Influence of ground and foliar fertilization on vegetative proprieties and volatile oil for *Origanum vulgarL*.

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Abstract

Pot trial was conducted out during the growing season of 2012-2013, cultivar *Origanum vulgare* L., located at two locations, to find out a better fertilizer formula to the growth and aromatic oils content of sweet marjoram plants. Twelve fertilizer formula were supposed as a treatments , which formatted from organic fertilizer Reset (4-4-3) NPK at 10 g.pot $^{-1}$, chemical fertilizer Jordan DAP at 5 g.pot $^{-1}$, organic fertilizer at 5 g.pot^{-1} + chemical fertilizer at 2.5 g.pot^{-1} , foliar spray with humic acid at 3 mg.L^{-1} , foliar spray with organic acid at 50 mg.L^{-1} and control without fertilization. Results study can be summarized as follows: Vegetative properties : All fertilizer formula indicated significant effects on vegetative growth of plants , fertilizer formula from organic fertilizer at 5 g.pot $^{-1}$ + chemical fertilizer at 2.5 g.pot^{-1} + foliar spray with arginic acid at 50 mg.l^{-1} gave a high plant length , branch numbers per plant , fresh and dry weight of vegetative parts were(47 cm in Anbar location-1st cut) , (31 branches in Anbar location-2st cut) 41gm^{-1}-26gm^{-1}. Furthermore, results indicated that foliar spray with humic acid gave a high percentage of fertilizer formula from chemical fertilizer at 4 g.pot^{-1} + foliar spray with argininc at 50 mg .pot^{-1} gave a high percentage of Thymolof36.43% in second cutting at Al-Anbar location the fertilizer formula from organic fertilizer 5g.pot^{-1} + chemical fertilizer at 2.5 g.pot^{-1} gave a high percentage from Carvacrol compound in Anbar location-2st cut was 58.40%, and the fertilizer formula from organic fertilizer5 g.pot^{-1} + chemical fertilizer2.5 g. pot^{-} + foliar spray with arginin50 mg.pot^{-1} at to gave a high percentage of 8,1Cineole compound , Caryophllene and Terpenineof 27.32% (Anbar location-2st) and 16.30% (Anbar location-2st cut).

Keyword: *Origanum vulgarL* , Organic fertilizer, Chemical fertilizer . Humic Acid

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Introduction

Marjoram plant is one of the labiate family which includes a large number of widespread medicinal plants around the world (31).

Marjoram is an important plant because it is a source of aromatic oils with high nutritional and medical values(9). Also the leaves and the peaks of the flower contain an aromatic oil with a rate of 3.5-0.4%, Also that plant contains a high proportion of compounds effective aromatic with medical impact. The most important compounds are: Carvacrol, thymol, P-Cymene, Terpinene, p-cymenene, P-Cymene-8-ol, Geraniol, linalool, Myrcene, Caryophylene, Thujene and Sabinene. (13 and 8).

Marjoram oil is used medically as a disinfectant for microbes because it contains thymol. It is also used to increase the production of milk and regulate the secretion of menstruation OF women and stimulate the work of the bile (29 and 21). It is used as a treatment for kidney disease, protecting the liver from damage and fibrosis and regulates the work of body hormones (30) and has a role in the treatment of cancer (22 and 23).There are several factors that affect the growth and production of Marjoram plant including: agricultural and environmental conditions, service processes and the type of fertilizer added (25). Organic fertilization increases the productivity of the plant from the green yield and the amount of the aromatic oil (27). It contains a spectrum of macro and micro nutrients which have an effect and its effect in improving the physical and chemical of soil properties such as soil porosity and water balance. And thus it increases soil ability in retaining water and reducing soil pH which plays a vital role in the availability of most nutrients and preventing them from deposition (5). Chemical fertilization plays an important role in improving the traits of vegetative growth, increasing the content of medical secondary metabolism compounds by increasing the ability of these nutrients to participate in the construction of primary and secondary metabolic compounds which have important impact in the formation of medical and aromatic compounds(3 and 7). Indeed fertilization of various types of chemical and organic plays an important role in improving plant growth and increase its productivity. However, the modern trend in agriculture seeks to provide organic compounds that are not fertilizer but are complementary to fertilizers and harmless to human health and increase the resistance of plants to harsh environmental conditions, especially if it's sprayed on the total vegetation (28). Furthermore, amino acids and organic fertilizers possess an important role in plant growth, which is reflected positively on increasing vegetative growth and productivity of the plant from the aromatic oil and to improve its quality (14).

There are a few information in this area in Iraq, thus the study was conducted to determine the effect of organic and chemical fertilization and spraying of amino acids and organic in the production of biological material, and in the quality and quantity of aromatic oil.

Materials and Methods

Pot experiment of Marjoram plant was carried out in the growing season at 2013 with two locations: First location was Horticulture Department - College of Agriculture of Anbar University and. The second location was Private Nursery in Baghdad to study the effect of combinations of chemical and organic fertilizers and spraying of organic and amino acids (as shown in Table 2) upon vegetable qualities and aromatic oils of Marjoram. Random samples were taken from the soil and used for agriculture before starting the implementation of the experiment to conduct physical and chemical analysis, which was conducted in the soil Department of Agriculture College of the University of Baghdad. Table (2) shows this results of the analyzes.

Experiment Implementation and Transactions

An experiment was carried out using Randomized Complete Block Design(R.C.B.D) with three replicates. The transactions were randomly distributed in the sectors of the 12 treatments, 8 pots for each treatment, one plant for each pot, 96 pots for one replicate and 288 bowls for each location.

The seedlings of the marjoram plant were obtained from one of the local nurseries in Baghdad. They were at a height of 5-8 cm and they were homogeneous in their growth then they were transferred to plastic pots with 25 cm diameter, 25 cm high, and capacity of 8 kg soil. The seedlings were planted in 8/4/2012

The process of soil fertilization has done by adding organic fertilizer type Resey produced by the Italian company CRAI which contains organic nitrogen 4% phosphorus and 4% potassium 3% organic carbon 41% and which has a moisture of 12% and number of the interaction pH = 7.2 and the chemical fertilizer DAP type (Di ammonium phosphate) Jordanian-made that contains on (0-46-18) NPK.

Fertilizer has been applied in two batches at the same amount that has mentioned above. The first batch was mixed with the soil of each pot before planting either the second batch, after two weeks from the first harvest (17), has mixed by putting the fertilizer in a small trench near the edges of the pot.

Either the paper fertilization was done with the use of hyacic acid which contains 18% of the humic acid and 3% of the folvic acid and (3-0-6) of NPK. In addition, arginine acid, which is a white powder, was sprayed. As the spraying process was carried out by using a back-pipe with 10-liter in the early morning and until full wetness with the addition of the diffuse material(bubbled soapy liquid) with concentration of ($0.1ml.L^{-1}$)to reduce the surface tension of water molecules and increase the opportunity to benefit from it (6). The first process of spraying was done after a month of planting, while the second one was done after two weeks of the first harvest. The first harvest was carried out at Anbar location after 64 days of planting seedlings and the second harvest after 81 days of the first harvest.

Statistical Analysis

The SAS program(Windows 2007) was the mean used to perform statistical analyzes and the means were comparison of the study groups were performed using d the least hypothetical difference test at the 5% probability level (16).

The experimental measurements were conducted at the stage of 80% of flowering level represented by the following:

1. Vegetative traits of the plant

A. Plant height (cm)

The height of each experimental unit was measured from the level of the soil surface to the highest peak in the plant at 80% of the flowering levels.

B. Number of branches (a branch. Plant^{-1})

The number of main branches of each plant was calculated at 80% of flowering levels.

C. Fresh weight of the vegetative Sum (g. Plant $^{-1}$)

Fresh weight of the vegetative sum was estimated after cutting 4 plants from the experimental unit at a level 80% of the flowering levels and at a height of 5-10 cm above the surface level of the soil (17).

D. Dry weight of the vegetative Sum (G. Plant^{-1})

Dry weight of the vegetative sum was estimated by placing the samples in a well oxygenated room which were regularly turned.

2. Estimating percentage of the oil

The percentage of the aromatic oils of marjoram plant was estimated by using Chromatography device which is a liquid with high performance HPLC.(10and 11). The HPLC type (Koyota) (Shimadzuo C-6A), which is associated with an (uv-vi detector) type (shimadzu SPD 6AV) has been used.

$$\text{Percentage of oil} = \frac{\text{The weight of the oil-containing cyclate flask - the weight of the empty flask}}{\text{The weight of the dried model from which the oil was extracted from}} \times 100$$

Table 1 Series, Symbols and complete names of treatments

	Treatments	Concentrations
.1	A_0b_0	Without application
.2	A_0b_1	Organic fertilizer + Arginine 3ml.L^{-1}
.3	A_0b_2	Organic fertilizer+Arginine50mg.L $^{-1}$
.4	A_1b_0	Organic fertilizer 10 g pot^{-1}+water spry
.5	A_1b_1	Organic fertilizer 10 g pot^{-1} +Humic acid 3ml^{-1}
.6	A_1b_2	Organic fertilizer 10 g pot^{-1}+Arginine50mg.L^{-1}
.7	A_2b_0	Chemical fertilizer 5gm pot^{-1} + water spry
.8	A_2b_1	Chemical fertilizer 5gm pot^{-1}+Humic acid 3m.L^{-1}
.9	A_2b_2	Chemical fertilizer 5gm pot^{-1}+ Arginine50mg.L^{-1}
.10	A_3b_0	Organic fertilizer + Chemical fertilizer 5 gm pot^{-1}2.5^{-1}gm pot^{-1}+ water spry
.11	A_3b_1	Organic fertilizer 5 gm pot^{-1}+Chemical fertilizer 2.5^{-1}gm pot^{-1}+Humic acid 3ml.L^{-1}
.12	A_3b_2	Organic fertilizer 5 gm pot^{-1}+Chemical fertilizer 2.5 gm pot^{-1}+Arginine 50mg.L^{-1}

Table (2) physical and chemical properties of the soil

Type of analysis	units	Analysis result
		Al- anbar
Soil texture	-	Sandy loam
Sand	%	78.2
Silt	%	17.2
Clay	%	4.6
pH	-	7.38
Ec	ds .m^{1}	1.3
N	---	0.13
P	Ppm	1.23
K	Meq.L^{-1}	0.228
Ca	Meq.L^{-1}	3.2
Mg	Meq.L^{-1}	4
Na	Meq.L^{-1}	4.326
Organic matter	%	1.14

Results and discussion

Vegetative traits of Marjoram

Results of the first harvest location shown in Table(3). Soil fertilization were a significant effect on the vegetative characteristics of the plant. Treatment A3 significantly exceeded the rest of the plants in all plant height, number of branches, fresh weight and dry weight of (45.11cm and 19.11 branches. Plant^{-1} and 27.86 g. Plant^{-1} and 16.33 g. Plant^{-1}) respectively while the treatment A0 gave a lowest value (32.11 cm and 8.00 branch .1 plants and 14.76 g. Plant^{-1} and 8.55 g. $^{-1}$) respectively.

The foliar spraying significan on the vegetative growth of the plants. treatment of b2 exceeded the other treatment in plant height, number of branches, fresh weight and dry weight (40.50cm and 15.33 branches, plants^{-1} and 22.44 g. Plants^{-1} and 13.33 g. Plants^{-1}) respectively, However the treatment b0 showed the lowest values (36.75 cm and 13.08 branches. Plants $^{-1}$ and 19.17 g. Plants $^{-1}$ and 11.16 g. Plants $^{-1}$). Results of the second harvest of the first location showed that all soil fertilization transactions exceeded the control treatment of A0. Treatment A3 gave the highest values of plant height, number of branches, wet weight and dry weight (38.55 cm and 28 branches.39.40 g, plant^{-1}, 23.66 g plants^{-1}) compared to the control treatment A0, which gave 30.55 cm and 14.00 branches. 19.77g. plants^{-1} and 8.22 g. Plants^{-1} on the sequence.

Significant superiority in most vegetative growth indicators (Table 4) may be attributed to the role of the transaction mixture of organic and chemical fertilizers (A3) because the nutritional substances that organic fertilizers contained such as carbon and nitrogen, which may be attributed to the ability in increasing and activating the vital activities of the plants by stimulating enzymatic systems and increasing the formation of nucleic acids

(RNA and DNA) (12). More over. organic nitrogen is converted to metal, which perpetuates the processing of preparing the plant with the ready-made element for absorption, which caused increasing of plant height (15). Positive role of nitrogen can be explained through its contribution in manufacturing chlorophyll pigment for its involvement in the installation of units (Prophyrins) that are involved in the construction of the chlorophyll molecule (18). As well as its role in stimulating the division of plant cells and increasing the meristematic activity by participating in the installation of some plant hormones, including IAA, which leads to increase the efficiency of photosynthesis and carbonation and then the manufactured nutritional substances increase and accumulate in the plant(20)which reflected at all on the plant finally increasing the vegetative growth of the plant and even its size.

Results of the use of chemical fertilizers to improve the qualities of vegetative growth coincide with the results of (4 and 26). The fertilization of marjoram with nitrogen fertilizer has hypothetically increased the productivity of the plant and the green crop. Also, the results of adding the organic fertilizer IN combined with a quantity of nitrogen fertilizer and phosphate to Marjoram plant an increasing in the height of the plant, the number of forests, the dry weight of the root coincide with (24).

Effect of soil and foliar fertilization on the percentage of volatile oil compounds in marjoram.

According to the results of the HPLC schemes, with 6 compounds (Appendix 4) were diagnosed based on the availability of standard compounds and the conditions of analysis. The percentages of these compounds have varied, ranging from high to medium, and there were compounds with low parameters.

From the results of the first harvest of the first location which shown in (Table 4), treatment A3 significantly exceeds over the rest by giving the highest percentage of p-cymene (17.13%), either the lowest percentage was 6.34% for A_0 one. The A_1 transaction exceeded in giving the highest proportion of Thymol compound which was (23.53%) compared to the of A_3 (15.60%) which recorded the lowest percentage. While A_3significantly exceeded the rest of the others by recording the highest percentage of carvacrol compound reached to (39.96%) while the A_1 recorded the lowest rate of (17.51%). The addition of organic fertilizer in transaction A_1 affects in achieving an increase in the percentages for each cineole compound 1.8, Caryophyllene compound, Terpenine compound 4-01 (14.85%, 16.56% and 10.63%) on the relay, while control(A_0) gave the lowest percentage of 12.35% And 13.99% and 8.67% respectively. control(b_0) exceeded in recording the highest percentage of p-cymene compound and Thymol (18.92% and 23.27%) on the sequence, while this proportion dropped to the lowest level in transaction b_2 (8.29% and 15.23%) respectively. The spraying with humic acid b_1 exceeded by giving the highest percentage of Carvacrol and cineole 1,8 that reached (34.17%) and (15.37%). The spray of arginine b_2 exceeded by giving the highest percentage of Caryophylene and Terpenine4-01 (20.03% and 13.44%) respectively, while the control gave the

lowest percentage reached to (10.97%) and (6.41%) on the relay.

In the bilateral interaction between soil and foliar fertilization, A_0b_1 exceeded on the rest by giving the highest percentage of P-cymene compound in the aromatic oil reached to (35.42%) followed and in significantly disparity A_1b_0, either the lowest proportion was (5.24%) with A_3b_2. The A_1b_0 exceeded over the rest by increasing the percentage of Thymol compound, which reached to (34.39%), while this proportion fell to the lowest level of A_3b_2 and reached to (9.51%). A_2b_1 exceeded by giving the highest percentage of carvacrol reached to (51.22%) followed by a significant difference A_3b_0, while the A_1b_2 recorded the lowest percentage reached to (9.60%).

A_1b_1 exceeded in giving the highest percentage of the 1-8Cineole compound at (18.17%) followed, in a hypothetical disparity in transaction A_3b_2 while control recorded the lowest percentage reached to (7.72%).

A_3b_2 gave the highest percentage of the Caryophyllene compound at (27.32%) followed by a significant disparity A_1b_2 either the lowest percentage was (0.00%) at A_1b_0.

A3b2 exceeded by giving the highest percentage of Terpenine4-01 (16.30%), while A_1b_0 and A_2b_1 were the lowest when reached to (0.00%).

The reason of these results may be attributed to the role of organic fertilization in increasing the readiness of large and small components and their effect on overall growth and improving enzymatic performance and Photosynthesis processes in particular, which is reflected in increasing vegetative growth and improving root growth, results of photosynthesis and secondary compounds (19).

Or the reason may be attributed to the role of the elements that have increased their accumulation in the leaves and their importance in improving the processes of the biological synthesis as the increased concentration of nitrogen in the leaves lead to increase the amino acids that participate in the biological construction of the effective chemical compounds (17). These results coincide with Ahsan(1)in Marjoram plant and Alansari(2), Reza(26) and Said *et. al*.(27) in Spinach plant.

Table (3) Effect of land and foliar fertilizer on vegetative characteristics of *Origanum vulgar*
ALanbar location – cut 2nd ALanbar location –cut 1st cut 2nd

Treatment	Plant height(cm)	number of branches (branch Plant^{-1})	Wet weight (g.plant^{-1})	Dry weight (g.plant^{-1})	Plant height(cm)	number of branches (branch Plant^{-1})	Wet weight (g.plant^{-1})	Dry weight (g.plant^{-1})
A_0	32.11	8.00	14.76	8.55	30.55	14.00	19.77	8.22
A_1	37.66	14.11	18.41	10.77	33.22	20.00	28.53	13.73
A_2	39.55	16.00	21.92	13.44	37.55	24.00	37.23	18.35
A_3	45.11	19.11	27.86	16.33	38.55	28.00	39.40	23.66
L.S.D 0.05	0.74	0.73	0.08	0.90	0.90	0.33	0.74	0.80
b_0	36.75	13.08	19.17	11.16	33.41	20.08	28.19	14.13
b_1	38.53	14.50	20.60	12.33	35.25	21.66	31.23	16.01
b_2	40.50	15.33	22.44	13.33	36.25	23.4	34.28	17.83
L.S.D 0.05	0.64	0.63	0.69	0.78	0.78	0.29	0.64	0.69
A_0b_0	30.00	7.00	12.63	7.00	28.00	12.33	15.00	6.00
A_0b_1	32.00	8.00	15.27	8.66	33.00	15.33	21.65	8.00
A_0b_2	34.33	9.00	16.38	10.00	30.66	15.66	22.66	10.66
A_1b_0	36.00	12.00	17.88	10.33	30.66	19.00	23.87	12.15
A_1b_1	38.00	15.00	18.14	11.00	32.00	20.00	26.46	14.06
A_1b_2	39.00	15.33	19.22	11.00	37.00	22.00	35.27	15.00
A_2b_0	37.00	15.00	20.57	12.33	36.33	23.00	36.21	16.72
A_2b_1	40.00	16.00	22.00	13.66	38.00	24.33	37.48	18.66
A_2b_2	41.00	17.00	23.19	14.33	38.33	25.00	37.66	19.66
A_3b_0	44.00	18.33	26.60	15.00	38.66	26.00	38.00	21.66
A_3b_1	44.33	19.00	27.00	16.00	38.00	27.00	39.33	23.66
A_3b_2	47.00	20.00	31.00	18.00	39.00	31.00	41.21	26.00
L.S.D 0.05	1.29	1.27	1.39	1.57	1.57	0.58	1.28	1.39

Table **(**4)Effect of land and foliar fertilizers on the percentage of volatile oil compounds
For the plant of *Origanum*Anbarlocation–cut1st

Treatments	P-cymene %	Thymol %	Carvacrol %	1.8 Cineole%	Caryophyllene %	Terpenine 4-01
A_0	6.34	18.76	29.04	12.35	13.99	8.67
A_1	16.88	23.53	17.51	14.85	16.56	10.63
A_2	10.28	15.70	33.93	14.54	15.56	10.36
A_3	17.13	15.60	39.96	13.88	14.10	8.85
L.S.D 0.05	0.02	0.04	0.15	0.16	1.48	0.02
b_0	18.92	23.27	28.92	11.43	10.97	6.41
b_1	10.77	16.69	34.17	15.37	14.17	8.80
b_2	8.29	15.23	27.24	14.92	20.03	13.44
L.S.D 0.05	0.02	0.03	0.13	0.14	1.28	0.01
A_0b_0	6.83	25.36	17.41	7.72	14.04	0.00
A_0b_1	35.42	12.47	34.08	14.70	14.85	11.41
A_0b_2	3.55	18.44	35.63	14.62	13.09	14.61
A_1b_0	19.81	34.39	32.43	13.35	0.00	0.00
A_1b_1	14.57	18.88	10.51	18.17	22.38	15.74
A_1b_2	16.24	17.32	9.60	13.04	23.65	11.41
A_2b_0	13.60	16.07	20.66	14.44	19.77	15.12
A_2b_1	9.12	15.08	51.22	13.48	10.87	0.00
A_2b_2	8.13	15.65	29.93	15.72	16.05	11.45
A_3b_0	12.43	17.26	45.19	10.21	10.07	10.53
A_3b_1	6.97	20.34	40.87	15.12	8.58	8.07
A_3b_2	5.24	9.51	33.81	16.30	27.32	16.30
L.S.D 0.05	0.04	0.07	0.26	0.28	56.2	0.03

References

1. Ahsan, S.A.2013.Study of effect of planting methods and fertilizer type on of yield of Majoranama *joram hortensisand*, Thymus *thymas vulgaris*. Alqadisiyah. Agric. Sci., 2(2):51-61.
2. Alansari, H. R. 2014 . Effect of spray of some minerals and organic material on growth and yield of *Spinacea oleracea* L. and its contents of medicinally active compounds. Ph.D Dissertation. College of Agriculture. University of Baghdad. Iraq.
3. Aldhalmy , S. A. M. 2008. Effect of some nitrogenous fertilizer and cutting dates on growth yield and quality of essential oil of *pelargonium odoratissimum* L. M.Sc Thesis. College of Agriculture. University of Kufa. Iraq.
4. Ali, A.; Y. Feng, and Bernd, H. 2009.Herbage yield, essential oil content and composition of three oregano *Origanum vulgare* L. populations as affected by soil moisture regimes and nitrogen supply. J. Industrial Crops and Products; 29: 554 – 561.
5. ALnuimy, S. N.1987. Fertilizers and soil fertility. Ministry of Higher education and scientific Research University of Mosul. Iraq.
6. AlSahaf, F. H. 1989. Applicable Plant Nutrition. Bait Alhekma. Ministry of Higher education and Scientific Research . Iraq.
7. Alshukry, E. F. 2002. Response of coriander *Coriandrum sativum* L. to date of sowing and nitrogenous fertilizer: effect, growth and production of essential oil. M.Sc Thesis. College of Agriculture, University of Baghdad. Iraq.
8. Azzazi, M. F. 2009. Encyclopedia of medicinal plants. Methods of planting production, marketing and medicinal uses. Ibn Sina Library Press. Egypt.
9. Baratta , M.T.; H. J. D. Dorman,; S.G Deans; A.C. Figueiredo: J.G. Barroso and Ruberto, G. 1998. Antimicrobial and antioxidant properties of some commercial essential oils. Flavor and Fragrance Journal, 13:235-244.
10. Busnway,R.J.1986.Determination of a and B-Cartene in some raw fruits and vegetables by high-performance liquid Chromatography. J. Agri. Food. Chem.,34:409-414.
11. Chen, Y. and T. Avaid.1990. Effect of humic substances on plant growth. pp.161-186. In: American Society of Agronomy and Soil Science Society of America (eds.), Humic substances in soil and crop science; selected Readings. American Society of Agronomy, Madison, WI. USA.
12. Citak, S. and S. Sonmez.2010. Effect of conventional and organic fertilization on spinach (*Spinacea oleracea* L.) growth, yield, vitamin C and nitrate concentration during two successive seasons. Scientia Horticulturae, 126(4):415-420.
13. D'antuono, L. F.; G. C. Galleti, and Bocchini, P.2000. Variability of Essential Oil Content and Composition of *Origanum vulgare*

L. Populations from a North Mediterranean Area (Liguria Region, Northern Italy). Annals of Botany, 86: 471– 478.

14. Dantas, B.F.; M. S. Pereira,; L.D. Ribeiro; J. L. T. Mala and Bassoi, L.H.2007.Effect of humic substances and weather conditions on leaf. Revista Brasileira de Fruticultura, 29(3):----------.
15. Efthimiadou, A.; D. Bilalis; A. Karkanis; B.W. Froud and Eleftherochorinos, I. 2009. Effects of cultural system (Organic and Conventional) on Growth, photosynthesis and Yield components of sweet corn (*Zea mays* L.) under Semi Arid Environment. Notulac Botanicae Horti Agrobotanici Cluj-Napaca,37(2):104-111.
16. Elsahookie, M. N and K. M. Ohaib.1990. Application in design and experiment of Analysis. Dar ALHekma Press. Mosul. Ministry of Higher Education and Scientific Research, Iraq.
17. Haikel, M and A. A. Omer.1988.Medicinal and Aromatic plants. Almaref. Alexandria, Egypt. pp 243-245.
18. Havlin , J. L.; J .D. Beatons; S.L. Tasdale and Nelson W.L. 2005. Soil fertility and fertilizer .7thed . Upper Saddle River. New Jersey. USA.
19. Hendawy, S.F. 2008. Comparative study of organic and mineral fertilizat-ion on (*Planta goarenaria* L.) plant. J. of Sci. Applid Res., 4(5):500-506.
20. Hosseny, M. H. and M. M. M. Ahmed.2009. Effect of nitrogen, organic and biofertilization on productivity of lettuce (Romaine cv.) in sandy soil under Assiut conditions. Ass. Univ. Bull. Environ. Res., 12(1):79-93.
21. Ien, J.R.; L. Ivanauskas; V. Janulis, and Tas, V. J. 2008.Composition and variability of phenolic compounds in *origanum vulgaris* L. from Lithuania. Biologija.,54(1):45-49.
22. Johnson, T.2002. Flora of North America. News Letter 16(2):1-5.
23. Leung, A.; Albert, Y and Steven Foster.2003.Encyclopedia of common natural ingredients used in food, drugs and cosmetics. Hoboken N.J. Wiley- Inter science. (HSA Library).
24. Mahfous, S.A.2003 .Effect of Biofertilization on Growth and Oil production of Marjoram (*Major anahotensis* L.)Ph.D. Thesis. Fac. Agri. Cairo Univ. Egypt.
25. Min, S.Y.; A. R. M. Tawaha and Lee, K. D.2005. Effects of ammonium concentration on the yield, mineral content and active terpene components of *Chrysanthemum coronarium* L. in a hydroponic system .Res .J. Agri. Biol. Sci., 1(2):170- 175.
26. Reza, J.; A. D. Majid; M. M. S. Ali and Kayvan, A. 2011.Nitrogen and iron fertilization methods affecting essential oil and chemical composition of thyme (*Thymus vulgaris* L.) medical plant. J. Adv. in Environ. Biology. 5(2):433 – 438.
27. SaidAl- Ahl, H. A. H.; S. A. Hasnaa, and Hendawy, S. F. 2009.Effect of potassium humate

and nitrogen fertilizer on herb and essential oil of oregano under different irrigation intervals. J. Applied Sci., 2(3):319– 323.

28. Shahata , S.A.; M. M. El-Mogy; K .F. A Gawad and E. A. Shalaby. 2011.Influence of compost, amino and humic acids on the growth, yield and chemical parameters of strawberries. Journal of Medicinal Plants Research,5(11):2304- 2308.
29. Sivoropoulou, A.; E. Papanicolaou; C. Nicolaou; S. Kokin, ; Lanaras, T and Arsenakis, M.1996.Antimicrobial and cytotoxic activities if origanum essential oils. J. Agric. Food Chem., 44:1202-1205.
30. Skoula; M. and K. Sotiris 1997. *Origanum dictamnus* L. and In *Oregano*: proceedings of the IPGRI international workshop on oregano. 8-12 May 1996, CIHEAM. Valenzano (Bari), Italy. Edited by S. Padulosi. Rome: International Plant Genetic Resources Institute. Italy.
31. Skoulo, M and J. B. Harborrne.2002. Taxonomy and Chemistry. In: Kintozoios, S.E.(Ed), organo: The *Genera origanum* and Lippa. Medicinal and Aromatic Plants – Industrial Pro.les Taylor and Francis. CRC Press, USA. pp.67-108.