.96	17.08	18.36	15.79	16.55
	50	16.25	18.21	18.71	17.17	17.58
	100	13.18	11.90	11.49	10.86	11.86
LSD 0.05		0.54				0.27
Duel interaction R × GA_3						
Freshwater algae extract (S) mg.L^{-1}		Freshwater algae extract (S) mg.L^{-1}				Freshwater algae extract (S) mg.L^{-1}
		0	25	50	75	
0		11.11	13.10	15.19	14.12	13.38
50		12.99	14.89	15.98	13.71	14.39
100		14.79	15.73	16.19	14.61	15.33
LSD 0.05		0.31				0.15
Duel interaction S × GA_3						
Marine algae extract (S) mg.L^{-1}		Concentration of GA3 mg.L^{-1}				Mean
		0	25	50	75	
0		12.42	14.19	15.22	13.23	13.77
50		13.46	15.30	16.84	15.17	15.19
100		13.01	14.23	15.29	14.04	14.14
LSD 0.05		0.31				0.51
Mean		12.96	14.57	15.78	14.15	
LSD 0.05		0.18				

Proportion of carbohydrates (%) in the vegetative part

Results of table (3) showed that the existence of significant differences in the mean carbohydrate proportion, where the concentration 100 mg.L^{-1} of freshwater algae extract gave the highest mean of 25.02% and an increased rate 15.19% compared to the plants of control.The concentration of 50 mg.L^{-1} marine algae extract has the highest mean carbohydrate proportion 24.79% and an increased rate 10.72% compared to the plants of control.

The increase in carbohydrate is attributed to the role of algae extracts because of their containing of the nutrients element especially potassium, which has an important role in the metabolism of carbohydrates and assists in the formation of amino acids and important proteins (Jundia, 2003). As well as increase the efficiency of absorption nutrients in addition to their containing of nutrients and amino acids contained Betaine substance, which is a source of nitrogen, extracts conserve chlorophyll molecule, prevent oxidation and generate energy for protein synthesis (Taha, 2008; Abdul-Amir *et al*., 2011; Mohammad and Al-Sareeh, 2016). The treatment of the plant with a

concentration 50 mg.L^{-1} of GA3 gave the highest mean carbohydrate proportion of 25.81% and an increased rate22.79% compared to the plants of control.

The reason for the increase in the proportion of carbohydrates after the application of plant with GA3 is due to its role in increasing the leaf area of plant and the dry weight of the vegetative total and the content of plant from chlorophyll. It was reflected in the increased efficiency of photosynthesis and hence the increase in the accumulation of carbohydrates amount (Qutb, 1981; TaizeandZeiger, 2010; Al-GalabiandAl-Khafaji, 2016; Al-Jaboury, 2017). The duel interactions showed a significant difference in the mean carbohydrate proportion. The concentrations 100 mg.L^{-1} of freshwater algae extract and 50 mg. $L^{-1}$of marine algae extract has recorded the highest mean interaction 28.82% with an increased rate 52.16% compared to the plants of control. The duel interaction between the extraction of the freshwater algae and GA3 also showed significant interaction. The concentrations 50 and 100 mg.L^{-1} of freshwater algae extract and 50 mg.L^{-1} of GA3 recorded the highest value of interaction 26.13 and 26.50% respectively and an increased rate (46.30 and 48.38 %) respectively compared to the plants of control. While the duel interaction between the marine algae extract and GA3 showed a significant interaction. The concentrations 50 mg.L^{-1} of marine algae extract and 50 mg. L^{-1} of GA3 gave the highest value of interaction 27.59% and an increased rate 37.33% compared to the plants of control. The triple interaction between the study treatments had a significant interaction. The treatments with concentration100 mg.L^{-1} of freshwater algae extract, 0 and 50 mg.$L^{-1}$of marine algae extract, 25 and 50 mg.L^{-1}GA3gave the highest value of the interaction 29.91, 30.19and 30.76% respectively, with an increased rates (79.53, 81.21 and 84.63%) respectively compared to the plants of control.

Table 3 : Effect of application of freshwater, marine algae extracts and GA3 hormone and their interaction in mean leaves content of carbohydrates (%).

Freshwater algae extract (R) mg.L^{-1}	Marine algae extract (S) mg.L^{-1}	Concentration of GA_3 mg.L^{-1}				Mean of duel interaction R×S
		0	25	50	75	
0	0	16.66	19.82	20.76	18.52	18.94
	50	18.08	20.97	24.97	24.13	22.04
	100	18.85	23.05	28.62	26.17	24.17
50	0	19.20	21.62	23.58	20.14	21.13
	50	20.96	24.04	27.06	22.03	23.52
	100	23.09	27.07	27.74	24.75	25.66
100	0	24.42	27.95	30.19	25.76	27.08
	50	26.51	29.91	30.76	28.09	28.82
	100	21.40	19.23	18.56	17.46	19.16
LSD 0.05		0.92				0.46
Duel interaction R × GA_3						
Freshwater algae extract (S) mg.L^{-1}		Freshwater algae extract (S) mg.L^{-1}				Freshwater algae extract (S) mg.L^{-1}
		0	25	50	75	
0		17.86	21.28	24.78	22.94	21.72
50		21.08	24.24	26.13	22.31	23.44
100		24.11	25.70	26.50	23.77	25.02
LSD 0.05		0.53				0.26
Duel interaction S × GA_3						
Marine algae extract (S) mg.L^{-1}		Concentration of GA3 mg.L^{-1}				Mean
		0	25	50	75	
0		20.09	23.13	24.85	21.47	22.39
50		21.85	24.97	27.59	24.75	24.79
100		21.11	23.12	24.98	22.79	23.00
LSD 0.05		0.53				0.26
Mean		21.02	23.74	25.81	23.01	
LSD 0.05		0.31				

Protein proportion (%) in the vegetative total

The results of the table (4) indicate a significant increase in the mean protein proportion in the vegetative part. The concentration 100 mg.L^{-1} of freshwater algae extract gave the highest mean 9.78% and an increased rate 13.85% compared to the treatment of control.

While the concentration 50 mg.L^{-1} marine algae extract recoded the highest mean protein proportion with a value of 9.75% and an increased rate 10.29% compared to the plants of control. The increase in the protein proportion is due to the role of algae extracts to increase the efficiency of nutrient absorption; to contain nutrients and amino acids as well as to contain the substance that is a nitrogen source and to maintain a

chlorophyll molecule and prevent its oxidation and generate the necessary energy for the synthesis of protein (Taha, 2008; Abdul-Amir *et al*., 2011, Mohammad and Al-Sareeh, 2016). As for the effect of GA3 hormone application, the concentration 50 mg.L^{-1} gave the highest mean protein proportion 10.11% and an increased rate 21.51% compared to the treatment of control.

The increase in protein proportion is due to its nitrogen exceed and the role played by GA3 in stimulating the synthesis of DNA, RNA, mRNA and special enzymes for protein-synthesis (Moore, 1982), thus increasing protein synthesis in the plant. Also, to increase the concentration of potassium as a result of the positive role of this element in stimulating enzymes catalysing many physiological processes within the plant system, including enzymes associated with protein metabolism (Malvi, 2011). As well as its active role in nitrate reduction and conversion to aminoacids, that are considered as the essential building in protein synthesis (Britto and Kronzucker,2008). The duelinteraction showed a significant interaction between the extraction of the fresh an marine algae in the mean protein proportion. The concentrations100 mg.L^{-1} freshwater algae extract and 50 mg.L^{-1} marine algae extract gave highest mean 11.20% and an increased rate (48.54%) compared to the plants of control. The duel interaction between the extraction of the refresh algae and GA3 has shown a significant interaction. The concentrations 50 and 100 mg.L^{-1} of freshwater algae extract and 50 mg.$L^{-1}$of GA3recorded the highest interaction value 10.13 and 10.43% respectively with an increased rate(44.10 and 48.36%) respectively compared to the plants of control. The duel interaction between the marine algae extract and GA3 resulted significant interaction. The concentration 50 mg.L^{-1} marine algae extract and 50 mg.L^{-1} of GA3 has the highest value of interaction 10.81%, with an increased rate (37.01%) compared to the plants of control. As for the triple interaction between the study treatments, the interaction was significant differences. The concentrations 100 mg.L^{-1} of freshwater algae extract, 0 and 50 mg.L^{-1} of marine algae extract, 25 and 50 mg.L^{-1} GA3 with the highest value of interaction 11.56, 11.78 and 12.09% respectively with an increased rate (81.48, 84.93 and 89.80%) respectively compared to the treatment of control.

Table 4: Effect of application of freshwater, marine algae extracts and GA3 hormone and their interaction in protein proportion in mean of vegetative part of dill plant (%).

Freshwater algae extract (R) mg.L^{-1}	Marine algae extract (S) mg.L^{-1}	Concentration of GA3 mg.L^{-1}				Mean of duel interaction R×S
		0	25	50	75	
0	0	6.37	7.96	8.44	7.38	7.54
	50	7.19	8.53	9.86	9.41	8.74
	100	7.52	9.08	11.06	10.24	9.48
50	0	7.74	8.75	9.18	8.01	8.42
	50	8.51	9.39	10.47	8.91	9.32
	100	9.09	10.43	10.74	9.69	9.99
100	0	9.56	10.83	11.78	10.04	10.55
	50	10.29	11.56	12.09	10.86	11.20
	100	8.65	7.62	7.41	6.72	7.60
LSD 0.05		0.62				0.31
Duel interaction R × GA_3						
Freshwater algae extract (S) mg.L^{-1}		Freshwater algae extract (S) mg.L^{-1}				Freshwater algae extract (S) mg.L^{-1}
		0	25	50	75	
0		7.03	8.52	9.78	9.01	8.59
50		8.45	9.52	10.13	8.87	9.24
100		9.50	10.01	10.43	9.21	9.78
LSD 0.05		0.36				0.18
Duel interaction S × GA_3						
Marine algae extract (S) mg.L^{-1}		Concentration of GA3 mg.L^{-1}				Mean
		0	25	50	75	
0		7.89	9.18	9.80	8.48	8.84
50		8.66	9.82	10.81	9.73	9.75
100		8.42	9.05	9.74	8.88	9.02
LSD 0.05		0.36				0.18
Mean		8.32	9.35	10.11	9.03	
LSD 0.05		0.21				

Proportion of Limonene and Myristin oil (%) in the fruits

The results of the tables (5, 6) showed containing of the essential oil of the dill plant on two active medical compounds (Limonene, Myristin). The results of the tables indicated that there were significant differences in the mean proportion of the active compounds in the oil of dill plant. The concentration 50 mg.L^{-1} freshwater algae extract recorded the highest mean 22.45 and 8.57% respectively, with an increased rate (16.91 and 16.92%) respectively compared to the treatment of control. The concentration 100 mg. L^{-1} of marine algae extract recorded also the highest mean proportion of active compound 21.36 and 8.12% respectively and an increased rate (8.48 and 8.56%) respectively compared to the plants of control. The increase is due to effect of algae extracts and their contained of neutral element which play important and effectiveness role in increasing the active compound with a medical effect by improving plant growth, effectiveness and rise its capacity in the production of secondary compounds (Al-Nuaimi, 1991). The increase in the oil proportion is due to the role of magnesium, which is contained in the algae extracts, mainly in the composition of the chlorophyll molecule (Yassin, 2001; Matrood *et al*., 2016; Al-Juoburi, 2017). As for the effect of GA3 application, treated plants have exceed at concentration 75 mg.L^{-1} by the highest mean reached 21.92 and 8.33% respectively, with an increased rate15.01 and 15.06% respectively compared to the treatment of control. The increase in the proportion of oils in active compounds is due to the fact that GA3 is leading to increased vegetative and flowering growth of the plant. Thus leading to the production of major compounds through the primary metabolic pathways in oil such as Acetyl COA through the pathway of mevalonic acid, which consists of mono-terpenes compounds, phosphoenol pyruvate (PEP) consisting of shikimic acid which is important for the formation of aromatic compounds. This is the result of increased essential and secondary product of metabolism resulting from photosynthesis that used in the production of major compounds for oil (Taize and Zeiger, 2002). As well as the role of GA3 in controlling the biosynthesis of the violate oils through the metabolic pathway of mevalonic acid (Reda *et al*., 2010). Duel interaction showed the results to interaction between the extraction of freshwater algae and marine algae in the mean oil proportion. The concentrations 50 mg.L^{-1} freshwater algae extract and 100 mg.L^{-1} marine algae extract gave the highest interaction of 23.31 and 8.86% respectively with an increased rate (27.10 and 27.12%) respectively compared to the treatment of control. The duel interaction between the extraction of the freshwater algae and GA3 had a significant interaction. The concentrations 50 mg.L^{-1} of freshwater algae extract and 75 mg.$L^{-1}$of GA3 has the highest value of interaction 24.00 and 9.12% respectively and an increased rate (31.98 and 32.09%) respectively compared to the plants of control.

The duel interaction between the marine algae extract and GA3 showed a significant interaction. The concentration 50 and 100 mg.L^{-1} of marine algae extract, 50 and 75 mg.L^{-1} of GA3 recorded the highest value of the interaction 22.09, 22.48, 22.12, 8.40, 8.54, 8.41% respectively and an increased rate(20.84, 22.98, 21.01, 20.86, 22.88 and 21.01%) respectively compared to the treatment of control. As for the triple interaction between the study treatments, there was a significant interaction. The concentration 50 mg.L^{-1} of freshwater algae extract, 50 and 100 mg. L^{-1} of marine algae extract, 50 and 75 mg.L^{-1} of GA3 gave the highest value of interaction 24.16, 24.28, 24.52, 9.18, 9.23, 9.32% respectively and an increased rate (40.30, 40.998, 42.39, 40.15, 40.92, 42.29%) respectively compared to the treatment of control.

Table 5: Effect of application of freshwater, marine algae extracts and GA3 hormone and their interaction in proportion of limonene (%).

Freshwater algae extract (R) mg.L^{-1}	Marine algae extract (S) mg.L^{-1}	Concentration of GA3 mg.L^{-1}				Mean of duel interaction R×S
		0	25	50	75	
0	0	17.22	17.85	18.25	20.03	18.34
	50	18.46	18.40	19.39	20.42	19.17
	100	18.82	20.21	20.87	21.41	20.33
50	0	19.75	21.56	22.41	23.19	21.73
	50	20.63	22.32	23.13	24.28	22.59
	100	21.23	23.34	24.16	24.52	23.31
100	0	17.85	18.55	19.33	20.27	19.00
	50	18.19	19.78	21.65	22.74	20.59
	100	19.36	20.75	21.23	20.42	20.44
LSD 0.05		0.72				0.36

Duel interaction R × GA_3					
Freshwater algae extract (S) mg.L^{-1}	Freshwater algae extract (S) mg.L^{-1}				Freshwater algae extract (S) mg.L^{-1}
	0	25	50	75	
0	18.17	18.82	19.50	20.62	19.28
50	20.54	22.41	23.23	24.00	22.54
100	18.47	19.69	20.74	21.14	20.01
LSD 0.05	0.41				0.21
Duel interaction S × GA_3					
Marine algae extract (S) mg.L^{-1}	Concentration of GA3 mg.L^{-1}				Mean
	0	25	50	75	
0	18.28	19.32	20.00	21.16	19.69
50	19.09	20.17	21.39	22.48	20.78
100	19.80	21.43	22.09	22.12	21.36
LSD 0.05	0.41				0.21
Mean	19.06	20.31	21.16	21.92	
LSD 0.05	0.24				

Table 6: Effect of application of freshwater, marine algae extracts and GA3 hormone and their interaction in proportion of Myristin (%).

Freshwater algae extract (R) mg.L^{-1}	Marine algae extract (S) mg.L^{-1}	Concentration of GA3 mg.L^{-1}				Mean of duel interaction R×S
		0	25	50	75	
0	0	6.55	6.79	6.94	7.61	6.97
	50	7.02	6.99	7.37	7.76	7.29
	100	7.15	7.68	7.93	8.14	7.73
50	0	7.51	8.20	8.52	8.82	8.26
	50	7.84	8.48	8.79	9.23	8.59
	100	8.07	8.87	9.18	9.32	8.86
100	0	6.79	7.05	7.35	7.70	7.22
	50	6.91	7.52	8.23	8.64	7.83
	100	7.36	7.89	8.07	7.76	7.77
LSD 0.05		0.27				0.14
Duel interaction R × GA_3						
Freshwater algae extract (S) mg.L^{-1}		Freshwater algae extract (S) mg.L^{-1}				Freshwater algae extract (S) mg.L^{-1}
		0	25	50	75	
0		6.91	7.15	7.41	7.84	7.33
50		7.81	8.52	8.83	9.12	8.57
100		7.02	7.49	7.88	8.04	7.61
LSD 0.05		0.16				0.08
Duel interaction S × GA_3						
Marine algae extract (S) mg.L^{-1}		Concentration of GA3 mg.L^{-1}				Mean
		0	25	50	75	
0		6.95	7.35	7.60	8.04	7.48
50		7.26	7.67	8.13	8.54	7.90
100		7.53	8.15	8.40	8.41	8.12
LSD 0.05		0.16				0.08
المتوسط		7.24	7.72	8.04	8.33	
LSD 0.05		0.09				

References

Ibrahim, A. O. M. (2010). Medicinal and aromatic plants and medicinal uses. National Research Center. Arab Republic of Egypt.

Al-Jaboury, M. A. A. (2017). Effect of application of gibberellin and seaweed extracts on vegetative growth characteristics, mineral content and some physical properties of volatile oils in the fruits of anise plant (*Pimpinellaanisum*L). J. Tikrit Univ. Pure Sci., (22) 5: 1662-1813.

Al-Jubouri, W. S. H. (2017). Effect of gibberellin and breclinolide in some growth and yield properties of two species *AnanthumGravelolens* L. MSc. Thesis. College of Education for Pure Sciences (Ibn Al Haitham), University of Baghdad.

Al-Galabi, S. K. M. A. and Al-Khafaji; S. M. S. A. (2016). Effects of spraying of GA3 and CPP on the growth and flowering of the Friesia plant variety GOLDEN MELODY. Al-FuratJ. Agric. Sci., 8 (2): 23-30.

Qutb, F. T. (1981). Medicinal plants: cultivators and components. Dar Al-Mrikh Publishing House. Riyadh: 354 pp.

Al-Khafagy, M. A. (2012). Agricultural growth regulators and their applications and their uses of

Horticulture. Ministry of Higher Education and Scientific Research. University of Baghdad. College of Agriculture.

Al-Saadi, H. A. and Suleiman, N. I. (2006). Algae. Ministry of Higher Education and Scientific Research, University of Baghdad.

Al-Sahaf, F. H. R. (1989). Applied Plant Nutrition. University of Baghdad, Ministry of Higher Education and Scientific Research. Baeet Al-Hekma, Iraq.

Taha, S. M. (2008). Effect of application with gibberellin acid, cycosil and three extracts from marine plants in some vegetative and flowering properties and components of two types of flax (*FragariaXananassa*Duch). PhD thesis, College of Agriculture, University of Salahaddin, Republic of Iraq.

Abdul-Amir, M. K.; Qais, J. A.-M. and Aetdal, S. M. (2011). Effect of application with leaf fertilizer, proseol and garlic on citrus seedlings *Citrus aurautium*L. Al-Furat J. Agric. Sci., 3 (4): 54-65.

Abdul-Abbas, F. A. and Al-Jabri, W. M. N. and Hassan, F. A. (2015). Effect of application on gibberellin acid and liquid of coconut in vegetative and flowering growth, and tuber root plants of Dahlia Plant *Variabilis* L. Al-KufaJ. Agric. Sci.,4 (7): 16-28.

Abdul-Muttalib, A. A. A. (2011). Use of Algae and seaweed extracts to improve the growth and quality of horticultural crops. Shams Agric. Univ., 122 (5). College of Agriculture, Ain Shams University, Egypt.

Abdul, K. S. (1987). Plant growth regulators (Part 1). University of Salahaddin, Ministry of Higher Education and Scientific Research, Iraq.

Al-Kateb, Y. M. (1988). Classification of Seed Plants, Ministry of Higher Education and Scientific Research, First Edition, Baghdad University, Dar Al-Kutub for Printing and Publishing, Iraq - Baghdad, 584 pp.

Kadhem, A. A. (2012). Effect of marine Algae extract in the growth and flowering of germanium *Pelarginiumgrandiflorum*. J. Al-Furat Agric. Sci. 4(3): 45-52.

Karim, Z. H. K. and Abdel-Hadi, S. and Aljail, S. (2012). Effect of spraying marine algae extracts and flowering induction factors on the growth and production of cauliflower *Bassicaoleracea*var. *botrytis*. Kufa Agric. Sci. Series (4)1: 165-178.

Mohammad, K. H. and Al-Sareeh, I. A.-A. (2016). Effect of magnesium spray and marine algae extract on some vegetative and biochemical properties of seed *Citrus aurantium* L. Assiut J. Agric. Sci, (74): 156-163.

Mohammed, A.-A. K. and Al-Yunis, M. A. (1991). Fundamentals of Plant Physiology. College of Agriculture, University of Baghdad. Ministry of Higher Education and Scientific Research, Iraq.

Matroud, S. A. K. and Hassan, F. A. and Kazem, I. A. (2016). Effect of date of cultivation and spraying with Kelpak seaweed extract in the growth and yield of seeds and oil of basil plant *Ocimumbasillicum* var. *cinnamon* L. J. Thi-Qar University Agric. Res., 5 (1).

Yassin, B. T. (2001). Fundamentals of Plant Physiology.College of Science, Qatar University.

Moore, T. (1982). Plant hormones and their physiology and biochemicals. (Translated by Abdul Muttalib Abdul MuttalibSayed Mohammed). University of Mosul, Ministry of Higher Education and Scientific Research, Iraq.

Al-Nuaimi, S. N. A. (1999). Effect of Fertilizer and Soil Fertility on Growth and Oil Extract of Yellow Chebanthus (*Cheiranthuscheiri* L.). University of Al Mosul.

Al-Mohammedi , A.N. ; Al Mehemdi , A.F. And Al Ajeelee , R.K (2014) . Impact Of Bat Guano OtonyCterisHemprichiiCamd And Seaweed Extract On Some Growth And Yield Traits Of Barakas seed Nigella Sativa L. J. Of Bio, Agric. And Healthcare , 4(1) : 565 .

AOAC. (1995). Offical Methods Of Analysis.(16th Ed). Washington, DC: Association Of Official Analytical Chemists.

Britto, D.T. and Kronzucker, H.J. (2008). Cellular Mechanisms Of Potassium Transport In Plants. Physiol. Planta., 66(1):1-14.

Brown and Deni.(2001).The Herb Society Of America New Encyclopedia Of Herbs And Their Uses.New York.

Gautam, P.; Singh, K.; Kalra, S. and Khanna, D. (2013). Dill Herb: Wall Against DySfunctions: An updated Profile.INT J. Recent Adv. Pharm. Res., 4(4):1-8.

Gindia, H. (2003). Physiology Of Fruit Trees. Dar Al Alrabia For Publication And Distribution, The Arab Republic Of Egypt – PP.471 .

Harbone, J.B. (1984). Phytochemical Method A guide To Modern Techniques Of Plant Analysis 2nd ed. London, New York, Chapman And Hall.

Hartman , H.T. ; Kester, D.E. ; Davies , F.T. and Geneve, J.R.L. (2002) . Plant Propagation : Principle And Practices 7th ed. Prentice Hall , Upper Saddle River, New jersey 07458 : 880 PP.

Herbert, D.; Philips, P.J. and Strange, R.E. (1971).Determination Of Total Carbohydrates .(c.f Methods in Microbiology). Norris. J.R. and D. W. Robbins(ed). Acad. Press, London New York, 5B Chap.3.

Iraki, N.M.; Bressan, R.A.; Hasegawa, P.M. and Carpita, N.C. (1989). A. Alteration Of The Physical And Chemical Stricture Of Primary Cell Wall Of Growth. Limited Plant Physiol., 39-47.

Kaur, G. J. and Arora, D.S. (2010).Bioactive Potential Of *Anethum graveolens*, FoenialumVulgare and TrachySpermumammi Belonging To The Family Umbeliferae Current Status J. Med. Plant Res., 4(2): 87-94.

Khan, W.; Rayirath, U. P.; Subramanians, S.; Jithesh, M.N.; Rayoranth, P.; Hodges, D. M.; Critchley, A.T.; Craigie, J.S.; Norrie, J. and Prithiviraj, B.(2009). Seaweed Extracts as Biostimulants of plant growth and Development (Review). J. Plant Growth Reg., 386-399.

Malvi, U.(2011). Interaction of Micronutrients With Major Nutrients With Special Reference To Potassium. Karnataka J.Agric.Sci.24:106-113.

Mousa, G.T.; El-Sallami, I. Hanal Ali, E.F. (2001). Response Of (*Nigella Sativa* L.) To Foliar Application Of Gibberellic Acid, Benzyl Adenine, Iron And Zinc. Assuit J. GricultureSci, 32 141-156.

Osman, S.M.; Khamis, M.A. and Thorya, A.M. (2010). Effect Of Mineral and Bio-NPK. Soil Application On Vegetative Growth, Flowering, Fruiting And Leaf Chemical Composition Of Young Olive Tress. Res. J. Agric. Biol. Sci., 6(1): 54-63.

Reda, F.; AbdElwahed, M.S. A. And Gamal El – Din, K.M. (2010) Effect Of Indole Acetic Acide, Gibberellic Acid And Kinetin On Vegetative Growth, Flowering, Essential Oilpattern of Chamomile Plant (*Chamomile Recutitia* L. Rausch) . World. J. Agric. Sci., 6(5): 595 – 600.

Taiz, L. and Zeiger, E. (2002). Plant Physiology. 3rdedn. SinauerAssociates: 690pp.

Taize, L. and Zeiger, E. (2010). Plant Physiology. Sinaure Assciates. Inc Publishers Sunelerland.

Vanisree, M.; Lec, C.; Shu – Fung, LO.; Nalawad, S., Lin, C. And Tsay, H. (2004). Studies On The Production of Some Important Secondary Metabolites Form Medicinal Plants. By Plant Tissul Culture Botanical Bull. Acad. Sin. 45: 1-22.

Vopyan, V.G. (1984).Agricultural Chemistry English Translation Mir-Publisher 1st.End.

Zargari, A. (1996). Medicinal Plants. 6thed. Vol. II, Tehran University Press, Tehran. 528-531.