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EVALUATION OF DIFFERENT FORMS OF ORGANIC FERTILIZERS ON THE PRODUCTIVITY OF VEGETATIVE GROWTH, OIL YIELD AND THE ACTIVE INGREDIENTS OF MARJORAM PLANT (*Origanum majorana*, L.)

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ABSTRACT

The present investigation was carried out at El-Kasasin Research Station belong to Ismailia Governorate, Agriculture Research Center in the Department Medicinal and Aromatic plants, Egypt during the two successive seasons of during 2019 and 2020 on *Origanum majorana*, L. plants.

The objectives of this work aimed to study the responses *of Origanum majorana*, L. to different levels of compost and different adding ways of compost tea and their interaction between them on the productivity of vegetative growth, oil yield and oil chemical components . A spite plot design with three replicates was followed in this study, levels of compost treatments; 0, 15 and 30 m^3/fed. were the main plots, while compost tea; control, spraying, soil drench and spraying + soil drench were accepted the sub plots.

Results showed that, the increase in levels of compost led to a direct increase in all growth characters. adding 30 m^3/fed compost log highest values in all characters of vegetative growth (plant height (cm), number of branches per plant, dry weight of leaves per plant (g) and per feddan (Kg).) and oil yield (essential oil percentage, essential oil per plant (ml), per feddan (L) of marjoram plant. On the other hand, adding compost tea through spray + soil drench together for the best results in all characters of vegetative growth and oil yield together. The best treatment resulting from the interaction between the levels of compost and methods of adding compost tea 30 m^3/fed. compost with spraying + soil drench for compost tea together. Which recorded the best values in all characters under study. In another way, the interaction treatment affected active ingredients of marjoram oil, where the results were clarified that, terpinen-4-ol compound recorded the highest percentage in the active ingredients of marjoram oil, where the increase reached 65.061% compared to control 31.057 % and other treatments, during the application of 30 m^3/fed. compost + spraying with soil drench for compost tea together**.**

Keywords: Sweet marjoram, *Origanum majoran*a (*Majorana hortensis*)- compost tea – compost – organic fertilizer

INTRODUCTION

Marjoram, sweet marjoram, *Majorana hortensis* (*Origanum majorana*) is an aromatic plant belong to family Lamiaceae, found in abundance in the Mediterranean region, and has been widely used since ancient times in herbal and alternative medicine. The leaves of marjoram are steam-distilled to produce an essential oil that is yellowish in color (darkening to brown as it ages). It has many chemical components, some of which are borneol, camphor, and pinene. Marjoram leaves are usually used as a spice to flavor food, and to improve its taste, such as adding it to salads, sauces, and seasoning meats. Rania, (2019).

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Marjoram has anti-inflammatory properties, because it contains antioxidants, such as carvacrol, which prevents cell damage, and protects them from infections and tumors. Drinking boiled marjoram leaves has a great role in treating and relieving symptoms of colds, flu, and influenza, and reducing and relieving sore throat, pharynx, cough, and runny nose. It was found that marjoram enhances the secretion of digestive enzymes in the digestive system, helps digestion, improves appetite, relieves stomach cramps, and contributes to the treatment of colic. Its role in relieving stomach ulcers has also been proven, and a decoction of marjoram is drunk to achieve these benefits. Marjoram helps regulate the menstrual cycle in women, as it stimulates menstrual flow. It contributes to hormonal reorganization in non-pregnant women. It also helps in the treatment of polycystic ovary syndrome.

Marjoram herb has great nutritional value due to its high content of vitamins, minerals and antioxidants. Its leaves are a rich source of vitamin A, vitamin K, carbohydrates, proteins, fats and some important nutrients such as Fe, Ca and Mg..... etc.

The interest in organic agriculture began a long time ago, but interest in it has increased significantly in recent times due to the serious problems afflicting traditional agriculture on the environment in general and on humans and animals in particular, and the global market for agricultural products has given great attention to organic products at the expense of traditional agricultural products Because organic products are characterized by high quality specifications and safe health specifications, unlike traditional agricultural products, and this is what made the countries of the world pay great attention to organic agriculture in Egypt in terms of the development of the organically cultivated area. Elham and Rania (2015) on *Hibiscus sabdariffa,* L. plants and Rania, (2010) on *Nicotiana glauca.*

Organic agriculture started in Egypt by cultivating 20 hectares in the Belbeis desert, and has now reached more than 200 thousand feddan. In Egypt, Ministerial Decree No. 1411 was issued in December 2008 to adopt the standards of the Egyptian Organic agriculture organization as a law until a law on organic agriculture is issued. In 2020, Organic Agriculture Law No. 12 was issued, whereby the law aims to expand organic production, to keep pace with the European Union's decision to stop importing Organic agriculture products from any country that does not have a law for organic agriculture. Rania and Abd El-Azim, (2016) on *Plantago psyllium* L.

Organic agriculture helps in opening new export markets and creating an opportunity for competitors to the global market in some field and horticultural crops, and not only that, but also goes beyond the importance of organic agriculture in increasing export returns that exceed the export returns of traditional crops. Rania, (2010) on *Nicotiana glauca* and Rania, *et. al.* (2020) on *Carum carvi,* L. plant.

Compost is a mixture of compost and fermentation of plant and animal waste for a period of three months, so it improves the construction and fertilization of sandy lands and improves the natural characteristics of the land and leads to increased water retention and rationalization of the use of chemical fertilizers because it contains major nutrients (nitrogen, phosphorous, potassium), micro-nutrients, and free from nematodes, weed seeds, root rot fungi and pathogenic bacteria.

Compost tea is the liquid resulting from soaking compost after leaving it for about 14 days. This liquid contains soluble nutrients and microorganisms. It contains phytohormones and PGPR growth regulators. All of this affects directly and indirectly on plants through the root periphery area. A role in modifying soil pH and composition. The benefits of compost tea are many, the most important of which is supplying the plant with macro and micro nutrients. It also protects the roots and other plant tissues from pathogens. It improves the composition of the soil. It helps the roots

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to grow easily to provide nutrients to the plant. Ibrahim, *et. al.* (2019) *Nigella sativa*, L. plants and Azza and Hendawy, (2010) on *Borago Officinalis* plant.

The main objective of the research is to produce a safe plant with high nutritional value and maintain soil fertility by using natural sources of fertilizers by studying the effect of different levels of compost and methods of adding compost tea and their interaction between them on the productivity of vegetative growth, oil yield and oil chemical components of marjoram plant.

MATERIAL AND METHOD

The present investigation was carried out at El-Kasasin Research Station belong to Ismailia Governorate , Agriculture Research Center in the Department Medicinal and Aromatic plants, Egypt during the two successive seasons of during 2019 and 2020 on *Origanum majorana*, L. plants. The objectives of this work aimed to study the responses *of Origanum majorana*, L. to different levels of compost and different adding ways of compost tea and their interaction between them on the productivity of vegetative growth, oil yield and oil chemical components

A spite plot design with three replicates was followed in this study, levels of compost; (C0) without compost, (C1) 15 m^3/fed and (C2) 30 m^3/fed. were the main plots, while methods of adding compost tea; (CT0) without compost tea, (CT1) spraying, (CT2) soil drench and (CT3) spraying + soil drench together were accepted the sub plots. On 10th and 15th March seedling of marjoram were sown in experimental soil in the both seasons; respectively, the distances between rows was 70 cm and 30 cm between hills was done leaving one seedling/hill. The experimental soil was sandy in texture " sand 87.13 % , silt 7.24 % and clay 5.56 %" and chemical properties were: soluble ions (meq/l) are represented in cations Ca^{+2} 5.7, Mg^{+2} 2.6, Na^{+1} 7.0 and K^{+1} 0.8 and anions Cl^{-1} 7.6, HCO_3 2.8 and $(SO_4)^{-2}$ 5.6, available N 7.3 mg/kg, P 2.8 mg/kg and K 13.4 mg/kg, pH 7.08 and EC (dSm^{-1}) 1.6 Mmhos/cm. according to Rania, *et. al.* (2020). The chemical analysis of compost tea was pH 7.20, EC (dSm^{-1}) 3.41 Mmhos/cm, organic carbon 0.33%, nitrogen percentage 0.04 %, phosphorous percentage 0.02%, NH_4-N 35.50 mg kg^{-1} and NO_3-N 5.30 mg kg^{-1}. In addition to the microbiological analysis of compost tea was total count of bacteria, fungi and actionmycetes 0.01x 10^7, 0.01x 10^5, 0.01x 10^6 (c.f.u./mL), respectively; according to Ibrahim, *et. al.* (2019).

Adding different levels of compost during soil preparation for planting, while compost tea was added 3 times during the first season after a month of planting, the second after two months of planting, and the third one a month after the first cuts during two seasons. At the end of the experiment, 25th May and 15th August in the first season and 1st June and 25th August in the second season, respectively.) The following data were recorded: plant height (cm), number of branches per plant, dry weight of leaves per plant (g), dry weight of leaves per feddan (Kg) was calculated as follows: dry leaves per plant × 20000 for all treatments, essential oil percentage, essential oil per plant (ml) was calculated as follows oil percentage × dry weight leaves (g/plant)/ 100, essential oil per feddan (L) was calculated as follows essential oil yield per plant × number of plants/feddan (20000 plants/feddan) and volatile oil composition by using G.L.C. The obtained data were statistically analyzed according to Snedecor and Cochran (1973), by using computer program of STATISTIX VERSION^9 Analytical software, (2008).

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RESULTS

1. Plant height (cm)

Table (1) showed that, the superiority of compost with the highest plant height values significantly compared to the other treatments. The table also shows that the increase in the level of compost led to a direct increase in plant height with a significant increase compared to the control treatment (without compost additions), where the level of compost was given 30 m^3/fed. the highest values of plant height reached 31.98 cm and 32.40 cm, with a significant increase of 32.2% and 23.7% compared to the control treatment of 8.79 cm and 8.68 cm in the first cuts during the first and second seasons, respectively. While, the same increase occurred in the second cuts, where the plant height was given 36.48 cm and 36.71 cm, with a significant increase of 20% and 19.8% during the first and second seasons, respectively.

Also, Table (1) illustrations a significant increase in plant height by applying the addition of compost tea using spray and soil drench together compared to spraying compost tea only or soil drench for compost tea alone. The increase in plant height in the first season was 33.87 cm and 37.78 cm, with a significant increase of 20.1% and 16.2% compared to the untreated plants of 13.78 cm and 21.54 cm in the first and second cuts, respectively, while the increase in plant height in the second season reached 34.31 cm and 37.96 cm with a significant increase of 20.7% and 16.1% compared to untreated plants 13.58 cm and 21.87 cm during the first and second cuts, respectively.

Table (1) data appears that, there is a significant interaction in plant height between the level of compost and methods of adding compost tea. The highest level of compost is 30 m^3/fed. was recorded the highest increase in plant height, this increase was a significant increase compared to the other interactions treatments. Also, the treatment was superior to the application of sprayed compost tea with soil drench compared to the other interactions treatments.

The highest increase in plant height for the first season was 47.40 cm and 49.40 cm, with a significant increase of 42.7% and 40.4% during the first and second cuts, respectively, compared to the control plants. Whereas, the data show that the increase in plant height during the second season reached 48.10 cm and 49.36 cm, with a significant increase of 44.4% and 40% during the first and second cuts, respectively, compared to the control plants. This significant increase in plant height resulted from the treatment of 30 m^3/ fed. compost + spraying with soil drench for compost tea together.

Related consequences were recorded by Rania, *et. al.* (2020) on *Carum carvi* L. plant and Hassan, *et. al.* (2020) on *Nigella sativa*, L. plants.

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Table (1): Effect of compost and compost tea and their interaction on plant height and number of branches per plant of *Origanum majorana*, L plant during the two seasons of 2019 and 2020.

Plant height (cm)										
	Season 1									
	Cut 1					Cut 2				
	CT0	CT1	CT2	CT3	Means	CT0	CT1	CT2	CT3	Means
C0	4.67^{I}	6.37^{I}	9.40^{H}	14.73^{G}	8.79^{C}	9.00^{J}	16.07^{I}	18.33^{H}	22.43^{G}	16.46^{C}
C1	16.23^{G}	25.13^{E}	30.40^{D}	39.47^{B}	27.81^{B}	26.90^{F}	29.73^{E}	33.27^{D}	41.50^{B}	32.85^{B}
C2	20.43^{F}	27.03^{E}	33.03^{C}	47.40^{A}	31.98^{A}	28.73^{EF}	31.70^{D}	36.07^{C}	49.40^{A}	36.48^{A}
Means	13.78^{D}	19.51^{C}	24.28^{B}	33.87^{A}		21.54^{D}	25.83^{C}	29.22^{B}	37.78^{A}	
	Season 2									
C0	3.67^{K}	6.47^{J}	9.60^{I}	14.97^{H}	8.68^{C}	9.67^{J}	16.60^{I}	18.63^{H}	22.57^{G}	16.87^{C}
C1	16.40^{H}	25.33^{F}	31.17^{D}	39.87^{B}	28.19^{B}	27.00^{F}	30.17^{E}	33.57^{D}	41.67^{B}	33.10^{B}
C2	20.67^{G}	27.33^{E}	33.50^{C}	48.10^{A}	32.40^{A}	28.93^{E}	32.07^{D}	36.20^{C}	49.63^{A}	36.71^{A}
Means	13.58^{D}	19.71^{C}	24.76^{B}	34.31^{A}		21.87^{D}	26.28^{C}	29.47^{B}	37.96^{A}	
	Number of branches per plant									
	Season 1									
C0	2.33^{L}	4.00^{K}	6.00^{J}	7.67^{I}	5.00^{C}	3.67^{L}	5.33^{K}	7.00^{J}	8.67^{I}	6.17^{C}
C1	9.00^{H}	11.67^{F}	15.33^{D}	20.33^{B}	14.08^{B}	10.00^{H}	12.67^{F}	16.33^{D}	21.33^{B}	15.08^{B}
C2	10.67^{G}	13.67^{E}	17.33^{C}	23.00^{A}	16.17^{A}	11.67^{G}	14.67^{E}	18.33^{C}	23.67^{A}	17.08^{A}
Means	7.33^{D}	9.78^{C}	12.89^{B}	17.00^{A}		8.44^{D}	10.89^{C}	13.89^{B}	17.89^{A}	
	Season 2									
C0	2.67^{K}	4.67^{J}	6.67^{I}	8.00^{H}	5.50^{C}	5.00^{L}	6.00^{K}	8.00^{J}	10.00^{I}	7.25^{C}
C1	9.67^{G}	13.00^{F}	17.33^{D}	22.00^{B}	15.50^{B}	11.33^{H}	14.00^{F}	17.00^{D}	22.33^{B}	16.17^{B}
C2	12.00^{F}	15.00^{E}	19.33^{C}	23.67^{A}	17.50^{A}	12.67^{G}	15.00^{E}	19.33^{C}	24.67^{A}	17.92^{A}
Means	8.11^{D}	10.89^{C}	14.44^{B}	17.89^{A}		9.67^{D}	11.67^{C}	14.78^{B}	19.00^{A}	
Averages that share the same alphabet do not differ from each other significantly according to Duncan's test at the 5% level.										

2. Number of branches per plant

Results in Table (1) showed that, a significant increase in number of branches per plant as a result of the effect of compost levels. The highest values in number of branches per plant when treating the plant with the highest compost level was 30 m^3/fed.

In the first season, the highest increase in number of branches per plant was 16.17 and 17.08, with a significant increase of 11.2% and 10.9% compared to the control plants that gave the lowest values for number of branches per plant 5.00 and 6.17 in the first and second cuts, respectively. On the other hand, data revealed that, the increase in number of branches per plant during the second season reached 17.50 and 17.92, with a significant increase of 12.0% and 10.7% compared to the control plants, which gave a low rate of increase of 5.50 and 7.25 during the first and second cuts, respectively.

As for the effect of adding compost tea methods, Table (1) results indicate that, a significant increase in number of branches per plant when using all methods of addition, and the best method was when spraying and soil drench for compost tea together.

The treatment of spraying and soil drench for compost tea together was considered the best treatments that gave the maximum values for number of branches per plant, followed by spraying compost tea only and then soil drench for compost tea alone.

Data indicate that, the first cuts increased in number of branches per plant 17.00 and 17.89, with a significant increase of 9.7% and 9.8% during the two seasons, respectively. Though the

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increase in the second cuts was 17.89 and 19.00 with a significant increase of 9.5% and 9.3% during the two seasons, respectively.

Statistical analysis of the data directed that, Table (1) the effect of interaction between levels of compost and methods of adding compost tea, where the results tended to a significant increase in number of branches per plant when treating marjoram plants with 30 m^3/fed. compost and spraying with compost tea and soil drench together.

Consequences showed that, the treatment of marjoram plants was 30 m^3/fed. compost with spraying with compost tea and soil drench together is the best treatment, where the maximum increase was recorded in number of branches per plant. In the first season, the highest values were 23.00 and 23.67 with a significant increase of 20.70 % and 20.00 %. However, in the second season gave 23.67 and 24.67 with a significant increase It reached 21.0 % and 19.7% during the both cuts, respectively, compared with the control plants that gave the lowest values in the first season 2.33 and 3.67 and in the second season 2.67 and 5.00 during the first and second cuts, respectively.

These outcomes are accord of those obtained by Rania, (2019) on *Origanum majorana* and Ibrahim, *et. al.* (2019) *Nigella sativa*, L. plants

3. Dry weight of leaves per plant (g)

Data in Table (2) indicate that, the effect of compost levels on the dry weight of leaves per plant (g) of marjoram plant. There is a direct increase in continuously increasing levels of compost and this resultant increase in dry weight of leaves per plant (g) is a significant increase compared to untreated plants. The best treatment was the highest level of 30 m^3/fed compost. Where the best values of dry weight of leaves per plant (g) during the 2019 and 2020 seasons.

In the first season, the best values for increasing dry weight of leaves per plant (g) were using 30 m^3/fed. compost 57.63 gm and 59.58 gm during the first and second cuts, respectively. While the increase was recorded in the second season 58.82 gm and 60.50 gm during both cuts, respectively, compared to the control plants.

On the other hand, data in Table (2) indicated that, there was a significant effect on the dry weight of leaves per plant (g) as a result of the different methods of adding compost tea, where the treatment excelled with spray + soil drench for compost tea together and gave the highest values of dry weight of leaves per plant (g).

In the first season, the maximum values for increasing dry weight of leaves per plant (g) when treating plants with spray + soil drench of compost tea together were 59.71 g and 64.70 g during the first and second cuts, respectively. But in the second season the increase was recorded 60.91 gm and 65.71 gm during the first and second cuts, respectively, compared to the control plants that gave the lowest value of dry weight of leaves per plant (g) in the first season 40.44 gm and 45.43 gm during the first and second cuts, respectively and recorded 42.60 gm and 46.52 gm in the second season in the two cuts, respectively.

Regarding the interaction between the levels of compost and the methods of adding compost tea, the results in Table (2) led to a significant increase in the result of the interaction between treatments, and the best treatment was 30 m^3/fed. compost with spraying + soil drench for compost tea together. Where this treatment recorded the best results and maximum values of dry weight of leaves per plant (g). In the first season, were recorded 72.50 g and 76.53 g, with a significant increase of 44.7 % and 35.7 % during the first and second cuts, respectively, While in the second season, were recorded 73.40 g and 78.30 g, with a significant increase of 40.5% and 35.5% during the first and second cuts, respectively, compared to the untreated plants that gave minimum values of dry weight of leaves per plant (g).

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These results are in agreement with those obtained by Rania and Abd El-Azim, (2016) on *Plantago psyllium* L. and Azza and Hendawy (2010) on *Borago Officinalis* Plant

Table (2): Effect of compost and compost tea and their interaction on dry weight of leaves per plant (g) and feddan (kg) of *Origanum majorana*, L plant during the two seasons of 2019 and 2020.

Dry weight of leaves per plant (g)										
	Season 1									
	Cut 1					Cut 2				
	CT0	CT1	CT2	CT3	Means	CT0	CT1	CT2	CT3	Means
C0	27.77^{J}	35.17^{I}	39.40^{H}	43.83^{G}	36.54^{C}	40.80^{J}	42.93^{I}	45.03^{H}	45.97^{H}	43.68^{C}
C1	45.53^{FG}	50.27^{DE}	55.60^{C}	62.80^{B}	53.55^{B}	46.80^{GH}	51.47^{E}	56.23^{D}	71.60^{B}	56.53^{B}
C2	48.03^{EF}	51.90^{D}	58.10^{C}	72.50^{A}	57.63^{A}	48.70^{FG}	50.10^{EF}	63.00^{C}	76.53^{A}	59.58^{A}
Means	40.44^{D}	45.78^{C}	51.03^{B}	59.71^{A}		45.43^{D}	48.17^{C}	54.76^{B}	64.70^{A}	
	Season 2									
C0	32.87^{I}	38.13^{H}	42.73^{G}	45.10^{FG}	39.71^{C}	42.80^{J}	43.67^{J}	45.23^{I}	46.60^{H}	44.58^{C}
C1	45.77^{F}	51.30^{DE}	56.90^{C}	64.23^{B}	54.55^{B}	47.67^{G}	49.53^{F}	56.63^{D}	72.23^{B}	56.52^{B}
C2	49.17^{E}	53.40^{D}	59.30^{C}	73.40^{A}	58.82^{A}	49.10^{F}	50.63^{E}	63.97^{C}	78.30^{A}	60.50^{A}
Means	42.60^{D}	47.61^{C}	52.98^{B}	60.91^{A}		46.52^{D}	47.94^{C}	55.28^{B}	65.71^{A}	
	Dry weight of leaves per feddan (Kg)									
	Season 1									
C0	555.90^{J}	703.30^{I}	788.10^{H}	876.70^{G}	731.00^{C}	816.20^{J}	858.60^{I}	900.20^{H}	918.80^{H}	873.40^{C}
C1	910.30^{FG}	1005.60^{DE}	1112.30^{C}	1255.40^{B}	1070.90^{B}	935.90^{GH}	1029.50^{E}	1124.30^{D}	1432.30^{B}	1130.50^{B}
C2	960.80^{EF}	1037.90^{D}	1162.60^{C}	1449.70^{A}	1152.70^{A}	973.70^{FG}	1001.80^{EF}	1260.30^{C}	1530.70^{A}	1191.60^{A}
Means	809.00^{D}	915.60^{C}	1021.00^{B}	1193.90^{A}		908.60^{D}	963.30^{C}	1094.90^{B}	1293.90^{A}	
	Season 2									
C0	657.60^{I}	763.50^{H}	854.80^{G}	902.10^{FG}	794.50^{C}	855.60^{J}	873.40^{J}	904.70^{I}	931.90^{H}	891.40^{C}
C1	915.20^{F}	1026.00^{DE}	1137.80^{C}	1284.70^{B}	1090.90^{B}	953.60^{G}	990.40^{F}	1132.50^{D}	1444.70^{B}	1130.30^{B}
C2	983.40^{E}	1067.60^{D}	1186.60^{C}	1468.50^{A}	1176.50^{A}	981.70^{F}	1013.20^{E}	1279.60^{C}	1565.90^{A}	1210.10^{A}
Means	852.10^{D}	952.40^{C}	1059.80^{B}	1218.40^{A}		930.30^{D}	959.00^{C}	1105.60^{B}	1314.20^{A}	
Averages that share the same alphabet do not differ from each other significantly according to Duncan's test at the 5% level.										

4. Dry weight of leaves per feddan (Kg)

Data in Table (2) the results confirm that, the increase in the levels of compost led to an increase in the dry weight of leaves per feddan (Kg) compared to the control where the highest level of compost was given 30 m^3/fed. the best increase in dry weight of leaves per feddan (Kg), this increase was significant in all treatments compared to the control. The treatment 30 m^3/fed. compost gives the highest values of dry weight of leaves per feddan (Kg) during the two seasons 2019 and 2020.

In the first season, the increase was recorded for dry weight of leaves per feddan (Kg) 1152.70 Kg and 1191.60 Kg with a significant increase of 58% and 36% compared to the untreated plants which gives 731.00 Kg and 873.40 Kg during the first and second cuts, respectively. Also, in the second season, the increase in dry weight of leaves per feddan was recorded 1176.50 Kg and 1210.10 Kg, with a significant increase of 48% and 36% compared to the untreated plants, which gives 794.5 Kg and 891.4 Kg during the first and second cuts, respectively.

Moreover, the results in Table (2) showed that, there were significant differences in the dry weight of leaves per feddan (Kg) between the levels of compost and the methods of adding compost tea. The spray + soil drench for compost tea together was superior to the rest of the treatments as well as the control.

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As the interaction treatment was superior to 30 m^3/fed. compost with spraying + soil drench for compost tea together significantly over all treatments interaction, the highest values of dry weight of leaves per feddan (Kg) were recorded in the first season, 1449.70 Kg and 1530.70 Kg during the first and second cuts, respectively, whereas it recorded 1468.50 Kg and 1565.90 Kg in the second season during the first and second cuts, respectively, compared with the control treatment.

These results are in affording with those achieved by Hassan, *et. al.* (2020) on *Nigella sativa*, L. plants and Ibrahim, *et. al.* (2019) *Nigella sativa*, L. plants.

5. Essential oil percentage

Table (3) showed that, the superiority of compost with the highest essential oil percentage values significantly compared to the other treatments. The table also shows that, the increase in the level of compost led to a direct increase in essential oil percentage with a significant increase compared to the control treatment (without compost additions), where the level of compost was given 30 m^3/fed. the highest values of essential oil percentage reached 1.024 % and 1.052 %, compared to the control treatment of 0.327 % and 0.333 % in the first cuts during the first and second seasons, respectively. While, the same increase occurred in the second cuts, where the essential oil percentage was given 1.144 % and 1.157 %, compared to the control treatment of 0.456 % and 0.483 % during the first and second seasons; respectively.

Also, table (3) illustrations a significant increase in essential oil percentage by applying the addition of compost tea using spray and soil drench together compared to spraying compost tea only or soil drench for compost tea alone. The increase in essential oil percentage in the first season was 0.995 % and 1.105 %, compared to the untreated plants of 0.478 % and 0.613 % in the first and second cuts, respectively, while the increase in essential oil percentage in the second season reached 1.029 % and 1.122 % compared to untreated plants 0.484 % and 0.639 % during the first and second cuts, respectively.

Table (3) data appears that, there is a significant interaction in essential oil percentage between the level of compost and methods of adding compost tea. The highest level of compost is 30 m^3/fed. was recorded the highest increase in essential oil percentage, this increase was a significant increase compared to the other interactions treatments. Also, the treatment was superior to the application of sprayed compost tea with soil drench compared to the other interactions treatments.

The highest increase in essential oil percentage for the first season was 1.350 % and 1.406 %, during the first and second cuts, respectively, compared to the control plants. Whereas, the data show that the increase in essential oil percentage during the second season reached 1.365 % and 1.424 % during the first and second cuts, respectively, compared to the control plants. This significant increase in essential oil percentage resulted from the treatment of 30 m^3/ fed. compost + spraying with soil drench for compost tea together.

Identical penalties were exhaustive by Gewefile, *et. al.* (2009) on *Nicotiana glauca* and Rania and Abd El-Azim, (2016) on *Plantago psyllium* L.

6. Essential oil per plant (ml)

Results in Table (3) showed that, a significant increase essential oil per plant (ml) as a result of the effect of compost levels. The highest values essential oil per plant (ml) when treating the plant with the highest compost level was 30 m^3/fed.

In the first season, the highest increase essential oil per plant (ml) was 0.613 ml and 0.703 ml compared to the control plants that gave the lowest values for essential oil per plant (ml) 0.123 ml and 0.201 ml in the first and second cuts, respectively. On the other hand, data revealed that, the

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increase essential oil per plant (ml) during the second season reached 0.642 ml and 0.724 ml compared to the control plants, which gave a low rate of increase of 0.136 ml and 0.217 ml during the first and second cuts, respectively.

As for the effect of adding compost tea methods, Table (3) results indicate that, a significant increase essential oil per plant (ml) when using all methods of addition, and the best method was when spraying and soil drench for compost tea together.

The treatment of spraying and soil drench for compost tea together was considered the best treatments that gave the maximum values for essential oil per plant (ml), followed by spraying compost tea only and then soil drench for compost tea alone.

Data indicate that, the first cuts increased essential oil per plant (ml) 0.642 ml and 0.675 ml during the two seasons, respectively. Though the increase in the second cuts was 0.766 ml and 0.789 ml during the two seasons, respectively.

Concentrating data in Table (3) obvious that, the effect of interaction between levels of compost and methods of adding compost tea, where the results tended to a significant increase essential oil per plant (ml) when treating marjoram plants with 30 m^3/fed. compost and spraying with compost tea and soil drench together.

Data conclusion, indicated that, the treatment of marjoram plants was 30 m^3/fed. compost with spraying with compost tea and soil drench together is the best treatment, where the maximum increase was recorded essential oil per plant (ml). In the first season, the highest values were 0.980 ml and 1.076 ml. However, in the second season gave 1.003 ml and 1.115 ml during the both cuts, respectively, compared with the control plants that gave the lowest values in the first season 0.071 ml and 0.134 ml. Even though, the increase was recorded in the second season 0.087 ml and 0.162 ml during the first and second cuts, respectively.

Similar consequences were detailed by Rania, (2010) on *Nicotiana glauca* and Rania, *et. al.* (2020) on *Carum carvi*, L. plant .

7. Essential oil per feddan (L)

Data in Table (3) indicate that, the effect of compost levels on the essential oil per feddan (L) of marjoram plant. There is a direct increase in continuously increasing levels of compost and this resultant increase in essential oil per feddan (L) is a significant increase compared to untreated plants. The best treatment was the highest level of 30 m^3/fed compost. Where the best values of essential oil per feddan (L) during the 2019 and 2020 seasons.

In the first season, the best values for increasing essential oil per feddan (L) were using 30 m^3/fed. compost 12.265 L and 14.065 L during the first and second cuts, respectively. While the increase was recorded in the second season 12.838 L and 14.477 L during both cuts, respectively, compared to the control plants, which recorded 2.466 L and 4.021 L in the first and second cuts during first season, respectively . Similarly, it recorded 2.700 L and 4.330 L in the first and second cuts during second season, respectively.

Furthermore, data in Table (3) indicated that, there was a significant effect on the essential oil per feddan (L) as a result of the different methods of adding compost tea, where the treatment excelled with spray + soil drench for compost tea together and gave the highest values of essential oil per feddan (L).

In the first season, the maximum values for increasing essential oil per feddan (L) when treating plants with spray + soil drench of compost tea together were 12.832 L and 15.325 L during the first and second cuts, respectively. Else, in the second season the increase was recorded 13.506 L and 15.781 L during the first and second cuts, respectively, compared to the control plants that

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gave the lowest value of essential oil per feddan (L) in the first season 4.163 L and 5.704 L during the first and second cuts, respectively and recorded 4.348 L and 6.047 L in the second season in the two cuts, respectively.

Table (3): Effect of compost and compost tea and their interaction on essential oil percentage, essential oil per plant (ml) and feddan (L) of *Origanum majorana*, L plant during the two seasons of 2019 and 2020.

Essential oil percentage										
	Season 1									
	Cut 1					Cut 2				
	CT0	CT1	CT2	CT3	Means	CT0	CT1	CT2	CT3	Means
C0	0.257^{J}	0.282^{IJ}	0.333^{I}	0.435^{H}	0.327^{C}	0.328^{L}	0.438^{K}	0.491^{J}	0.568^{I}	0.456^{C}
C1	0.536^{G}	0.723^{E}	1.125^{C}	1.199^{B}	0.896^{B}	0.707^{H}	0.996^{F}	1.170^{D}	1.342^{B}	1.054^{B}
C2	0.642^{F}	0.955^{D}	1.149^{BC}	1.350^{A}	1.024^{A}	0.803^{G}	1.117^{E}	1.248^{C}	1.406^{A}	1.144^{A}
Means	0.478^{D}	0.653^{C}	0.869^{B}	0.995^{A}		0.613^{D}	0.850^{C}	0.970^{B}	1.105^{A}	
	Season 2									
C0	0.263^{J}	0.289^{IJ}	0.338^{I}	0.443^{H}	0.333^{C}	0.379^{J}	0.452^{I}	0.516^{H}	0.586^{G}	0.483^{C}
C1	0.543^{G}	0.733^{E}	1.154^{C}	1.280^{B}	0.928^{B}	0.726^{F}	1.033^{D}	1.183^{C}	1.355^{A}	1.074^{B}
C2	0.644^{F}	0.967^{D}	1.231^{B}	1.365^{A}	1.052^{A}	0.812^{E}	1.122^{C}	1.271^{B}	1.424^{A}	1.157^{A}
Means	0.484^{D}	0.663^{C}	0.908^{B}	1.029^{A}		0.639^{D}	0.869^{C}	0.990^{B}	1.122^{A}	
	Essential oil per plant (ml)									
	Season 1									
C0	0.071^{H}	0.099^{GH}	0.131^{G}	0.191^{F}	0.123^{C}	0.134^{L}	0.188^{K}	0.221^{J}	0.261^{I}	0.201^{C}
C1	0.244^{F}	0.364^{E}	0.626^{C}	0.754^{B}	0.497^{B}	0.331^{H}	0.512^{F}	0.658^{D}	0.962^{B}	0.616^{B}
C2	0.309^{E}	0.496^{D}	0.668^{C}	0.980^{A}	0.613^{A}	0.391^{G}	0.559^{E}	0.786^{C}	1.076^{A}	0.703^{A}
Means	0.208^{D}	0.320^{C}	0.475^{B}	0.642^{A}		0.285^{D}	0.420^{C}	0.555^{B}	0.766^{A}	
	Season 2									
C0	0.087^{J}	0.111^{IJ}	0.145^{I}	0.200^{H}	0.136^{C}	0.162^{L}	0.197^{K}	0.233^{J}	0.273^{I}	0.217^{C}
C1	0.249^{H}	0.376^{F}	0.656^{D}	0.823^{B}	0.526^{B}	0.346^{H}	0.512^{F}	0.670^{D}	0.979^{B}	0.627^{B}
C2	0.317^{G}	0.517^{E}	0.731^{C}	1.003^{A}	0.642^{A}	0.399^{G}	0.568^{E}	0.813^{C}	1.115^{A}	0.724^{A}
Means	0.217^{D}	0.334^{C}	0.511^{B}	0.675^{A}		0.302^{D}	0.426^{C}	0.572^{B}	0.789^{A}	
	Essential oil per feddan (L)									
	Season 1									
C0	1.431^{H}	1.986^{GH}	2.625^{G}	3.822^{F}	2.466^{C}	2.676^{L}	3.767^{K}	4.419^{J}	5.224^{I}	4.021^{C}
C1	4.881^{F}	7.277^{E}	12.518^{C}	15.078^{B}	9.938^{B}	6.615^{H}	10.230^{F}	13.160^{D}	19.233^{B}	12.310^{B}
C2	6.178^{E}	9.930^{D}	13.357^{C}	19.596^{A}	12.265^{A}	7.822^{G}	11.187^{E}	15.732^{C}	21.518^{A}	14.065^{A}
Means	4.163^{D}	6.397^{C}	9.500^{B}	12.832^{A}		5.704^{D}	8.395^{C}	11.104^{B}	15.325^{A}	
	Season 2									
C0	1.730^{J}	2.213^{IJ}	2.890^{I}	3.995^{H}	2.700^{C}	3.243^{L}	3.947^{K}	4.670^{J}	5.459^{I}	4.330^{C}
C1	4.974^{H}	7.524^{F}	13.130^{D}	16.458^{B}	10.521^{B}	6.925^{H}	10.235^{F}	13.398^{D}	19.581^{B}	12.535^{B}
C2	6.339^{G}	10.335^{E}	14.614^{C}	20.067^{A}	12.838^{A}	7.973^{G}	11.368^{E}	16.264^{C}	22.304^{A}	14.477^{A}
Means	4.348^{D}	6.690^{C}	10.211^{B}	13.506^{A}		6.047^{D}	8.517^{C}	11.444^{B}	15.781^{A}	
Averages that share the same alphabet do not differ from each other significantly according to Duncan's test at the 5% level.										

About the interaction between the levels of compost and the methods of adding compost tea, the consequences in Table (3) led to a significant increase in the result of the interaction between treatments, and the best treatment was 30 m^3/fed. compost with spraying + soil drench for compost tea together. Where this treatment recorded the best results and maximum values of essential oil per feddan (L). In the first season, were recorded 19.596 L and 21.518 L during the first and second cuts, respectively, Whereas, in the second season, were registered 20.067 L and 22.304 L during the first and second cuts, respectively, compared to the untreated

plants that gave minimum values of essential oil per feddan (L) were registered 1.431 L & 2.676 L and 1.73 L & 3.243 L in both cuts during the two seasons, respectively.

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Similar results were recorded by Elham and Rania (2015) on *Hibiscus sabdariffa,* L. plants and Rania, (2010) on *Nicotiana glauca.*

8. Volatile oil composition by using G.L.C

Table (4) and Fig. (1) appearance that, the essential oil analysis by GLC, turns out that Terpinen-4-ol compound the largest Ingredients in the oil of marjoram is , as showed that more than 20 compound such as "terpinen-4-ol and ρ-cymene, carvone, thuyanol, α-thujene, linalool, α-terpinene, thymol, d-limonene, linalyl acetate, terpinolene, cis-sabinene hydrate, citronellol, carvacrol, α-terpineol, β-myrcene, trans-sabinene hydrate, 1,8-cineol, β-caryophyllene, α-thujene, α-pinene, sabinene, camphene, α-phellandrene, γ-terpinene..... .... etc". These compounds are present in different proportions in the active ingredients of the essential oil, which gave the main reason for the medicinal benefits of marjoram oil.

With regard to the effect of compost levels on the active components of marjoram oil, note that the compound Terpinen-4-ol represents the largest compound in the oil of marjoram plant. The data showed that, an increase of Terpinen-4-ol when increasing the level of compost, and the increase was recorded at 44,504 % when the plant was treated with 30 m^3/fed compost compared to control treatment which recorded 31.057%. Also, the compounds increased thymol 3.480%, d-limonene 2.950%, linalyl acetate 2.847% and linalool 4.496% compared to the control that gave 2.076%, 0.706%, 0.850% and 1.527%, respectively, while they were not completely present when plants were treated with 15 m3/fed. compost.

ρ-Cymene recorded the best ratio of 10.142 % in the treatment 15 m^3/fed compost. Whereas, it was less than the treatment 30 m^3/fed compost 8.836 %, while it was significantly reduced in the control plants by 1.635%. α-terpinene compound decreased when treated with 30 m^3/fed compost followed by 15 m^3/fed compost by 3.603% and 3.831%, respectively, while, increased in untreated plants by 6.274%.

Each of the compound carvone, thuyanol and α-thujene decreased when the plants treated with 30 m^3/fed compost, was recorded 7.503%, 7.352% and 4.659%, respectively; although, these compounds increased to 5.376%, 4.560 and 14.123% in the plants without compost (control).

Six active components were absent in the analysis of oil components when the plants treated with 30 m^3/fed compost they are "α-thujene, α-pinene, sabinene, camphene, α-phellandrene and γ-terpinene", while only two compounds were absent in the control treatment, they are "1,8-cineol and β-caryophyllene". However, about 15 were absent they are α-thujene, α-pinene, sabinene, camphene, α-phellandrene, γ-terpinene, d-limonene, linalool, thymol, α-terpineol, linalyl acetate, carvacrol, 1,8-cineol, β-caryophyllene and citronellol when adding compost at a level of 15 m^3/fed.

As for effect of adding compost tea note from the data in the Table (4) and Fig. (1) an increase in the compound terpinen-4-ol, when plants treated with spraying + soil drench for compost tea together was recorded at 43.914 %, while the same compound decreased during the plants treated with compost tea as soil drench only which was recorded 42,837%, though the treatment spraying compost tea only, which notched 35.475 % compared to the untreated plants (without compost tea), which notched 31.057%, which have the lowest value for terpinen-4-ol .

α-Terpinene compound increased to 9.536% when the plant was treated with spraying + soil drench for compost tea together, while decreased to 8.424%, 8.347% when treated with soil drench alone and spraying alone; respectively. Likewise, ρ-cymene compound reached 5.501% when treating the plant with spraying + soil drench for compost tea together, but, increased in a unusual to 11.692%, 6.517% when adding compost tea as spraying alone and soil drench alone; respectively. While, decreased completely in the control plants which recorded 1.635%.

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In the untreated plants (control) was increased α-thujene compound to 14.123%, while its decreased to 5.117%, 4.649% and 4.596% when treated plants with compost tea by spraying + soil drench together, compost tea as spraying only and soil drench only; respectively. As well, α-pinene compound an increase in reached 5.057% when the plant was treated with spraying + soil drench for compost tea together , while, was absent with compost tea as soil drench only, but it decreased in both with compost tea as spraying only 0.915% and control 0.430% . Also, carvone compound reached 4.413 % when adding compost tea as spraying + soil drench together, while it increased in the untreated plants (control) 5.376 %.

On the other hand, camphene compound when treating the plant with spraying + soil drench for compost tea together recorded an increase of 4.201 %, but it was less than treating the plant with compost tea as spraying only 0.936 % and compost tea as soil drench only 0.550 % compared to the plants not treated with compost tea 1.178% . As well as, trans-sabinene hydrate compound recorded 3.337 % when the plant application with spraying + soil drench for compost tea together. Whereas it was less than treating the plant with compost tea as spraying only 0.489 % and compost tea as soil drench only 0.377 % compared to the untreated plants 5.100 % which increased significantly. Likewise, both α-pinene and 1,8-cineol compounds were absent in the control plants. However, α-thujene was absent when compost tea adding as spraying only, while α-thujene and α-pinene compounds were not present when compost tea adding as soil drench only. But, β-caryophyllene compounds was absence when compost tea adding as spraying + soil drench together treatment.

Concerning the interaction relationship between the levels of compost and the methods of adding compost tea, the consequences in Table (4) and Fig. (1), it was clear that about 17 components of marjoram oil disappeared, i.e. α-thujene, α-pinene and sabinene. campphene, α-phellandrene, γ-terpinene, d-limonene, α-terpinene, terpinolene, trans-sabinene hydrate, linalool, thymol, α-terpineol, linalyl acetate, carvacrol, 1,8-cineol, β-caryophyllene when plants were treated with 30 m^3/fed. compost with spraying + soil drench for compost tea together compared to the control plants, which only 1,8-cineol and β-caryophyllene disappeared from the components of marjoram oil.

Terpinen-4-ol compound recorded the highest percentage in the active ingredients of marjoram oil, where the increase reached 65.061% when treated 30 m3/fed. compost with spraying + soil drench for compost tea together compared to control 31.057% and other treatments.

In the treatment 30 m3/fed. compost with spraying + soil drench for compost tea together found that Terpinen-4-ol represented 65.061%, followed by Carvone 6.523%, while the α-Thujene compound recorded 0.637% from active ingredients of marjoram oil. On the other ways, Terpinen-4-ol was recorded 31.057%, followed by α-Thujene. 14.123%, but Carvone compound recorded 0.637% from active ingredients of marjoram oil.

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Table (4): Effect of compost and compost tea and their interaction on volatile oil composition by using G.L.C of *Origanum majorana*, L plant during second cut in 2020 season.

	C0 CT0	C0 CT1	C0 CT2	C0 CT3	C1 CT0	C1 CT1	C1 CT2	C1 CT3	C2 CT0	C2 CT1	C2 CT2	C2 CT3
α-Thujene	2.161	-	-	1.353	-	-	0.656	-	-	-	-	-
α-Pinene	0.430	0.915	-	5.057	-	0.912	4.020	-	-	-	-	-
Sabinene	4.910	5.445	-	1.200	-	4.691	0.503	-	-	-	1.151	-
Camphene	1.178	0.936	0.550	4.201	-	0.794	1.787	-	-	-	4.423	-
α-Phellandrene	2.384	3.374	6.460	1.264	-	2.783	0.665	-	-	-	0.740	-
γ-Terpinene	1.185	1.126	5.122	0.856	-	0.903	0.360	-	-	3.605	1.454	-
d-Limonene	0.706	1.149	0.735	0.541	-	0.886	6.107	-	2.950	0.981	0.795	-
α-Terpinene	6.274	8.347	8.424	9.536	3.831	7.178	6.743	-	3.603	4.194	0.871	-
Terpinolene	5.857	4.908	2.687	3.132	6.280	4.528	1.801	7.277	1.685	7.118	4.773	-
β-Myrcene	3.924	1.946	3.913	1.944	9.144	1.678	1.897	3.017	0.775	2.565	6.511	4.428
Thuyanol	4.560	3.462	2.059	1.559	4.556	1.202	3.228	6.812	7.352	4.429	1.446	4.858
Carvone	5.376	4.311	3.910	4.413	3.443	4.049	5.295	3.193	7.503	4.915	4.446	6.523
α-Thujene	14.123	4.649	4.596	5.117	5.149	5.648	4.972	1.122	4.659	9.751	6.203	4.441
ρ-Cymene	1.635	11.692	6.517	5.501	10.142	4.113	1.686	4.763	8.836	2.443	1.113	5.333
Citronellol	2.752	2.038	1.828	1.355	-	1.627	2.948	7.257	1.347	2.160	1.568	3.063
Terpinen-4-ol	31.057	35.475	42.837	43.914	44.009	46.469	48.290	55.546	44.504	47.453	51.614	65.061
cis-Sabinene hydrate	0.988	1.304	1.167	1.206	4.867	1.289	1.494	0.463	1.475	1.353	1.465	6.291
trans-Sabinene hydrate	5.100	0.489	0.377	3.337	8.581	0.185	4.108	1.515	0.512	0.321	4.299	-
Linalool	1.527	3.746	3.507	0.883	-	0.402	1.114	6.428	4.496	3.968	0.790	-
Thymol	2.076	1.226	0.357	1.569	-	4.833	0.498	1.126	3.480	0.301	0.758	-
α-Terpineol	0.475	1.094	1.214	1.514	-	0.160	0.807	1.481	0.927	1.044	1.605	-
Linalyl acetate	0.850	0.504	1.027	0.772	-	1.600	1.080	-	2.847	0.339	0.785	-
Carvacrol	0.637	0.625	0.410	0.399	-	1.351	0.630	-	1.329	0.485	0.523	-
1,8-Cineol	-	0.384	0.289	0.879	-	0.360	-	-	0.420	0.560	1.067	-
β-CaryoPhyllene	-	0.856	0.433	-	-	0.445	-	-	0.412	0.757	0.936	-
U.K	-	-	0.659	-	-	0.286	-	-	0.375	0.310	0.665	-
U.K	-	-	0.248	-	-	0.794	-	-	0.613	0.476	-	-
U.K	-	-	0.304	-	-	0.189	-	-	-	0.475	-	-
U.K	-	-	0.368	-	-	0.265	-	-	-	-	-	-
U.K	-	-	-	-	-	0.379	-	-	-	-	-	-

Levels of compost; (C0) without compost, (C1) 15 m3/fed and (C2) 30 m3/fed. And methods of adding compost tea; (CT0) without compost tea, (CT1) spraying, (CT2) soil drench and (CT3) spraying + soil drench together.

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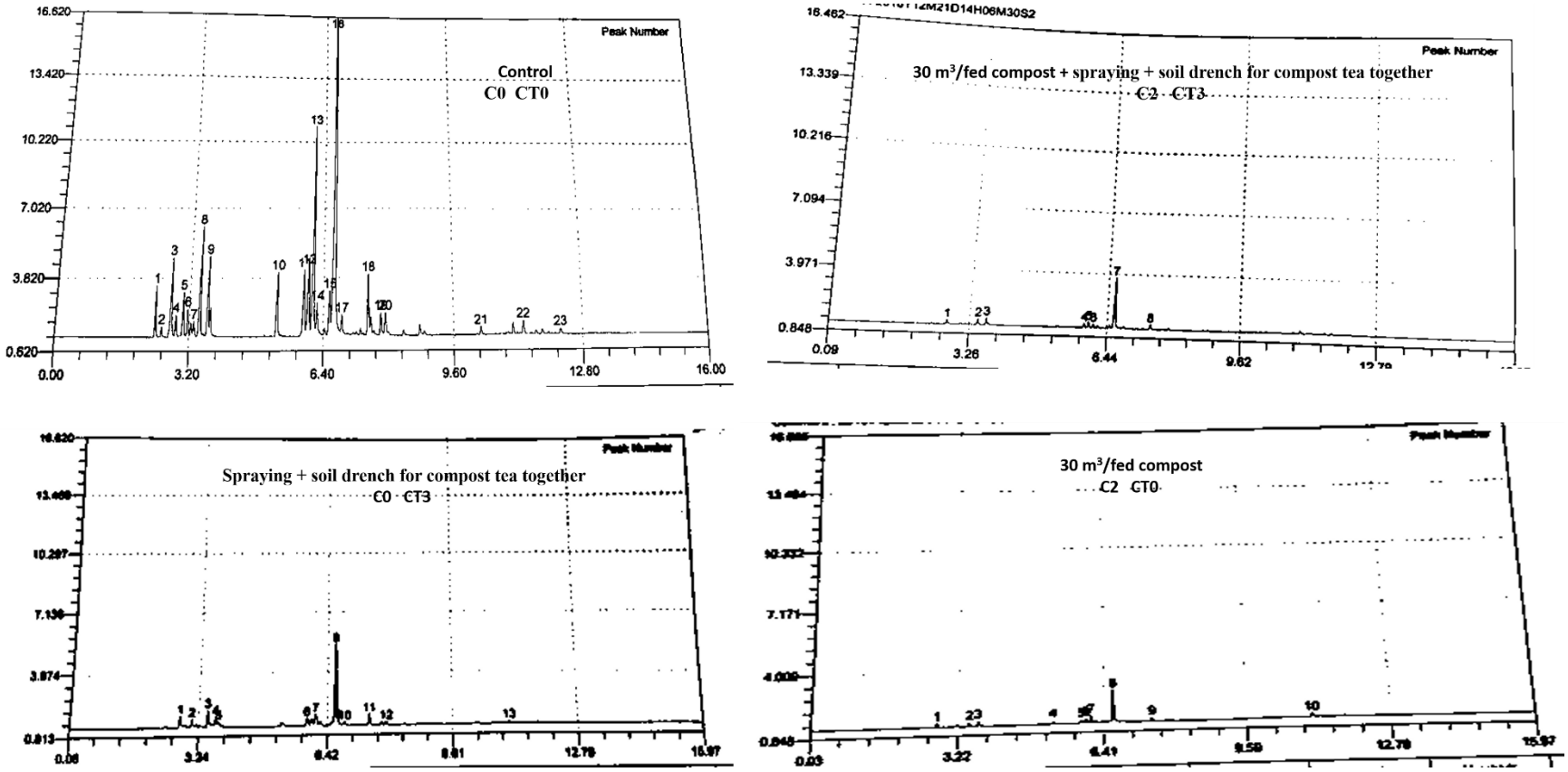
Figure (1): Effect of compost and compost tea and their interaction on volatile oil composition by using G.L.C. analysis of extract *Origanum majorana*, L oil in 2020 season.



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The compounds cis-sabinene hydrate 6.291%, ρ-cymene 5.333%, thuyanol 4.858%, β-myrcene 4.428% and citronellol 3.063 % recorded the largest values when treating the plants 30 m3/fed. compost with spraying + soil drench for compost tea together, compared to the untreated plants, which recorded lower percentages in oil components, reaching 0.988 %, 1.635%, 2.076 %, 3.924 % and 2.752%, respectively.

α-Thujene compound was significantly reduced, where the lowest percentage was 4.441% for the reaction 30 m3/fed. compost with spraying + soil drench for compost tea together, while there was a significant increase in the untreated plants, where the increase was recorded by 14.123% of the active components of marjoram oil.

These results established with those reported by Azza and Hendawy (2010) on *Borago Officinalis* plant and Elham and Rania (2015) on *Hibiscus sabdariffa* L. plants.

DISCUSSION

Results in Tables (1, 2, 3 and 4) show that, the increase of all characters of vegetative growth (plant height (cm), number of branches per plant, dry weight of leaves per plant (g) and per feddan (Kg).) and oil yield (essential oil percentage, essential oil per plant (ml), per feddan (L) and volatile oil composition using GLC) of marjoram plant as a result of treating plants with different levels of compost and methods of adding compost tea and their interaction on growth Vegetative, yield, essential oil yield and components of the volatile oil of marjoram plants .

Data recorded in Tables (1, 2, 3 and 4) clear that, there was a significant increase in all the studied characters and noted that there was a direct relationship between the levels of compost and the increase in growth characteristics. The higher the compost levels, the higher the growth characters and productivity, so the best treatment gave the highest values for the all characters under study, 30 m^3/fed compost. It leads to the dissolution of nutrients and an increase in the availability of macro- and micro-nutrients provided by these fertilizers, which stimulate the metabolic and photosynthesis processes, which leads to an increase in cell activity and stimulates cell division, which leads to an increase in the leaf area of the plant, which reflected positively on the increase in the number of leaves / plant / feddan, plant height and increase in the number of branches.

In addition, compost contains 2-5% of humic and falvic acids, they stimulate the growth and increase the production and quality of plants. These acids produced by compost facilitate micro-nutrients such as Fe, Mn, Zn and Cu and make them in an accessible form for uptake by plant roots. In addition, compost can increase the number and activities of microorganisms in the soil by stimulating their biodegradation. All these factors are reflected on the productivity and growth characteristics of marjoram plant, which leads to an increase in growth and vegetative production of leaves / plant / feddan, which reflected in the increase in oil production / plant / feddan.

Similar consequences were detailed by Elham and Rania (2015) on *Hibiscus sabdariffa*, L. plants and Rania, *et. al.* (2020) on *Carum carvi*, L. plant

Data in Tables (1, 2, 3 and 4) the different ways of adding compost tea led to a significant difference in the studied characteristics, and it was the best treatment when using spray + soil drench for compost tea together due to spraying compost tea on the leaves, as it contains nutrients that are easily entered through the leaves, which speeds up the photosynthesis process and increases its performance for the marjoram plant. Although, the soil drench addition of compost tea had a direct and indirect effect on plants by providing nutrients in the area surrounding the

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roots as a result of it containing soluble nutrients, which works to increase the delivery of water and nutrients to all parts of the plant and thus an increase in photosynthesis and an increase In the formation of protein and carbohydrates, this is reflected in the increase in growth through an increase in all the different physiological processes in the plant.

These results are harmony with those obtained by Rania, (2010) on *Nicotiana glauca*, Azza and Hendawy (2010) on *Borago Officinalis* plant and Ibrahim, *et. al.* (2019) *Nigella sativa*, L. plants.

Tables (1, 2, 3 and 4) indicated that, the interaction between the effect of using different levels of compost and methods of adding compost tea on vegetative growth, productivity, essential oil yield and components of the volatile oil of marjoram plant, where the best treatment was the interaction of 30 m3 /fed. compost with spraying + soil drench for compost tea together recorded a significant increase and best values in all the studied characters attributed to the direct and indirect effect of compost on plants through the root periphery area as a result of it containing soluble nutrients and micro-organisms. It contains Phytohormones and PGPR growth regulators also have a role in modifying the soil pH and ground structure, which leads to the supply of the plant with macro and micro nutrients. It helps the roots to grow easily to provide food. It protects the roots and other plant tissues from pathogens by increasing the numbers and micro-organisms in the soil and helps to restore the balance Among the microorganisms in the soil that have been disturbed due to chemical fertilization.

On the other hand, compost tea contains some hormones, vitamins, proteins, amino acids and humic acids, in addition to containing some main nutrients NPK and secondary nutrients such as Ca, Mg and S, in addition to some trace elements such as Fe, Cu, Zn, Mn, which leads to a speed in the activity and division of cells as a result of the availability of nutrients necessary for growth. All these factors contributed to an increase in vegetative production and oil yield of marjoram plant.

Whereas, the low effect on the values of vegetative growth and oil yield as a result of the low activity of microorganisms in the soil as a result of reducing the amount of added compost that led to a decrease in organic matter; Hence, the rate of decomposition of organic matter decreased by reducing the numbers of microorganisms. As the liberation of nutrients in the soil decreased, the plant could not absorb all the nutrients necessary for its growth, and therefore this appeared in the form of a lack of all growth characteristics.

The progressive response of *Origanum majorana*, L plants to interaction between levels of compost and methods of adding compost tea was assimilated by Rania and Abd El-Azim, (2016) on *Plantago psyllium*, L., Hassan, *et. al.* (2020) on *Nigella sativa*, L. plants and Gewefile, *et. al.* (2009) on *Nicotiana glauca.*

REFERENCE

Analytical software, (2008). Statistix Version 9, Analytical Software, Tallahassee, Florida, USA.

Azza A. Ezz El-Din and S.F. Hendawy (2010). Effect of dry yeast and compost tea on growth and oil content of *Borago Officinalis*,L. plant. Research Journal of Agriculture and Biological Sciences, 6(4): 424-430.

Elham, M. Attia and Rania, M. Khater (2015). Effect of different planting dates and organic fertilizers treatments on growth and yield of *Hibiscus sabdariffa*, L. plants. Egyptian J. Desert Res., 65(1): 153-170.

ISSN 2537_ 0715
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Received: September 2021, Accepted: October 2021

Gewefile, S.G.M.; G.A.A. Bishr; Kamelia M. Reda and Rania M. Khater (2009). Effect of different saline water irrigation and compost levels on the growth and active ingredients of *Nicotiana glauca* under Sinai conditions. J. Agric. Sci. Mansoura Univ., 34(4): 3533-3546.

Hassan E. A. ; Mohamed N. H.; Hamad El. H.; Rania M. R. Khater (2020). Response of black cumin (*Nigella sativa*, L.) plants to the addition of natural fertilizers and the inoculation by bacteria mix and seaweed liquid extract. Archives of agriculture sciences journal. Vol. 3, (2): Pp. 1-15.

Ibrahim, H.A.K., Khater, R.M.R. & Hegab, R. H. (2019) Evaluate the effect of compost tea and some chelated micronutrients forms on black cumin productivity. *SN Appl.* Sci. 1, 28.

Rania M. Khater (2019): Effect of irrigation with magnetic water and nitrogen fertilizers source on the vegetative growth, essential oil ingredients and productivity of *Origanum majorana*, L. Journal of Architecture and Construction Vol. 2, (3): Pp. 27- 40.

Rania M. Khater and Abd El-Azim, W.M. (2016). Effect of fertilization and humic acid treatments on seeds production of *Plantago psyllium*, L. Egyptian J. Desert Res. 66, (1): Pp. 95-114.

Rania M. Khater, Wafaa H.A. Abd-Allah and R.M.M. El Shafay (2020) Effect of organic fertilization and spraying *Aloe vera* extract on the growth and productivity of *Carum carvi*, L. plant under Shalateen conditions in Egypt. Plant Archives, Volume 20, (2): Pp. 4959-4971.

Rania, M.R., Khater (2010): Effect of some agriculture treatments on the growth and active ingredients of *Nicotiana glauca* under Sinai conditions. Ph.D. Thesis. Zagazig Univ.

Snedecor, G.W. and Cochran, W.G. (1980). In "Statistical Methods". 7th Ed. Iowa State Univ., Press, Amer., Iowa, USA.