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Effect of organic and inorganic fertilizers on growth, herbs product and chemical composition of rosemary plants (*Rosmarinus offcinalis L*.)

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ABSTRACT: This study was carried out during two successive seasons of 2015 and 2016 at the Experimental Farm of Ali Mubarak (Nubaria), Horticulture Research Station, Horticulture Research Institute **(HRI)**, Agricultural Research Center **(ARC)**. The aim of this study was decrease the inorganic fertilizers (NPK) from recommended dose (300 – 200 -100) kg/fed. to half (150 – 100 -50) kg/fed .or quarter (75 – 50 -25) kg/fed. with applied organic fertilizer Cattle Manure (**CM**) at 10, 20 and 40 m^3/fed. and effect of it on growth and yield on Rosemary, *Rosmarinus offcinalis* L. The results showed that using organic fertilizer Cattle Manure with decreased inorganic fertilization (NPK) at all concentrations led to an increase in all characters of vegetative growth, essential oil and chemical composition compared to control plants (recommended dose of NPK) .The best results were obtained when using the treatment of CM at 40m^3 /fed. with half recommended dose of NPK(150 – 100 -50) kg/fed.

***Keywords*:** Rosemary, *Rosmarinus offcinalis* L., Fertilizer, Production

INTRODUCTION

Medicinal and Aromatic Plants (MAPs) give considerably higher income than the many other crops in Egypt. They provide the raw materials for the local and foreign drug industry. Lamiaceae (Labiatae) family includes large numbers of medicinal and aromatic plants. *Rosmarinus officinalis* L. (rosemary,) is one of the most important Medicinal and Aromatic Plants (MAPs) which belongs to the Lamiaceae family . It is used externally as parasiticide, cicatrisant, for muscular pains and rheumatism, dermatitis, dandruff and exzema. It promotes hair growth and stimulates scalp. Internally it is used for asthma, bronchitis whooping cough, to stimulate poor circulation, it is employed for palpitation, debility, headache, neuralgia, rental fatigue, nervous exhaustion, and stress-related dissorders, dyspepsia, flatulence, hepatic disorders, hyper cholesterolaemia, and jaundice(Valnet,1973 and Lawless,1992) .Its oil is extensively used in soap, detergents, cosmetics, house-hold sprays and perfumes especially conlognes. Also extensively used in most major food categories, especially meat products, and drinks. Serves as a natural antioxidant (Lawless, 1992). Organic fertilization is a very important method of providing the plants with their nutritional requirements without having an undesirable impact on the environment. For many years, organic fertilization and other methods of biodynamic agriculture (including preventive disease control and preventive pest control) have been used basically as a means of alleviation of the problem of chemical residues in the export market commodities. However, it was soon realized that such agricultural methods are particularly important in newly reclaimed sandy desert land, where they not only help in stabilizing soil fertility, but also sustainably improve the chemical and physical characteristics of the soil. There is now a very fast growing demand for organically grown food products, as well as medicinal and aromatic plants (for both the local and export

markets), which helps in the fast spreading of organic agriculture all over Egypt and in many other countries, especially the developing countries of the southern hemisphere.(Abdelsayed,2003). The main components of essential oil of rosemary are 1, 8 cineol, borneol,Camphor, Burnylacetate, Alpha-pinene and Betapinene,that depending on the geographic location of the plant and the percentage of each of these materialsis variable (Zargari, 1997).

Many researches dealing with the subject were conducted, on *Rosmarinus officinalis* L. plants, Abdelaziz, et.al. (2007) showed that, plants treated by a mixture of compost and microorganisms showed a significant increase in vegetative growth, total N, P and carbohydrate content and essential oil production. The findings clearly indicate that compost and microorganisms could replace conventional NPK fertilizers in the cultivation of rosemary, and consequently minimize environmental pollution by these compounds. Also, Emadi *et al*, (2007), reported the rate of constituents in leaves of *Rosmarinus officinalis* plant being collected in three periods (before, after and during blooming) as α-pinene (20.08%, 27.65% and 17.82%), 1.8-cineole (7.32%, 7.55% and 9.99%) and camphor (9.11%, 8.84 and 15.68%).

Jelacic, et.al. (2007) reported that, The applied biostimulators made a significant effect on the quality of rosemary seedlings. Moreover, Zeinb, Mahmoud, (2012) Showed that, Interaction between compost at 8 ton/ fed. and bio-fertilization of Azotobacter chroococcum, *Bacillus megaterium* and *Bacillus circulans* had a significant effect on vegetative growth characteristics, chemical compositions and essential oil yield of Rosemary plants.Also, Ozcan and Chalchat (2008), studied the composition of *Rosmarinus officinalis* L oil from Turkey, they reported that the yields and the total oil obtained were 1.9%% and 99.93% respectively and the composition is characterized by a high content of p-cymene (44.02%), linalool(20.5%), γ-terpinene (16.62%), thymol (1.81%), β-pinene (3.61%), α-pinene (2.83%) and eucalyptol (2.64%). Singh and Guleria(2013) mentioned that, combined application of vermicompost 10 t ha−1 + fertilizer NPK (100:25:25 kg ha−1) significantly increased the herbage and oil yield of rosemary compared to control (no fertilizer) . Herbage yield increased by 66.1% and oil yield by 54.9% with the application of vermicompost 10 t ha−1 + fertilizer NPK (100:25:25 kg ha−1) which indicated that 50% inorganic fertilizer can supplemented with organic manure without affects the oil yield of rosemary. Also, Valiki and Ghanbari (2015) found that, agronomic traits were very significantly affected by the manure and chemical fertilizers compared to the control. The effect of the manure fertilizer was statistically more that chemical fertilizers on the all characteristics. The maximum plant height, leaf wet and dry weights, wet yield, dry yield and the amount of the essence of the plant were attained when manure fertilizers applied and the maximum stem wet and dry weights and the total number of the chain stems were also attained by chemical fertilizers. Sheep fertilizers as the manure fertilizers increased all the traits and also the rate of essence significantly compared to vermin-compost fertilizers. Chemical fertilizers, has many negative effects on environment and human health as well as economic. In fact, MAPs were used in the therapeutic purposes and folk medicine, so, its production must be safe and free from any chemicals. Accordingly, the aim of the present research was to produce such crops using the organic and nature fertilizers instead of the chemical ones(partially or totally) in order to obtain chemical free and safe products.

Table (1) The physical and chemical characteristics of the soil and cattle manure (CM) in the two seasons (2015 and 2016).

Chemical and physical characteristics			Sandy soil		Chemical and physical characteristics	CM	
			1st season	2nd season		1st season	2nd season
Soluble Cations (meg./100 gm soil)	Soluble Cations	Ca+2	0.60	0.65	N (%)	2.1	2.00
		Mg+2	0.32	0.30	P (%)	1.03	1.02
		Na+	0.40	0.39	K (%)	1.09	1.11
		K+	0.04	0.03	Fe (ppm)	645.16	649.17
	Soluble Anions	Co3 -	…….	…….	Zn (ppm)	152.9	160.7
		Hco3-	0.55	0.52	Mn (ppm)	180.5	183.9
		Cl-	0.40	0.40	Cu (ppm)	43.5	42.5
		So4-	0.41	0.42	Weight of 1 m^3/(kg)	512	510
pH			8	7	pH	6	7
E.C. (ds/m)			0.25	0.27	Humiditiy (%)	23.6	24.9
sand%			94	93	Organic matter content (%)	55.5	60.8
Silt%			2.75	2.71			
Clay%			2.94	2.90			
Texture Class			Sandy				

The fertilization treatments were as follows :

1. NPK1(Control plants)
2. NPK2 with CM1
3. NPK2 with CM2
4. NPK2 with CM3
5. NPK3 with CM1
6. NPK3 with CM2
7. NPK3 with CM3

*NPK1 (300 -200 -100) kg./fed., NPK2 (150 – 100 – 50) kg./fed. and NPK3 (75 – 50 – 25) kg./fed.
*CM1 (Cattle Manure at 10 m^3/fed.), CM2 (Cattle Manure at 20 m^3/fed.) and CM3 (Cattle Manure at 40 m^3/fed.).

In each seasons, two cuts were taken from the plants , the date of the first and second cuts at 20th May and 25th October, respectively, in the first and second seasons.
The following data were recorded for every cut :
Vegetative growth parameters at the end of each cut , the recorded data included plant height (cm), number of branches/plant, fresh and dry weights of herb g/plant, kg/fed. and ton/fed.
Essential oil % was determined in the fresh herb according to British Pharmacopeia(1963), Essential oil yield /palnt (ml) and chemical analysis analyzed using gas liquid chromatographical analysis, to determine their main

constituents. The use of GLC in the quantitative determination was performed using the methods described by Bunzen et al. (1969) and Hoftman (1967).Plant chemical composition : At the end of cuts each season , chemical analysis of fresh leaf samples was conducted to determine their total chlorophyll content using the method described by Saric et al., (1967). The total carbohydrates content in the dried leaves were determined using the method described by Dubois et al., (1959). The Potassium contents in the dried samples of leaves was determined as described by Chapman and Pratt (1961).The experimental design was complete randomized blocks with three replicates.Data were statistically analyzed according to Snedecor and Cochran (1982).

Results and Discussion

Vegetative growth

The results of the two seasons , 2015 and 2016 were recorded in Tables (2) included plant height (cm), number of branches per plant , fresh and dry weights of herb (g /plant). The results cleary indicated that, treatments of organic fertilizer (Cattle Manure) at 10, 20 and 40 m^3/fed. with half dose of chemical fertilizer NPK2(150-100-50) were more effective in increasing plant height (cm), number of branches per plant and fresh and dry weights of herb (g /plant) compared to control plants NPK1 (300-200-100 kg./fed.). The least value was obtained when plants fertilized with of cattle manure (CM1)at 10 m^3/fed. with NPK3 (75-50-25), This was true in the first and second cuts in two seasons.

Plants fertilized with CM^3 (40m^3 /fed.) with NPK2 (150-100-50 kg/fed.) gave the highest values in plant height (cm), [65.25,63.93, 68.86 and 69.41 cm, in the first and second cuts of the first and second seasons, respectively. Also, number of branches per plant were 40.32, 66.88, 40.80 and 65.50, in the first and second cuts of the first and second seasons, respectively. Moreover, fresh weight of herb (FWH) (g /plant) were 624.70, 734.59, 543.47 and 694.93 g/plant, in the first and second cuts of the first and second seasons, respectively. Concerning the dry weight of herb (DWH) (g /plant) the obtained values were 207.64, 254.41, 194.10 and 224.13 g/plant, in the first and second cuts of the first and second seasons, respectively when plants received the same rate of fertilization , compared with chemical fertilizer (control plants) and the rest of the treatments. From the above results, it can be concluded that organic manures (with half or quarter doses from inorganic fertilizer) increased plant height (cm), number of branches per plant , fresh and dry weights of herb (g /plant) . This conclusion is in agreement with the findings of Abdelsayed,(2003),on *Catharanthus roseus* G. plants, , Abdelaziz, et.al. (2007) Jelacic, et.al. (2007), Singh and Guleria (2013)and Valiki and Ghanbari (2015) on rosemary plants.

Table (2) :Effect of organic and inorganic fertilizer on Plant height (cm), Number of branches and Fresh weight (g/plant) of rosemary plant (*Rosmarnus offcinalis* L.) during the two seasons of 2015 and 2016.

	Plant height (cm)				Number of branches/ plant				Fresh weight (g/plant)				Dry weight (g/plant)			
	First season (2012)		Second season (2013)		First season (2012)		Second season (2013)		First season (2012)		Second season (2013)		First season (2012)		Second season (2013)	
	First cut	secon d cut	First cut	secon d cut	First cut	secon d cut	First cut	secon d cut	First cut	secon d cut	First cut	secon d cut	First cut	secon d cut	First cut	secon d cut
NPK1 (control)	**59.99**	**57.80**	**55.50**	**54.67**	**29.77**	**50.28**	**30.51**	**49.50**	**337.45**	**636.70**	**381.79**	**538.22**	**123.87**	**199.85**	**130.66**	**166.03**
NPK2 + CM 1	**60.45**	**59.34**	**57.63**	**63.23**	**32.58**	**61.89**	**35.33**	**59.33**	**570.56**	**700.35**	**524.92**	**601.30**	**191.77**	**211.46**	**167.57**	**202.99**
NPK2 + CM 2	**61.31**	**61.81**	**65.33**	**64.54**	**35.25**	**64.05**	**38.08**	**62.46**	**583.81**	**711.34**	**524.40**	**628.16**	**203.61**	**236.98**	**170.40**	**210.31**
NPK2 + CM 3	**65.25**	**63.83**	**68.86**	**69.41**	**40.32**	**66.88**	**40.80**	**65.50**	**624.70**	**734.59**	**543.47**	**694.93**	**207.64**	**254.41**	**194.10**	**224.13**
NPK3 + CM 1	**48.80**	**50.07**	**45.96**	**47.09**	**26.89**	**50.33**	**27.39**	**49.99**	**323.39**	**602.51**	**360.67**	**523.43**	**123.93**	**199.27**	**124.37**	**157.00**
NPK3+ CM 2	**59.26**	**57.60**	**52.87**	**51.34**	**30.80**	**51.77**	**30.69**	**53.05**	**384.75**	**672.97**	**415.81**	**650.81**	**135.50**	**207.82**	**136.70**	**197.93**
NPK3 + CM 3	**60.13**	**57.49**	**55.47**	**52.94**	**33.82**	**52.99**	**33.35**	**55.86**	**431.48**	**688.97**	**517.09**	**682.42**	**141.35**	**211.21**	**155.80**	**207.30**
Lsd at 0.05	**1.055**	**0.8210**	**1.873**	**2.166**	**1.449**	**2.669**	**1.691**	**1.265**	**6.641**	**5.316**	**6.414**	**6.089**	**3.596**	**2.940**	**5.319**	**4.122**

NPK1 (300-200-100) kg/fed. – NPK2 (150-100-50) kg/fed. - NPK3 (75-50-25) kg/fed - CM 1 (10m3/f) - CM 2 (20m3/f) - CM 3 (40m3/f)

The important role of organic fertilizer (CM) in enhancing the growth of rosmary plant could be attributed due to the stimulation of root growth, which promoted water absorption, as well as the uptake of different nutrients, and their translocation throughout the plant tissues.

Essential oil production

The effect of organic and inorganic fertilization treatments on essential oil percentage and oil yield per plant (ml) of rosemary plants is shown in table 3. The recorded data in both seasons, revealed that, most different fertilization treatments increased essential oil percentage and oil yield per plant (ml), compared to the control plants, exception NPK2, which decreased essential oil percentage compared the control plants in first cut of the first season.

In all cuts of the two seasons, raising the application rate of organic fertilization resulted in a steady increase essential oil percentage and oil yield per plant (ml) of rosemary plants.

In two cuts, of the two seasons, NPK2 (150-100-50 kg/fed.) fertilization with inorganic fertilization (CM3 at 40 m3/fed.) was the superior in this regard. It gave the highest values with means ,0.262 % , 0.309 % , 0.229 % and 0.289 % of essential oil

Table (3): Effect of organic and inorganic fertilizer on Essential oil % and oil yield per plant(ml) of rosemary plant (*Rosmarnus offcinalis* L.) during the two seasons of 2015 and 2016.

	Essential oil %				Oil yield per plant(ml)			
	First season (2012)		Second season (2013)		First season (2012)		Second season (2013)	
	First cut	second cut	First cut	second cut	First cut	second cut	First cut	second cut
NPK1	0.165	0.202	0.158	0.175	0.56	1.29	0.60	0.94
NPK2 + CM 1	0.164	0.203	0.161	0.176	0.94	1.42	0.85	1.06
NPK2 + CM 2	0.180	0.215	0.171	0.179	1.05	1.53	0.90	1.11
NPK2 + CM 3	0.262	0.309	0.229	0.289	1.64	2.27	1.24	2.01
NPK3 + CM 1	0.175	0.199	0.161	0.189	0.57	1.20	0.58	0.99
NPK3+ CM 2	0.184	0.235	0.179	0.205	0.71	1.58	0.74	1.33
NPK3 + CM 3	0.187	0.245	0.205	0.212	0.81	1.69	1.10	1.45

NPK1 (300-200-100) kg/fed. (control) – NPK2 (150-100-50) kg/fed. - NPK3 (75-50-25) kg/fed - CM 1 (10m3/f) - CM 2 (20m3/f) - CM 3 (40m3/f)

percentage, in the first and second cuts of the first and second seasons, respectively, and oil yield per plant (ml) with means of 1.64, 2.27 , 1.24 and 2.01 in the first and second cuts of the first and second seasons, respectively.

From the above results, it can be concluded that organic manures (CM) with decreased inorganic fertilizers increased the essential oil percentage and oil yield per plant (ml). This conclusion is in agreement with the results reported by Attia (1995) on *Pelargonium graveolens*, Abdelsayed,(2003),on *Catharanthus roseus* and Zenib, Mahmoud,(2012). on Rosemary (*Rosmarinus* officin*a*lis).

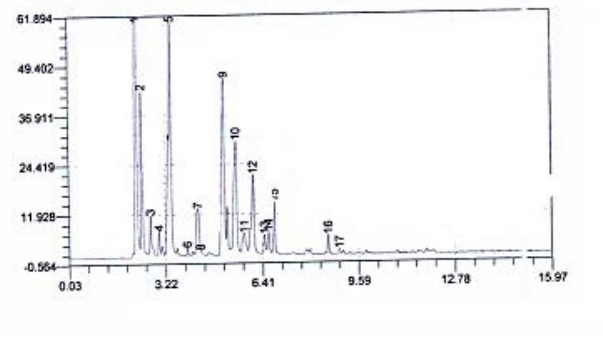
Essential oil components

In total, eleven volatile compounds representing from 57.34 to 65.89 % of the total composition were identified of oil rosemary (*Rosmarinus officinalis* L.) plants and the oil of each treatment was separately subjected to gas liquid chromatography and the main compounds and their relative percentages are shown in (Table 4). Some of the compounds have increased compared to control by treatments and some other have dropped or any percent of these compounds exist. Therefore it can be concluded that the type of components of rosemary essential oil was dependent on the conditions and the treatments, so that in this experiment determined the effect of various fertilizer (organic and chemical) on components of essential oils. The main one being α-pinene followed camphor, camphene, cineol, bornylacetate, β-pinene, limonene, boroneol, ∝-caryophyllene, terpineol and linalool, these results agreement with (Zargari, 1997), Emadi and Amin (2007) and Ozcan and Chalchat 2008) on rosemary plants. ∝-Pinene compound, was found to be the first major compound and Ranged from 18.84 to 19.81%. Its maximum content was observed in the essential oil of the herb that received chemical fertilizers (NPK1) and half doss of chemical fertilizers with cattle manure (NPK3 + CM3), respectively. The second main compound was identified as the camphor, which ranged from its 8.41 to 8.82 % was obtained from plants received NPK2 + CM 2 and NPK3 + CM 1, respectively. Results in accordance with Akbarnia et al, (2003) research on (Trachyspermum ammi), the amounts of nitrogen and phosphorus higher than desirable reduced some oils of

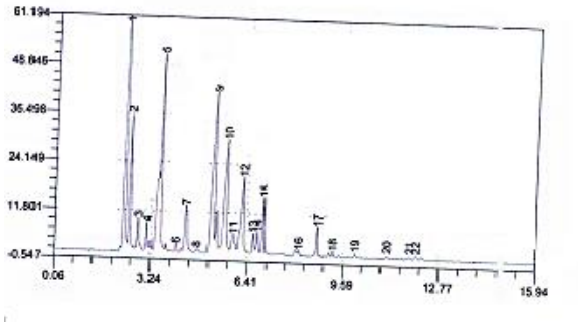
plant. They also suggested that the conventional fertilization system, the main composition (Parasymn, thy mol and Pamatrpynn) with low fertilizer (30 kg N and 20 kg Pha) compared to the control.

Table (4): Effect of organic and inorganic fertilizer on chemical composition of essential oil of rosemary (*Rosmarinus officinalis* L.) plants in the second season 2016.

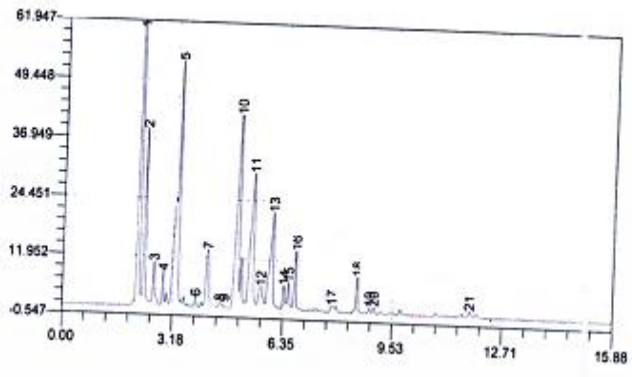
Compounds	NPK1	NPK2 + CM 1	NPK2 + CM 2	NPK2 + CM 3	NPK3 + CM 1	NPK3+ CM 2	NPK3 + CM 3
1. ∝-Pinene	18.84	18.91	18.99	19.21	19.20	19.34	19.81
2.Camphene	7.29	6.96	7.06	7.88	7.28	8.17	7.33
3.β-pinene	4.00	4.08	4.25	4.29	4.89	4.14	4.99
4.Limonene	3.46	3.78	3.88	3.83	3.91	3.98	3.99
5.Cineol	5.56	5.59	5.51	5.61	5.89	5.90	5.76
6.Linalool	0.02	4.29	4.43	4.33	4.77	4.34	4.41
7.Camphor	8.68	8.66	8.41	8.74	8.82	8.82	8.73
8.Terpineol	1.65	1.52	1.52	1.25	1.32	1.78	1.75
9.Borneol	2.25	2.51	2.80	2.88	2.86	2.97	2.99
10. Borneol acetate	2.46	3.55	2.64	2.72	2.38	3.67	3.46
11.∝-Caryophyllene	1.13	1.98	1.73	2.47	2.36	2.70	2.67
Total	**57.34**	**61.83**	**61.22**	**63.21**	**63.68**	**65.81**	**65.89**



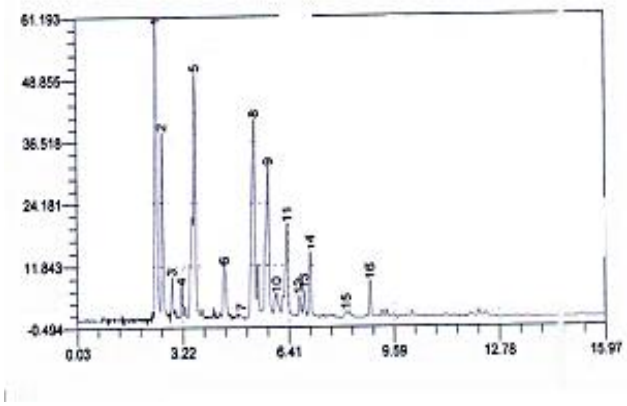
1. Control plants



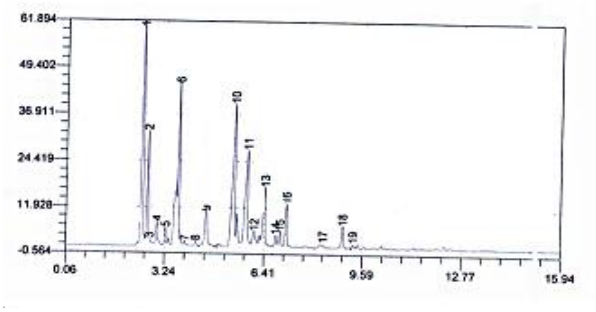
2.NPK2+CM

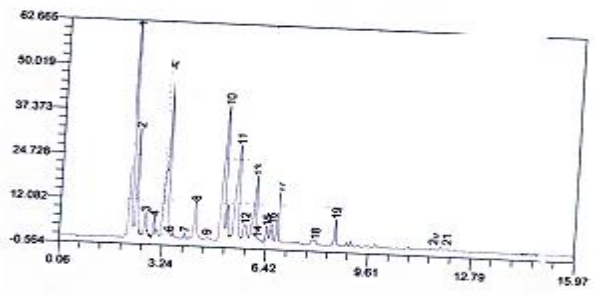


3. NPK2+CM2

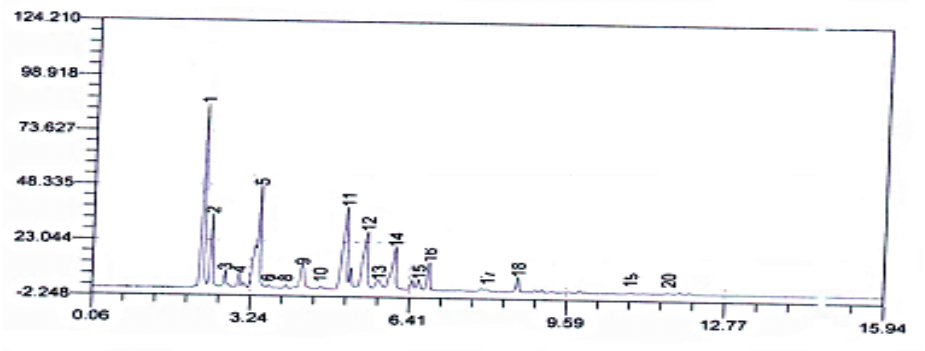


4. NPk3+CM3





5. **NPK3+CM1** **6. NPK3+Cm3**



Figures (1): Effect of organic and inorganic fertilizer on chemical composition of rosemary plant *(Rosmarnus offcinalis L.)* plants during the second season.

Photosynthetic Pigment contents

Data recorded on the response of the chlorophyll , carotenoids contents(mg/g fresh weight) of rosemary plants to organic and inorganic fertilizers , are presented in Table (5). In both seasons, application of different fertilization treatments caused an increase in the chlorophyll and carotenoids contents compared to that of control plants (NPK1). Similar increases in the chlorophyll and carotenoids contents (mg/g fresh weight) as a result of chemical and organic fertilization treatments have been reported by Abdelsayed,(2003),on Catharanthus roseus and Zenib, Mahmoud,(2012) on Rosemary (Rosmarinus officinalis) .The results recorded in the two seasons showed that, the chlorophyll, carotenoids contents(mg/g fresh weight) and anthcyanin contents (mg/g dry weight) were increased gradually by raising the application rate of CM fertilization. The highest values were recorded in plants supplied with NPK2 + CM3 the highest fertilization rates.

Table (5) :Effect of organic and inorganic fertilizer on pigments content (mg/gm fresh weight) of rosemary plant (*Rosmarnus offcinalis* L.)

		Pigments content (mg/gm fresh weight)															
		Chlorophyll (a)				Chlorophyll (b)				Total Chlorophyll				Carotenoids			
		F. Season 2012		S. Season 2013		F. Season 2012		S. Season 2013		F. Season 2012		S. Season 2013		F. Season 2012		S. Season 2013	
		f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut
1	**NPK1(control)**	0.72	0.69	0.76	0.75	0.35	0.31	0.36	0.34	1.07	1.00	1.12	1.09	0.18	0.19	0.17	0.20
2	**NPK2 + CM 1**	0.73	0.72	0.83	0.78	0.35	0.30	0.42	0.40	1.08	1.02	1.25	1.18	0.19	0.21	0.18	0.21
3	**NPK2+ CM 2**	0.81	0.79	0.84	0.82	0.43	0.41	0.42	0.41	1.24	1.10	1.26	1.23	0.19	0.23	0.20	0.21
4	**NPK2 + CM 3**	1.12	1.05	1.22	1.16	0.56	0.55	0.61	0.60	1.68	1.60	1.83	1.76	0.23	0.26	0.25	0.25
5	NPK3+ CM 1	0.71	0.73	0.80	0.77	0.36	0.34	0.40	0.38	1.07	1.07	1.20	1.15	0.18	0.20	0.22	0.23
6	NPK3+ CM 2	0.92	0.87	0.97	0.93	0.42	0.39	0.51	0.49	1.34	1.26	1.48	1.42	0.19	0.20	0.23	0.23
7	NPK3+ CM 3	0.95	0.90	1.01	0.98	0.43	0.42	0.52	0.52	1.38	1.32	1.53	1.50	0.20	0.21	0.23	0.24

NPK1 (300-200-100) kg/fed. – NPK2 (150-100-50) kg/fed. - NPK3 (75-50-25) kg/fed - CM 1 (10m3/f) - CM 2 (20m3/f) - CM 3 (40m3/f)

Total Carbohydrates(mg/g dry weight), N%, P% and K% contents

Data recorded on the response of the total carbohydrates (mg/g dry weight) , N%, P% and K% contents in leaves of rosmary plants to organic and inorganic fertilization , were presented in Table (6). In both seasons, application of organic fertilization (CM) with NPK2(150-100-50) treatments caused an increase in the total carbohydrates (mg/g dry weight), N%, P% and K% contents compared to that control plants(NPK1), on the other hand, application of organic fertilization (CM) with NPK2(75-50-25) treatments caused decreased in the total carbohydrates (mg/g dry weight), N%, P% and K% contents compared to that control plants(NPK1)

The results recorded in the two seasons showed that, the total carbohydrates (mg/g dry weight), N%, P% and K% contents were increased by raising the application rate organic fertilization (CM). Among the different fertilization treatments, the application of CM3 at 40m3/fed. with NPK2 (150-100-50) kg/fed. gave the highest total carbohydrate [(6.25, 6.31, 6.29 and 6.30 mg/g dry weight), N% (3.33, 3.38, 3.42and 3.47) , P%(0.67, 0.67, 0.68 and 0.68 %) and K%,(3.20, 3.22, 3.23 and 3.25 %) in the first and second cuts, in the first and second seasons, respectively].

Similar increases in the total carbohydrates (mg/g dry weight)), N%, P% and K% contents as a result of chemical and organic fertilization treatments have been reported by Zenib, Mahmoud,(2012). on Rosemary (Rosmarinus officinalis).

Table (6) :Effect of organic and inorganic fertilizer on NPK% and Total carbohydrate %of rosemary plant (Rosmarnus offcinalis L.)

		NPK%												Total carbohydrate %			
		N%				P%				K%				F. Season 2012		S. Season 2013	
		F. Season 2012		S. Season 2013		F. Season 2012		S. Season 2013		F. Season 2012		S. Season 2013					
		f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut	f.cut	s.cut
1	NPK1(control)	1.82	1.91	2.01	2.10	0.51	0.53	0.54	0.55	2.39	2.41	2.41	2.44	4.73	4.71	4.75	4.80
2	NPK2 + CM 1	2.15	2.19	2.22	2.25	0.54	0.56	0.55	0.56	2.59	2.61	2.60	2.63	5.10	5.08	5.13	5.11
3	NPK2+ CM 2	2.55	2.61	2.63	2.69	0.60	0.61	0.62	0.63	2.88	2.90	2.95	2.98	5.35	5.42	5.40	5.41
4	NPK2 + CM 3	3.33	3.38	3.42	3.47	0.67	0.67	0.68	0.68	3.20	3.22	3.23	3.25	6.25	6.31	6.29	6.30
5	NPK3+ CM 1	1.16	1.18	1.22	1.29	0.49	0.50	0.50	0.52	1.42	1.45	1.46	1.48	3.14	3.20	3.18	3.16
6	NPK3+ CM 2	1.24	1.26	1.44	1.48	0.50	0.51	0.51	0.53	1.70	1.70	1.72	1.73	3.75	3.64	3.65	3.60
7	NPK3+ CM 3	1.37	1.51	1.59	1.66	0.52	0.52	053	0.55	2.01	2.05	2.04	2.06	4.14	4.20	4.15	4.16

NPK1 (300-200-100) kg/fed. – NPK2 (150-100-50) kg/fed. - NPK3 (75-50-25) kg/fed - CM 1 (10m3/f) - CM 2 (20m3/f) - CM 3 (40m3/f)

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