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EFFECT OF ORGANIC AND INORGANIC FERTILIZATION ON VEGETATIVE GROWTH AND VOLATILE OIL OF MARJORAM (*Majorana hortensis* L.) PLANT.

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ABSTRACT

A field experiment was carried out during 2009/2010 season to evaluate organic and inorganic fertilization effects on vegetative growth, nutrient uptake and volatile oil of marjoram (*Majorana hortensis* L.) plant. The organic fertilization (sheep manure) was added a month before cultivation. Sheep manure at the rate of 20 $M^3 fed^1$.

Six treatments were conducted; namely

1- Inorganic fertilization (100%, recommended doze)
2- Organic fertilization (100 %)
3- Inorganic fertilization 75% + organic fertilization 25%
4- Organic fertilization 75 %+ Inorganic fertilization 25%
5- Inorganic fertilization 50 % + organic fertilization 50 %
6- The control treatment

Two cuts were harvested, the first one being after four months of planting (July month) and the second one after seven months of planting (August month).

The results could be summarized as follows:

- The highest significant values of plant height and shoot number $plant^{-1}$ in both 1st and 2st cuts as a result of increasing application organic fertilization treatments as compared with the control. Also data showed that, similar results in fresh and dry weight with 1st and 2st cuts as a result of increasing application organic fertilization treatments as compared with the control, on the other hand dry matter percentage, the highest significant values in both 1st and 2nd cuts as a result of increasing application organic fertilization treatments as compared with the control.
- The values of NPK increased as a result of increasing application organic fertilization treatments as compared with the control. On the other hand, the values of Fe, Zn, Mn and Cu decreased as a result of increasing application of organic fertilization treatments as compared with the control.
- The values of volatile oil percentage in herb in 1st and 2nd cuts were recorded with organic fertilization treatments.
- Terpinene-4-ol was the main component of volatile oil ,the highest percentages were recorded with organic fertilization treatments as compared with the control. This research is trying to reduce the mineral fertilizer application for their dangerous on general health and highly cost of these fertilizer, with improving production of important crops.

Keywords: Organic, inorganic, fertilization, volatile oil, marjoram (*Majorana hortensis* L.) plant

INTRODUTION

Marjoram, (*Majorana hortensis* L.) is a hardy perennial and herbaceous plant which grows in many areas of Egypt and eastern Mediterranean countries. Commercial *M. hortensis* L. oil (sweet marjoram) is used as a spice and condiment. Volatile oil produced by this plant is

antispasmodic, digestive, bitter tonic, expectorant, diuretic, antidiabetic, antimicrobial, and antioxidant. In addition it is used in many industries. It is cultivated as culinary herb and as garden plants, Sivropoulou *et al.* (1996). Some properties like antimicrobial, antioxidant and antimutagenic activities have been attributed to the essential oil from Marjoram,*(* Dapkevicius *et al.* 1998).

Garg and Bahl (2008) reported that, organic materials are known to increase P availability and enhance efficient use of applied P fertilizer. Manure can also improves soil fertility, increase water-holding capacity, decline wind and water erosion, improves aeration, and promotes beneficial organisms. Johnson and Eckert,(1995) reported that there are two principle objectives in applying animal manure to land: 1) to ensure the maximum utilization of the manure nutrients by crops and 2) to minimize water pollution hazard,. And also, manure plots showed higher dry matter production, species wealth, percentage cover, and drastic changes in botanical composition than that of non-manure plots. The principle objective of the present research was to identify manure management systems which minimize environmental pollution and result in good agronomic rangeland yields, (Mugerwa *et al.* 2008). The objective of this study was to evaluate the effect of organic and inorganic fertilization on vegetative growth, nutrient uptake and volatile oil of marjoram (*Majorana hortensis* L.) plant.

MATERIALS AND METHODS

The current investigation aims at evaluating fertilization effects on vegetative growth, nutrient uptake and volatile oil of marjoram (*M. hortensis*)plant . A Field experiment was set up at Soil and Water department Farm, Faculty of Agriculture, Al - Azhar university , Nasr City , Cairo, Egypt.

Plant materials.

Plantlets of marjoram (*M. hortensis*) were obtained from private nursery at Al- Kanatier Alkhairyia region grown in plastic pot (8cm),10-15 cm of shoot length and 4-6 leaves .plantlets cultured in experimental area in 25th March 2009

The experimental soil

The soil is sandy loam (54.72% coarse sand, 21.33% fine sand, 11.13 % silt and 12.82 % clay), containing 0.89 % organic matter, its soil bulk and particle densities are 1.32 and 2.62 kg m^{-3}, respectively and its total porosity was 49.61%. The experiment was conducted in a randomized complete block design with three replicates.

The experimental area was divided into equal size plots : the plot area was 1.5 x 3.0 meter, containing three ridges 50 cm apart , every ridge was 3 meters long containing 10 plants at 30 cm in between .

Soil sampling and analyses

The soil sample (0-30 cm depth), was air dried and then ground to pass through a 2mm sieve. Some physical and chemical analysis were carried out according to the standard methods undertaken by Black *et al.*, (1965) and Page *et al.,* (1982), the results are shown in Table 1. Also,

available Fe, Mn, Zn, and Cu were determined in the experiment of soil using ammonium bicarbonate-DTPA extractable according to Soltanpour and Schwab (1977) and their contents in the obtained extract were measured by Atomic Absorption spectrophotometer.

Table 1: Physical and chemical analyses of soil .

Soil Properties	value
Particle size distribution %	
Coarse sand	54.72
Fine sand	21.33
Silt	11.13
Clay	12.82
Textural class	**Sandy loam**
O.M. %	0.89
$CaCO_3$ %	1.10
pH (soil past extract)	7.66
EC dS m^{-1}	0.36
Soluble ions (meq L^{-1})	
Ca^{++}	1.15
Mg^{++}	1.11
Na^{++}	1.12
K^{+}	0.25
CO_3^{--}	0.00
SO_4^{--}	1.33
Cl^{-}	1.35
HCO_3^{-}	0.95
Heavy metals ppm (available)	
Fe	3.02
Mn	3.13
Zn	2.80
CU	1.10

The experimental treatments.

Both the inorganic and organic fertilization rates were added according to the recommendation of the Ministry of agriculture. The organic fertilization (sheep manure) was added a month before cultivation at the rate of 20 $M^3 fed^{-1}$. The inorganic fertilization was added as ammonium sulfate and K-sulfate at the rates of 300and150 Kg fed^{-1}, respectively. Fertilizer rats were splitted into two equal doses. The first addition was carried out 30days after transplanting, the second addition was performed after two weeks from the first cut (4.5months after transplanting, respectively).

Chemical analyses of organic fertilizer used in this experiment (Table 2) was carried out according to Black *et al.* (1965). The experimental treatments were as follow :

1- Inorganic fertilization (100%, recommended doze)
2- Organic fertilization (100 %)
3- Inorganic fertilization 75% + organic fertilization 25%
4- Organic fertilization 75 %+ Inorganic fertilization 25%
5- Inorganic fertilization 50 % + organic fertilization 50 %
6- The control treatment

Table 2: Chemical analysis of sheep manure.

O.M. %	N %	K_2O %	P_2O_5 %	C/N ratio	O.C. %
33.15	1.7	2.3	3.2	11.5	19.5

Measurement and Determinations:

Two cuts were harvested, the first one being after four months of planting (July, 2009) and the second one after seven months of planting (August, 2009). The, studied vegetative parameters are:

1- Plant height cm plant^{-1}
2- Shoot number plant^{-1}
3- Fresh weight g. plant^{-1}, recorded after each cut.
4- Dry weight g. plant^{-1}, dry weight of herb was recorded after air dried in shade room.
5- Dry matter percentage = dry weight / fresh weight x100. Dry matter production was calculated through the values of green production and dry weight percentage.

At the end of the experiment the harvested plants were digested to determine NPK and micronutrients; Fe, Mn, Zn and Cu according to Page *et al.* (1982). .

Volatile oil extraction

Marjoram Herb was extracted by steam distillation for 3-4 hour, according to the method described in British pharmacopoeia (1963). Gas Liquid Chromatography (GLC) method was used for the analyses of the essential oils.

The statistical analysis: All experiments were conducted under complete randomized design (CRD) with three replications and 9 plants for each replicate (Snedecor and Cochran, 1972) and the means were compared using L.S.D. test.

RESULTS AND DISCUSSION

Effect of fertilization treatments on vegetative parameters of marjoram (*Majorana hortensis* L.) plant :

Plant height

Data of Table 3 and Fig.1 show that, the tallest significant values of plant height cm plant^{-1} were recorded with (100 inorganic , 100 organic, 75 % inorganic + 25 % organic and 50 % inorganic + 50 % organic, fertilization) as (70.3, 67.0, 70.0 and 69.6cm plant^{-1}, respectively) in 1st cut . While, in 2nd cut the best significant values were (65.0, 63.3 and 68.3 cm plant^{-1} respectively) recorded under (100 % organic,75% inorganic+25% organic and 75% organic + 25 % inorganic fertilization). On the other hand, the lowest significant values of plant height cm plant^{-1}was recorded under control treatment in both 1st and 2nd cuts as (40.6 and 46.3 cm plant^{-1}, respectively). Also data showed that, plant height cm/plant decreased under 100% inorganic in 2nd cut (55.0 cm plant^{-1}) comparing with 1st cut (70.3 cm plant^{-1}), also the same trend recorded with 75% inorganic + 25 %organic were (70.0 cm plant^{-1} with 1st cut) and (63.3 cm/plant, with 2nd cut).

Table 3: Effect of fertilization on vegetative parameters oil of marjoram (*Majorana hortensis* L.) plant.

Fertilization Treatments	Vegetative parameter									
	1st cut					2nd cut				
	Plant height Cm plant^{-1}	Shoot number plant^{-1}	Fresh weight gm plan^{-1}	Dry weight gm plant^{-}	Dry matter %	Plant height Cm plant^{-1}	Shoot number plant^{-1}	Fresh weight gm plan^{-1}	Dry weight gm plant^{-1}	Dry matter %
100% inorganic f.	70.3	16.3	322	104	32.29	55.0	9.6	161.3	43.5	26.96
100% organic f.	67.0	13.0	202.6	61	30.10	65.0	10.1	149.3	41.8	27.99
75%inorganic+25%organic f.	70.0	16.0	337	102	30.26	63.3	10.5	176.3	51.1	28.98
75 organic +25% inorganic f.	60	12.9	229	64	27.9	68.3	12.7	149.3	44.7	29.93
50 % inorganic+50 organic f.	69.6	13.0	207	48.3	23.10	61.0	9.3	170	47.6	28.0
Control	40.6	8.66	48	13.46	27.6	46.3	7.3	91	16.2	25.0
L.S.D. at 5 %	6.5	3.8	72	9.2	3.62					
L.S.D. at 5 % (1st Cut)	9.01	2.23	53.1	13.2	4.21					
L.S.D. at 5 % (2nd Cut)						5.84	1.6	35.3	5.4	2.55

It may be caused by solving inorganic fertilization in soil with water irrigation. Concerning, the effect of organic fertilization, the best significant results in both 1st and 2nd cuts were recorded with (100 % organic fertilization) it were (67.0 and 65.0 cm plant^{-1}, respectively.

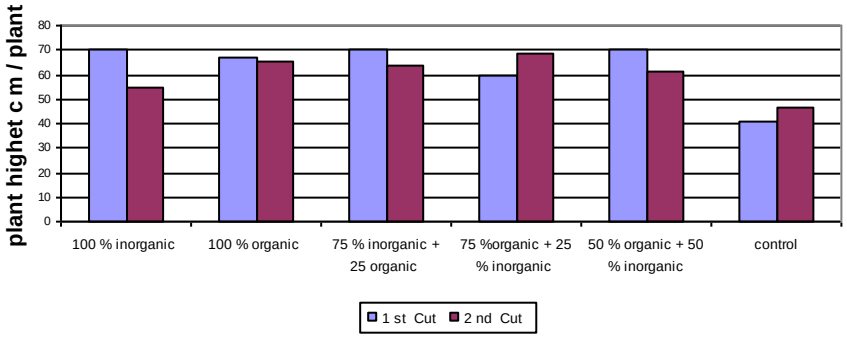

Fig.(1): Effect of fertilization on plant height cm plant $^{-1}$

Shoot number plant $^{-1}$

The biggest significant values of shoot number plant^{-1} recorded in 1st cut with (100 % inorganic fertilization) and (75 % inorganic fertilization + 25 organic fertilization) were (16.3 and 16.0/ plant) . While in the 2nd cut with (75 % organic + 25 % inorganic fertilization) were (12.70 shoot number plant $^{-1}$). On the other hand, the highest significant value of shoot number /plant in both two cuts recorded with 75 % organic fertilization + 25 % inorganic fertilization were (12.9 and 12.7 shoot number plant $^{-1}$) in 1st and 2nd cuts, respectively. Concerning, the lowest significant values were recorded with control treatment (8.66 and 7.30 shoot number plant^{-1}) in 1st and 2nd cuts,

respectively. Our results were in agreement with, Hanife, *et al* (2010) who reported that, the effects of manure applications on ratios of legume, grass, and other plants in the botanical composition were found to be significant.

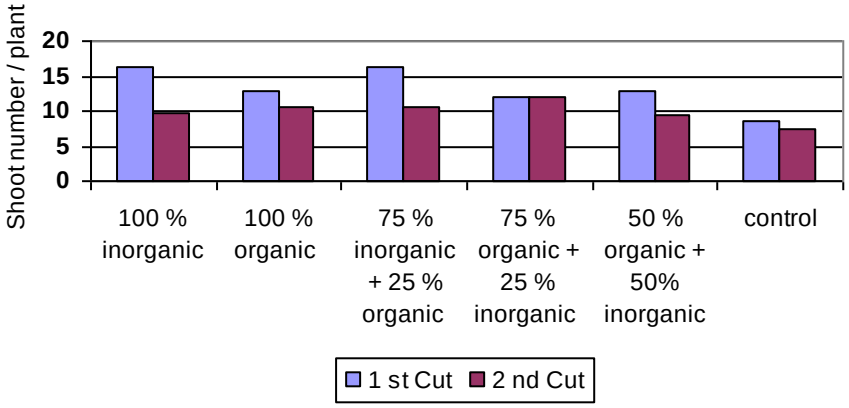

Fig.(2): Effect of fertilization on shoot number plant $^{-1}$
Fresh weight (g. plant^{-1})

Herb of marjoram plants were positively responded to increased levels of either inorganic and organic Inorganic fertilization (100%) and 75 % inorganic +25 % organic fertilization recorded the highest significant values of fresh weight gm/ plant in 1st cut as follow (322 and 337 g. plant^{-1}, respectively). While in 2nd cut, Inorganic and organic fertilization treatments had no significant effect on fresh weight gm plan^{-1}t, regardless the control treatment which was recorded the lowest significant value (91 g. plant^{-1}). The best result of fresh weight gm/plant recorded in 2nd cut was recorded with 75 % inorganic + 25 % organic fertilization (176.3 g. plan^{-1}t).On the other hand ,the biggest values of fresh weight g.plant^{-1} in two cuts were recorded with 75 %inorganic + 25 %organic fertilization (337g. plant^{-1} in 1st cut and 176.3 g./plant in 2nd cut). While the lowest values were recorded with control treatment (48 g.plant^{-1} in 1st cut and 91 gm plant $^{-1}$in 2nd cut) Fig.3.

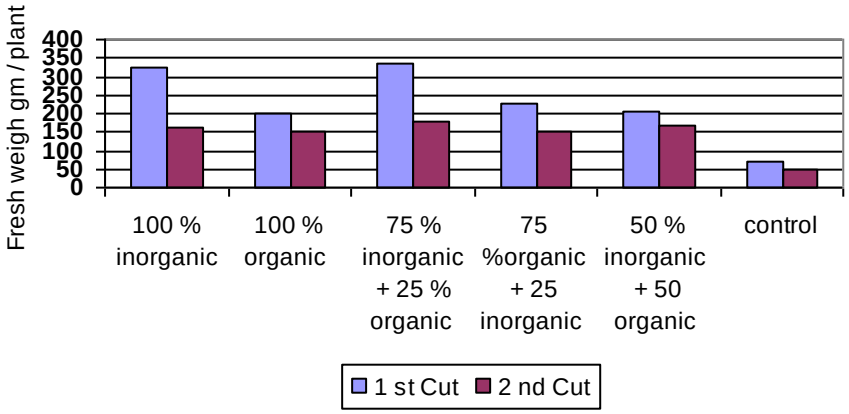

Fig.(3): Effect of fertilization on fresh weight (g. plant^{-1})

Dry weight (g. plant^{-1})

Dry weight values during 1st cuts behaved similarly in the same trend shown by fresh weight of marjoram plant . 100 % inorganic fertilization and 75 % inorganic + 25 % organic fertilization were recorded the highest significant values of dry weight plant^{-1} (104 and 102 g. plan^{-1}t, respectively in 1st cut). While, in 2nd cut , the best significant values of dry weight gm/plant recorded with(75 %inorganic + 25 % organic fertilization) and(50 % inorganic + 50 organic fertilization) were (51.1 and 47.6 g. plant^{-1}). On the other hand, control treatment recorded in 1st and 2nd cuts the lowest significant values of dry weight gm plant^{-1} (13.46 and 16.2 g. plant^{-1} , respectively) . Treating marjoram plants with sheep manure increased the formation of vegetative growth, this may be due to the increase of phosphorus mineralization with sheep manure and the increase in dry weight may be due to increase in fresh weight which was reflected as an increase in the plant height and the shoot number. These results in line with, Gewaily *et al* (2006) reported that, inoculation of marjoram plant with bio fertilizer and using organic residues enhanced the vegetative growth. At the same time, increases in nitrogen content in the soil as a result of nitrogen fixation may enhance the mineralization process, Dewidar (2007).

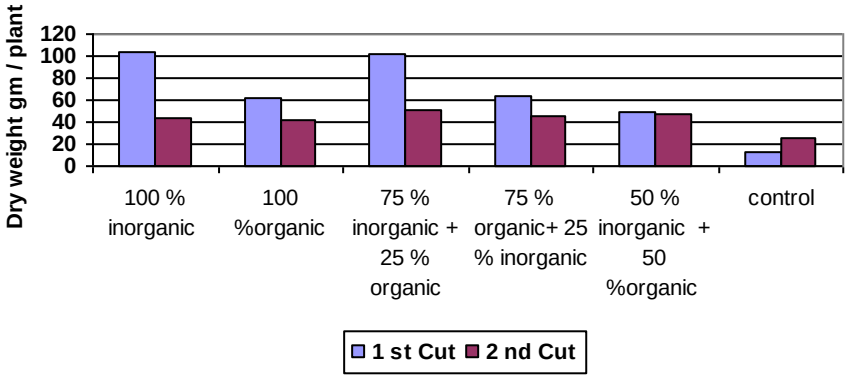

Fig.(4): Effect of fertilization on dry weight (g. plant^{-1})

Dry matter percentages

The highest significant values of Dry matter percentage were recorded with 100%inorganic, 100 % organic and 75 % inorganic + 25 % organic fertilization, in 1st cut were (32.29, 30.10 and 30.26 % respectively). While, in 2nd cut,100% organic , 75 % inorganic+ 25 % organic, 75 % organic+ 25 % inorganic and 50 % inorganic + 50 % organic fertilization treatments recorded the best significant results (27.99, 28.98,29.93 and 28.0 %). On the other hand, the lowest significant values of dry matter percentage in 1st cut were recorded with 50 % inorganic + 50 % organic fertilization (23.1 %). while in 2nd cut, 100 % inorganic fertilization and control treatments recorded the lowest significant values (26.96 % and 25.0 %, respectively). In general, the results of dry matter in both 1st and 2nd cuts showed that, the highest significant values were recorded with 75 % inorganic 25 % organic fertilization (30.2 % in 1st and 28.98 % 2nd cuts, respectively), while the

lowest significant values were recorded with control treatment. Our results were in agreement with, Hanife, *et al*. (2010) who reported that, total dry matter production was improved by the application of manure, and the application of sheep manure on rangelands will be able to increase dry matter yield, Fig 5.

Effect of fertilization treatment, on values of macronutrients content and uptake in plant.

Concerning the effect of fertilization treatments application NPK content and uptake by (*Majorana hortensis* L.) plant, the data presented in Table 5 show that values of NPK content (%) and uptake (mg/plant). Were affected due to the application of fertilization treatments as compared with the untreated control.

The highest values of NPK content % and uptake (mg/plant) obtained with 100% organic and 75% organic + 25% inorganic and 50% organic + 50% inorganic treatments, in both 1st and 2nd cuts as compared with the lowest values with the untreated control. These increases in NPK content % and uptake (mg/plant) by (*Majorana hortensis* L.) plant with organic fertilization might be due to the role of organic fertilization in improving of soil fertility and increasing the availability of these macronutrients. In this concern, Abd-Elhady 2007, who found that application of organic matter, and clay minerals played an important role in chemical behavior of macronutrients in soil and plant. These are in agreement with those of Zai *et al.*, 2008, who stated that the compost of pea residue with chicken manure and chicken manure plus rapeseed residue enriched soil with NPK and other nutrients, and increased nutrient accumulation in plant.

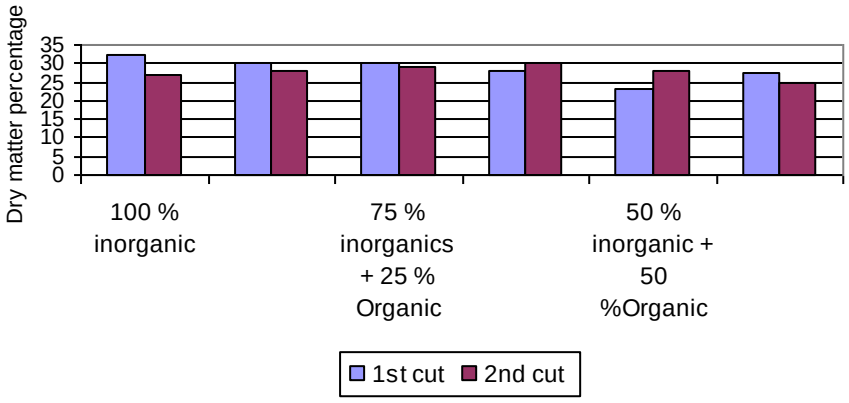

Fig.(5): Effect of fertilization on dry matter percentage

Effect of fertilization treatment on values of micronutrient content and uptake in plant.

The data of micronutrients content and uptake by (*Majorana hortensis* L.) plants, the data presented in Table 4 show that the values of Fe, Zn, Mn and Cu content (mgkg^{-1}) and uptake (µg/plant) were affected due to the application of organic and inorganic fertilization as compared with the untreated control.

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The results showed that the available content($mgkg^{-1}$) and uptake (µg/plant) amounts of Fe, Zn, Mn and Cu were reduced with increasing application of organic fertilization at 100 organic and 75% organic + 25% inorganic treatment as compared with untreated control. This pointed out the important role of application of organic fertilization, which reduced the solubility of heavy metals in soil and plant. These results are in agreement with those of Abd-Elhady (2007) who recorded that the application of organic fertilization were an important soil component in the adsorption of metals. Also, Herwijnen *et al.*, (2007), suggested that metal immobilization and bioavailability are governed by the formation of complexes between metals and organic matter.

Volatile oil percentage

With respect to Volatile oil percentage , the highest two values of volatile oil percentage were recorded in 1st cut with 75 % organic + 25 % inorganic fertilization (1.0 %) and 100 % inorganic fertilization (0.92%). While in 2nd cut with 75 % organic + 25 % inorganic fertilization (1.4 %) and 75 % inorganic + 25 % organic fertilization (1.32 %). On the other hand, the lowest values of volatile oil percentage recorded with control treatment in both two cuts (0.32% and 0.44 %, respectively). Also, previously data showed that, 75 % organic + 25 % organic fertilization recorded the biggest values of volatile oil percentage in both 1st and 2nd cuts (1.0 % and 1.4 %, respectively) . In general, oil yield was much higher for the 2nd cut than that of the 1st under organic fertilization treatment and induced relative increase by about 2-3 fold over the control at the 1st and 2nd cuts. Our results are in line with, El-Ghandour *et al.* (2009) who stated that oil yield was higher in sheep manure amendment treatment from Table 4 and fig.6, It can be concluded that marjoram plants as medicinal plants significantly responded to organic fertilization which positively affected plants vegetative growth and the volatile oil yield.

Table 5: Effect of fertilization on volatile oil of marjoram (*Majorana hortensis* L.) plant.

Fertilization Treatments	Volatile oil %	
	1st cut	2nd Cut
100% inorganic fertilization	0.92	0.96
100 organic fertilization	0.60	1.20
75% inorganic + 25% organic fertilization	0.56	1.32
75 organic +25% inorganic fertilization	1.0	1.40
50 % inorganic + 50 organic fertilization	0.50	1.04
Control	0.32	0.44

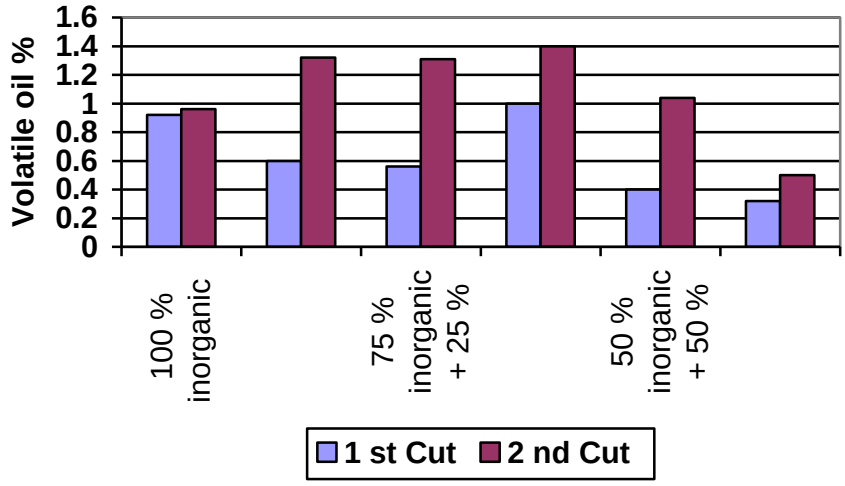

Fig.(6): Effect of fertilization on volatile percent

Data in Table 6 showed that, the main components of marjoram herb were Terpinene-4-ol , limonene , β-pinene and mercene. The highest percentage of Terpinene-4-ol was recorded with control, 75 %organic +25 % inorganic and 100% inorganic fertilization in 2nd cut (39.5, 38.2 and 374 %) while in 1st cut the highest percentage (35.96 %) was recorded with 75 % organic + 25 % inorganic fertilization. In limonene percentage the highest percentage (17.6 and 15.5 %, with 1st and 2nd cuts respectively) were recorded with control treatment.

Table 6: Effect of fertilization on main components of Volatile oil of marjoram (*Majorana hortensis* L.) plant.

Fertilization Treatments	Cuts	Volatile oil component								
	1st cut	Phellandrene	sabinene	β-pinene	Mercene	limonene	Terpinene -4-ol	α-terpinene	Linalyle acetate	β-caryophellene
100% inorganic f.		5.7	5.3	10.1	8.0	10.6	27.0	5.6	1.8	1.9
100% organic f.		1.2	6.8	6.5	8.8	14.2	30.3	6.3	2.1	0.69
75% inorganic + 25%organic f.		4.1	3.8	7.7	11.8	15.2	33.6	5.8	1.1	1.5
75 organic +25% inorganic f.		4.6	4.6	8.6	6.1	8.8	35.9	7.1	2.2	1.6
50 % inorganic + 50 organic f.		3.4	5.1	11.1	8.0	8.9	32.5	4.8	1.4	0.65
Control		1.8	1.9	4.4	1.1	17.6	30.3	7.6	1.9	3.4
100% inorganic f.	2nd cut	5.5	5.7	10.9	8.7	12.4	37.4	5.3	0.00	0.89
100% organic f.		5.4	5.0	9.1	15.8	2.2	29.3	5.9	0.46	2.1
75% inorganic + 25%organic f.		2.4	7.7	14.6	6.4	7.4	34.0	5.7	0.0	1.4
75 organic +25% inorganic f.		1.7	5.9	11.6	5.1	2.4	38.2	8.2	0.4	1.8
50 % inorganic + 50 organic f.		2.5	6.1	10.3	7.9	11.7	30.1	1.2	0.56	0.8
Control		1.2	2.4	7.5	6.2	15.5	39.5	7.0	0.33	0.79

Concerning β-pinene, the best percentage were recorded with 75 % inorganic +25 % organic and 75 %organic +25 % inorganic (14.6 and 11.65 %) in 2nd cut . While in mercene , 100 % organic and 75 % inorganic + 25 % organic fertilization were recorded the best percentage in 2nd and 1st cuts, respectively it were (15.8 and 11.8 %). In general, previous data show that, 2nd cut gave the highest results compared with 1st cut .

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تـأثير التسـميد العضـوى و الكيمـاوى علـى النمـو الخضـري والزيـت الطيـار فـى نبـات البردقوش

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أقيمت تجربة حقلية خلال موسم 2009 /2010م لدراسة تأثيرمستويات التسميد العضوي ومقارنتة بالتسميد الكيماوى على المحصول الخضري وإمتصاص العناصر ومكونات الزيت الطياربالعشب لنبات البردقوش .وقد تم إضافة الاسمدة العضويه (مخلفات الاغنام) بمعدل 20مترمكعب للفدان قبل زراعة نبات البردقوش بشهر .

وقد شملت التجربة المعاملات الاتية:–

1- تسميد معدنى 100%(تبعا للتوصيه السمادية) 2- تسميد عضوى 100% 3- تسميد معدنى 75%+ تسميد عضوى25% 4- تسميد عضوى75%+ تسميد معدنى 25% 5- تسميد عضوى50%+ تسميد معدنى 50% 6- بدون معاملات (كنترول)0وقد تم حصاد نبات البردقوش خلال قطفتين – الاولى تمت بعد الزراعة بأربعة شهور أما القطفة الثانية بعد سبعة شهور من الزراعة 0

ويمكن تلخيص أهم النتائج التى أمكن الحصول عليه فيما يلى :-

- زادت قيم إرتفاع النبات وعدد الافرع للقطفة الاولى والثانية نتيجة لزيادة معاملات الاسمد العضويه مقارنة بالكنترول وكذلك زادت قيم الوزن الطازج والوزن الجاف للنبات للقطفة الاولى والثانية نتيجة لزيادة معاملات الاسمد العضويه مقارنة بالكنترول، وعلى الجانب الاخر زادت نسبة المادة الجافه للعشب فى كلا من القطفه الاولى والثانيه عند معاملات (تسميد معدنى 75%+ تسميد عضوى25%)
- زادت نسبة إمتصاص العناصر الكبرى NPK بينما تناقصت مستويات إمتصاص العناصرالصغرى للنبات للقطفة الاولى والثانية عند زيادة معاملات الاسمد العضويه مقارنة بالكنترول0
- زادت قيم النسبه المئويه للزيت الطيار للقطفة الاولى والثانية مع زيادة معاملات الاسمد العضويه مقارنة بالكنترول0
- زادت قيم (التربينين) المكون الاساسى للزيت للنبات للقطفة الاولى والثانية مع زيادة معاملات الاسمد العضويه مقارنة بالكنترول0

ويعتبر هذا البحث محاولة لتقليل وترشيد استخدام الأسمدة المعدنية نظرا لخطورتها على الصحة العامة وارتفاع تكلفة استخدامها مع الحفاظ على انتاجيه المحاصيل الهامه تحت ظروفنا المحليه.

قام بتحكيم البحث

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Table 4: Effect of fertilization treatment, on values of macro and micro nutrients content and uptake in plant.

Fertilization Treatments	Cut 1st													
	N		P		K		Fe		Mn		Zn		Cu	
	Content (%)	Uptake (mg/plant).	Content (%)	Uptake (mg/plant).	Content (%)	Uptake (mg/plant).	Content ($mgkg^{-1}$)	Uptake (µg/plant).	Content ($mgkg^{-1}$)	Uptake (µg/plant).	Content ($mgkg^{-1}$)	Uptake (µg/plant).	Content ($mgkg^{-1}$)	Uptake (µg/plant).
100% inorganic f.	0.99	10.29	0.302	3.14	.041	0.42	10.61	1103.4	29.44	3061.7	67.20	6988.8	30.6	3182.4
100% organic f.	1.73	10.55	0.336	2.049	0.060	3.66	3.70	225.7	22.68	1383.4	56.97	3475.1	26.71	1629.3
75% inorganic + 25%organic f.	1.44	14.68	0.302	2.06	0.060	0.612	6.62	675.2	26.58	2711.1	48.81	4978.6	12.48	1272.9
75 organic +25% inorganic f.	1.68	10.752	0.386	2.470	0.075	0.480	8.54	565.7	6.66	426.24	86.83	5557.1	19.34	1237.7
50 % inorganic + 50 organic f.	1.53	7.389	0.297	1.434	0.069	0.333	11.43	548.9	30.07	144.2	81.69	3923.5	22.45	1078.2
Control	0.98	1.319	0.270	0.367	0.063	0.084	2.00	114.81	8.53	678.3	50.40	143.07	10.63	25.95
Cut 2														
100% inorganic f.	1.82	0.873	0.427	1.85	0.072	0.313	15.15	441.5	32.35	1407.2	74.85	3255.9	25.76	1120.05
100% organic f.	1.91	7.983	0.539	2.953	0.085	0.355	9.49	395.6	30.45	1272.8	81.05	3387.8	17.66	738.18
75% inorganic + 25%organic f.	2.09	10.679	0.610	3.117	0.080	0.408	13.82	659.2	28.32	1447.1	63.81	3260.6	19.39	990.8
75 organic +25% inorganic f.	1.62	7.241	0.521	2.328	0.083	2.328	11.67	521.6	28.13	1257.4	81.05	3622.9	20.44	951.73
50 % inorganic + 50 organic f.	1.62	7.711	0.485	0.357	0.075	0.357	7.06	336.5	23.86	1135.7	91.24	4343.2	18.25	868.7
Control	1.6	2.292	0.277	0.142	0.088	0.142	1.62	25.95	11.98	191.91	57.4	919.5	11.63	186.3