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EFFECT OF SOME ORGANIC MANURES ON THE GROWTH, VOLATILE OIL YIELD AND CHEMICAL COMPOSITION OF *OCIMUM BASILICUM* L. PLANT

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ABSTRACT: Two types of organic manures namely buffalo manure and cotton compost were applied at three levels; i.e., 12.5, 25 and 50% each by volume to sweet basil plant grown in 30 cm pots filled with washed sand as growing media, besides to control (washed sand). Increasing the buffalo manure up to 25 or 50% had significantly increased plant growth parameters as well as the volatile oil percent. While cotton compost at 12.5 or 25% had a significant effect on the different plant growth characters. Maintime, the volatile oil percent was increased as the cotton compost was increased up to 50%. But the higher values of the yearly oil yield/plant were obtained from the plants received 25% cotton compost, followed by buffalo manure at 50%. Adding the organic manures decreased both linalool and α-terpeniol concentration compared to the control. On the contrary, methyl chavicol was increased due to adding any of the organic manures, especially cotton compost at 50% level. In the same time, ocimene concentration was not affected by any treatments. The two organic manures increased chlorophyll content in plant leaves and also, N,P.K,Fe and Mn, while decreased Zn content in plant herb. From the foregoing results, the addition of cotton compost at 25% or buffalo manure at 50% to sandy growing media could be recommended for basil plant.

INTRODUCTION

Sweet basil is well known for its numerous economical, medicinal and aromatic values, the importance of basil is increasing and has undoubtedly a promising future in Egypt, especially when cultivated in the newly reclaimed sandy soil.

The organic fertilization is a very important factor for providing plants with their nutritional requirements without having an undesirable impact on the environment. Such agriculture methods are, particularly, interest and significantly important in the newly reclaimed sandy soil, where they not only help in increasing and stabilizing soil fertility, but also sustain and improve the chemical and physical characteristics of the soil.

Many investigators reported that adding organic manures as fertilizer led to stimulate biodegradation throw increasing the population and activities of micro-organisms in the soil (Parr, 1975) and minimizing the less of nutrients by leaching (Balbaa, 1973). Moreover, Jacoub (1999) investigated the effect of some organic manures (poultry, cattle and horse manures) and inorganic fertilization (NPK) on growth, oil yield and chemical composition of sweet basil and thyme plants. The plants were planted in 30 cm pots filled with sandy soil and supplied with fertilization treatments. The auther reported that NPK and organic fertilizers increased plant height, number of branches, herb fresh and dry weight/plant, oil percentage and oil yield/plant. Also, NPK and organic fertilizers increased chlorophyll a and b, total carbohydrate, N,P,K and Mn content while, decreased Zn content in basil and thyme plant leaves and stems. It was also found that the treatments increased P-cymene, thymol and carvacrol percentage in thyme oil. Also, Abd El-Raouf (2001) reported that increasing the organic fertilization rates (as compost) significantly increased the growth characters of basil; i.e., plant height, number of branches, herb fresh and dry weights in addition to oil content/plant. The best fertilization rates were 45 and 55 m^3/fed. in the first and the second seasons, respectively. Raising the rate of organic manure from 55 to 65 m^3/fed. reduced the fresh herb yield/fed. The organic fertilization at a rate of 35 m^3 /fed. gave the highest percentage of eugenol, whereas, the treatments had no clear trend on linalool percentage which varied from one season to

another. On the other hand, Singh *et al.* (1990) in field experiments with *Mentha arvensis* showed that increases of 300% in herb, 118% in sucker production, 230% in oil and 175% in net income were obtained when crop received 40 t FYM + 120 kg N/ha. Application of FYM alone at up to 40 t/ha did not significantly increase herb yield. Maheshwari *et al.* (1993) fertilized *Cymbopogon martinii* with FYM at 0 and 15 t/ha and found that FYM increased the herb yield by 8% and oil yield by 10% compared with the control, but the treatment had no significant effect on the geraniol content. Hammam (1996) on anise plants mentioned that the application of farmyard manure (0.46% N), as an organic fertilizer in one dose at the time of soil preparation at rates of 10, 20 and 40 m^3/fed. was less effective (especially at the lowest rate) than chemical fertilization. The highest rate of organic fertilization (40 m^3/fed.) significantly increased plant dry weight when compared to the control. Fruit production was more favourably affected by organic fertilization especially with higher rates (20 or 40 m^3/fed.) than chemical fertilization at low rates. El-Ghawwas *et al.* (2002), on fennel used chiken and animal manures at 14, 21 and 28 m^3/fed. and planting distances at 20, 40 and 60 cm., reported that the third level of the two kinds of manures (28 m^3/fed.) significantly produced the tallest plants at spaces of 60 cm and 40 cm. The second level (21 m^3/fed.) significantly produced the highest number of branches and umbels at 40 cm space. The highest value of fruits yield/plant and per plot was significantly obtained with the second level at 20 cm distance. The highest volatile oil percent was significantly obtained from applying both kinds of manures by the second level at 40 cm and 60 cm spaces respectively. The highest values of anethol were found in the treatments amended with the second level at 20 cm distance for chicken manure and 40 cm for the animal manure. Moreover, Abou El-Fadl *et al.* (1990) studied the effect of different organic manure compost sources; i.e., chicken manure, maize, broad bean, rice straw, peahusks, tomato wastes and orange rind on growth and yield of roselle plants. The results indicated that the highest yield of dry sepals was produced from maize straw compost and bean compost.

The objective of the present work was to study the influence of buffalo manure and cotton compost mixed with sand growing

media at different levels on the growth, volatile oil yield and its quality and chemical composition of sweet basil plant.

MATERIALS AND METHODS

This work was carried out during the two successive growth seasons of 2000 and 2001 at the Experimental Farm, Faculty of Agriculture, Ain Shams University, Shobra El-Kheima, to study the effect of adding two kinds of organic manure; i.e., buffalo manure and cotton compost at different rates on the growth, volatile oil yield and chemical composition of sweet basil plant grown in sandy soil.

Sweet basil seeds were sown in beds on 13th and 10th March 2000 and 2001 for the first and the second season, respectively. After forty five days from planting, seedlings were transplanted to 30 cm pots filled with washed sand amended with: 0, 12.5, 25 and 50% (v/v) of buffalo manure or cotton compost. Buffalo manure was obtained from Milk Replacer Research Center, Faculty of Agriculture, Ain Shams University, Shobra El-Kheima, while cotton compost was prepared by the Egyptian Company for Agricultural Residues Utilization, Dokky, Giza, Egypt. The chemical analyses of both kinds of organic manures were done using a method described by Page (1982) as shown in Table 1.

All plants with the different treatments were fertilized monthly during the two growing seasons with complete fertilizer (El-Badee nitrofrosca) at a constant rate of 30 ml/L as a soil drench. This fertilizer was produced by Abu-Zaabal Fertilizer and Chemical Company. Each litre contains: free azout 100 g (in nitrate form), phosphorus 415 g (ortho phosphoric acid), Mg 2 g, Ca 50 g, Cu 0.59g, traces form sulphure, Fe 15 g, Zn 0.8 g. While potassium sulphate (48% K_2O) was also added monthly at rate of 0.5 g/pot. Treatments were arranged in 3 replications, each containing 10 pots using a complete randomized block design. The plants were harvested 3 times during July, September and November in the two seaosns, and the different growth parameters were recorded. The volatile oil percentage of plant herb at every harvest was estimated according to Guenther (1961). Gas liquid chromatography (G.L.C.) was also performed using a programmed procedure on some oil samples during the third harvest

of the first season in the Central Lab.Fac.of Agric., Ain Shams Univ. The components of basil oil was determined according to Bunzen *et al.* (1969). Nutrients content in dry plant herb

Table 1: Analytical data of organic manures before adding to basil growing sandy soil.

Organic fertilizer / Report	Buffalo manure		Cotton compost	
	1st season	2nd season	1st season	2nd season
Moisture content (%)	3.92	4.63	1.81	1.93
pH	6.51	6.12	8.80	8.72
EC ms/cm	3.11	3.42	4.65	5.11
N%	1.18	1.46	2.26	2.02
P%	0.68	0.34	0.29	0.31
K%	2.86	1.85	3.02	2.78
Organic carbon (%)	22.89	25.95	22.58	23.89
Organic matter (%)	39.47	46.19	51.50	53.61
C/N ratio	19.40:1	17.77:1	9.99:1	11.83:1
Micro-elements (mg/kg)				
Fe	652	811	1397	1150
Mn	106	212	193	211
Cu	43	39	64	93
Zn	79	80	411	398

were determined after wet digestion as follows: Nitrogen % was carried out using Microkjeldahl method according to A.O.A.C. (1990). While P,K, Fe, Zn and Mn were determined using a method mentioned by Chapman and Pratt (1978). Chlorophyll content was determined in the fresh leaves (mg/100 g) according to A.O.A.C. (1990). These chemical analyses were done during the first growing season. Data of both seasons were tabulated and statistically analyzed according to the procedure mentioned by Snedecor and Cochran (1981).

RESULTS AND DISCUSSION

I. Plant growth parameters :

Data of different plant growth parameters of sweet basil plant as affected by organic manures expressed as plant height, number of branches/plant, and fresh, dry weights and yearly yield of herb/plant are found in Table 2, Table 3 and Tables 4 and 5, respectively during the two seasons.

Data reported in these Tables indicate clearly that, in general, increasing buffalo manure led to positive increases in different plant growth parameters. But, it was found that providing basil plants with buffalo manure at low level (12.5%) had no significant effect on the different plant growth parameters. Raising the addition level up to 25 or 50% resulted in steady and significant increases in all plant growth parameters during the two seasons.

On the other hand, it is evident that all vegetative growth characters significantly increased as the addition level of cotton compost was increased to reach 25%, then the values tended to decrease as the rate of cotton compost increased. So, the least values were obtained from the growing media amended with cotton compost at 50%, during the two seasons.

The obtained decrement of plant growth in this work may be due to the higher pH and EC of cotton compost at higher level, which may affected negatively the nutrient absorption by the plant and in turn reflected on the plant growth.

In general, it could be observed that the best treatment was cotton compost and buffalo manure at levels 25 and 50%, respectively. The higher values of the different plant growth characters were confirmed by Singh *et al.* (1990) on *Mentha arvensis*, Hammam (1996) on anise, Abou El-Fadl *et al.* (1990) on roselle, and more recently by El-Ghadban (1998) on marjoram, Jacoub (1999) on sweet basil and thyme, Abd El-Raouf (2001) on sweet basil, and El-Ghawwas *et al.* (2002) on fennel. The results indicate that the organic manures not only extended the plant height, but also increased the number of branches and weight of the plant herb. As an explanation, organic fertilization undoubtedly supplied the growing plants with the required micro and macronutrient

Table 2: Effect of some organic manures on basil plant height (cm) during the two seasons of 2000 and 2001.

% of organic manures mixed with sand growing media		1st season (2000)			2nd season (2001)		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	0	46.17	64.17	65.83	49.17	61.83	64.50
Buffalo	12.5	48.50	68.17	69.33	52.17	64.33	67.17
manure	25	55.67	76.67	72.83	53.83	70.17	74.67
	50	53.33	80.83	74.67	56.83	73.17	78.50
Cotton	12.5	49.33	73.33	70.83	51.67	70.50	72.17
compost	25	54.17	77.67	76.33	52.33	77.33	79.33
	50	45.83	62.17	58.83	54.67	55.67	57.33
L.S.D. at 5%		7.01	6.02	2.67	NS	7.66	2.89
L.S.D. at 1%		NS	8.45	3.75	NS	10.75	4.06

Table 3: Effect of some organic manures on number of branches/plant of sweet basil plant during the two seasons of 2000 and 2001.

% of organic manures Mixed with sand growing media		1st season (2000)			2nd season (2001)		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	0	6.67	9.33	12.67	8.33	10.33	13.33
Buffalo	12.5	7.33	10.33	13.33	9.33	10.67	13.67
manure	25	8.33	12.67	15.00	9.33	12.33	15.33
	50	9.33	13.67	15.67	9.67	14.00	16.33
Cotton	12.5	8.00	11.33	13.67	9.33	12.67	14.67
compost	25	9.00	13.00	16.33	10.00	14.67	17.33
	50	6.33	8.67	12.37	7.33	10.33	12.67
L.S.D. at 5%		1.01	1.32	1.52	0.94	1.23	0.87
L.S.D. at 1%		1.42	1.85	2.13	1.32	1.73	1.22

Table 4: Effect of some organic manures on the fresh and dry weights of herb of sweet basil plant during the first season of 2000..

% of organic manures mixed with sand growing media		F.W. of herb/plant (g)			D.W. of herb/plant (g)			Yearly yield of F.W. and D.W. of herb/plant (g)	
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	F.W.	D.W.
	0	194.83	392.17	348.17	36.17	73.50	66.17	935.17	175.83
Buffalo	12.5	209.50	413.50	360.17	37.83	75.17	67.33	983.17	180.33
manure	25	245.50	532.33	415.33	47.33	104.83	81.17	1193.17	233.33
	50	281.17	564.50	475.17	55.83	113.83	91.33	1320.83	261.00
Cotton	12.5	248.33	508.67	410.67	48.83	101.67	79.83	1167.67	230.33
compost	25	264.83	572.83	503.83	53.33	114.67	97.17	1341.50	265.17
	50	213.67	381.67	320.83	38.67	71.33	57.33	916.17	167.33
L.S.D. at 5%		32.36	28.31	13.96	6.28	5.27	2.92	51.85	7.25
L.S.D. at 1%		45.42	39.73	19.60	8.82	7.39	4.10	72.78	10.08

F.W. = Fresh weight/ D.W. = Dry weight

Table 5: Effect of some organic manures on the fresh and dry weights of herb of sweet basil plant during the second season of 2001..

% of organic manures mixed with sand growing media		F.W. of herb/plant (g)			D.W. of herb/plant (g)			Yearly yield of F.W. and D.W. of herb/plant (g)	
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	F.W.	D.W.
Buffalo manure	0	204.50	434.33	345.50	37.17	82.83	65.83	984.33	185.83
	12.5	219.33	451.67	359.83	39.83	86.17	67.83	1030.83	193.83
	25	238.83	512.83	406.67	45.17	97.83	77.33	1158.67	220.33
	50	264.17	590.50	458.67	52.50	118.17	88.50	1313.33	259.17
Cotton compost	12.5	246.17	536.17	383.83	49.17	104.67	72.83	1166.17	226.67
	25	284.67	608.33	537.33	56.50	122.33	102.67	1430.33	281.50
	50	203.67	429.83	264.17	37.83	80.33	51.33	897.67	169.50
L.S.D. at 5%		11.95	60.88	41.18	2.43	11.48	7.13	66.17	12.53
L.S.D. at 1%		16.78	85.45	57.81	3.41	16.11	10.01	92.87	17.59

F.W. = Fresh weight/ D.W. = Dry weight

elements. Naturally, these elements play important roles in the metabolic processes like photosynthesis, respiration and carbohydrate synthesis. In addition, some heavy metals may accumulate in plant tissues grown on soil treated with organic composts and enhance chlorophyll and carbohydrate content in these plants (Abou El-Seoud *et al.* 1997). Thus it was suggested that organic manures favours both the meristemic activity and extension of cells in the plant under study.

2. Volatile oil content :

Data of oil percentage as affected by organic manures are shown in Table 6. It is clear that increasing organic manures levels increased the volatile oil percentage. In general, it is evident that sand soil amended with buffalo manure or cotton compost at low rate (12.5%) gave nearly the same effect as with the control (sand soil). Raising the level of either buffalo manure or cotton compost up to 25 or 50% to the growing media, resulted in significant increases in oil percent in different harvests compared with the control during the two seasons. The highest volatile oil percentages were generally obtained from applying 50% cotton compost, followed by 25% cotton compost or 50% buffalo manure. This was true during the both seasons.

When the yearly oil yield/ plant was calculated, it could be noticed that the addition of buffalo manure at 12.5% to the growing media had no significant effect compared to the control. While, increasing its level up to 25 or 50%, significant increases of the yearly oil yield/plant were obtained. The addition of cotton compost at any level to the growing media, resulted in significant increases in the yearly oil yield/plant compared with the control.

On the other hand, it is evident that the oil yield/plant was increased by raising the cotton compost level from 12.5 to 25%, then it was decreased at the highest rate (at 50% of growing media). This could be attributed to the decrement in the fresh and dry weights of basil herb per plant when cotton compost was applied at the highest level (50%) to the growing media. The highest yearly oil yield/plant was produced from the sand soil amended with cotton compost at 25%, followed by the sand soil amended with buffalo manure at 50% during the two growing seasons.

Table 6: Effect of some organic manures on the volatile oil percentage and the yearly oil yield/plant (ml.) of sweet basil plant during the two seasons of 2000 and 2001.

% of organic manures mixed with sand growing media		1st season (2000)			Yearly oil yield/plant (ml)	2nd season (2001)			Yearly oil yield/plant (ml)
		Oil %				Oil %			
		1st cut	2nd cut	3rd cut		1st cut	2nd cut	3rd cut	
Buffalo manure	0	0.32	0.25	0.22	0.45	0.33	0.27	0.22	0.48
	12.5	0.33	0.25	0.23	0.48	0.35	0.28	0.22	0.53
	25	0.37	0.32	0.27	0.73	0.38	0.32	0.28	0.69
	50	0.42	0.37	0.30	0.93	0.42	0.35	0.28	0.88
Cotton compost	12.5	0.35	0.28	0.25	0.65	0.37	0.30	0.25	0.65
	25	0.42	0.38	0.32	0.97	0.45	0.42	0.35	1.15
	50	0.45	0.38	0.33	0.63	0.47	0.38	0.37	0.68
L.S.D. at 5%		0.04	0.04	0.03	0.04	0.04	0.06	0.04	0.06
L.S.D. at 1%		0.06	0.06	0.04	0.05	0.06	0.08	0.06	0.08

These results are in accordance with the findings obtained by Jacoub (1999) on basil and thyme, Abd El-Raouf (2001) on basil, Singh *et al.* (1990) on *Mentha arvensis*, Maheshwari *et al.* (1993) on *Cymbopogon martinii* and El-Ghawwas *et al.* (2002) on fennel plant.

3. Chromatographic analysis :

G.L.C. was adapted for oil analysis using some oil samples as shown in Table 7. The chromatogram 1 shows the presence of 16 components as thirteen of them were identified, while the other components remained unidentified (Peaks No. 1, 2 and 7) due to the lack of authentic samples. The obtained data indicate that the major components in sweet basil oil sample of the control treatment (sand soil) were: linalool, methyl chavicol, α-terpeniol, ociemene and eugenol, while the other components were found in small quantities. Generally, it is clear that the two types of organic manures at different levels decreased both linalool and α-terpeniol concentration compared to the control. Whereas, the concentration of methyl chavicol was increased due to the addition of any organic manure, especially with cotton compost at higher level (50%). The ocimene concentration did not clearly affected due to the different treatments. Eugenol concentration fluctuated up and down due to the different addition levels of organic manures compared to the control. Similar results were recorded by Jacoub (1999) on basil and thyme, Abd El-Raouf (2001) on basil and El-Ghawwas *et al.* (2002) on fennel plant.

4. Chemical analyses :

4.1. Chlorophyll content :

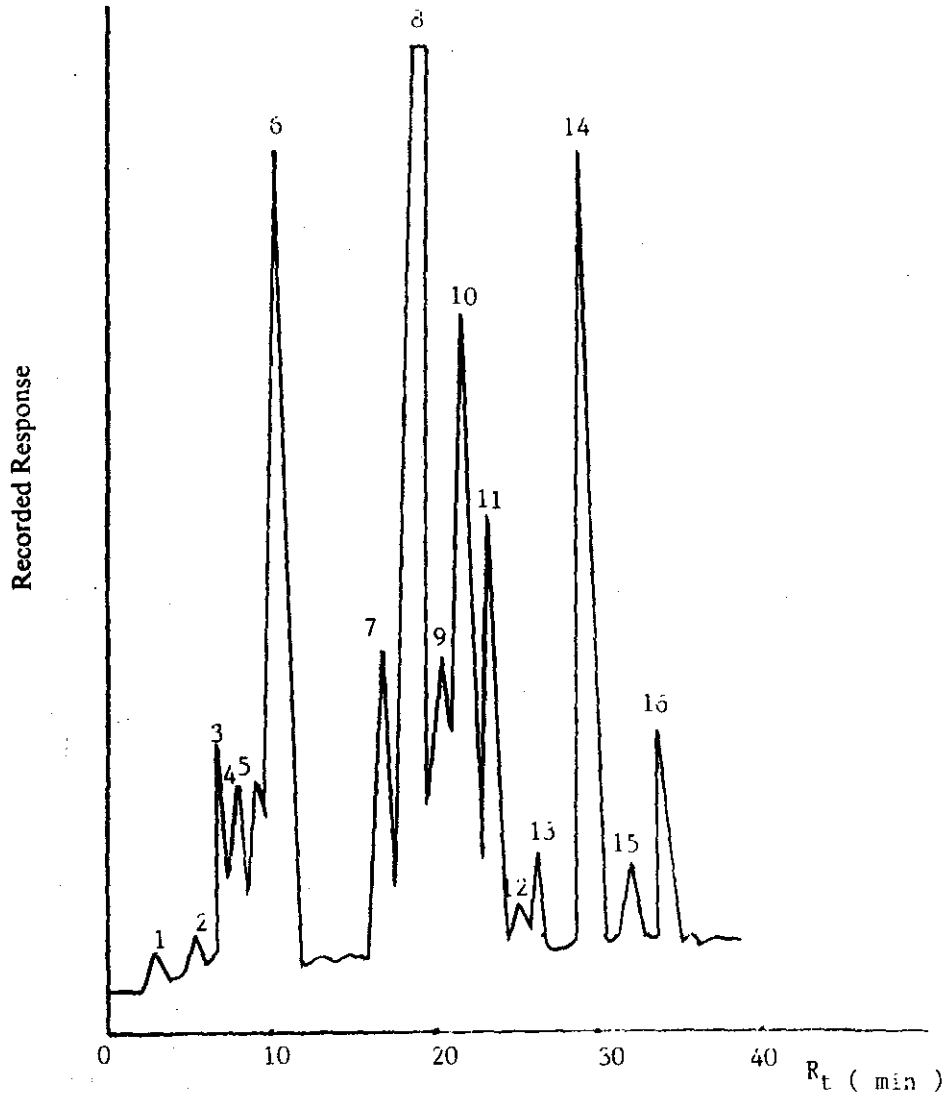
From the foregoing presentation of results in Table 8, it appeared that the application of organic manures; i.e., buffalo manure or cotton compost resulted in increasing the content of chlorophyll in basil plant leaves. Generally it is evident that higher values were resulted with the addition of cotton compost or buffalo manure each at 50% level. While the lowest values were recorded with the control (sand soil) during the different harvests. The previous results were confirmed with those obtained by Jacoub (1999) on basil and thyme plants.

4.2. Macro and micro-nutrients content in plant herb :

Data found in Table 9 reveal generally that, different applied levels of both kinds of organic manures increased the plant herb content of macronutrients (N,P and K) and micronutrients (Fe and Mn) when compared with the control. The highest increments were obtained with the treatment of cotton compost at 25% level, followed by buffalo manure at the rate of 50%. Meanwhile, the lowest values were recorded with

Table 7: The obtained components of sweet basil volatile oil and their percentages as affected by some organic manures during the 3rd harvest of the first season of 2000.

Peak No.	Components	(%) of Buffalo manure			(%) of Cotton compost	
		0	25	50	25	50
1	Unidentified	0.38	0.41	0.32	0.38	0.29
2	Unidentified	0.39	0.53	0.47	0.41	0.51
3	α-pinene	1.57	1.62	1.51	1.53	1.69
4	β-pinene	1.31	1.43	1.71	1.98	1.94
5	Limonene	0.82	1.48	1.02	1.09	1.11
6	Ocimene	7.58	8.63	8.80	7.37	8.58
7	Unidentified	2.68	3.82	3.53	2.73	2.99
8	Linalool	50.42	48.42	45.71	46.49	43.72
9	Linalyl acetate	4.10	3.64	3.48	2.14	3.35
10	α-Terpeniol	8.83	7.72	7.68	8.03	7.06
11	Benzyl acetate	2.99	4.16	5.27	3.81	3.71
12	Nerolidol	1.46	1.34	0.69	0.62	0.54
13	Farnesol	1.16	1.09	1.07	0.67	0.73
14	Methyl chavicol	10.87	11.13	12.84	16.51	19.62
15	Phenyl ethyl alcohol	1.11	0.43	0.29	0.51	0.63
16	Eugenol	4.33	4.15	5.60	5.73	3.53



Chromatogram 1: A typical sample G.L.C. trace showing the separation of the constituents of the essential oil of the untreated basil plant.

Table 8: Effect of some organic manures on the chlorophyll contlent in fresh leaves of basil plant (mg/100 g) during the first season of 2000.

% of organic manures mixed with sand growing media		Chlorophyll content (mg/100 g)		
		1st cut	2nd cut	3rd cut
Buffalo manure	0	32	34	31
	12.5	33	34	29
	25	35	36	32
	50	36	37	34
Cotton compost	12.5	36	38	31
	25	35	38	33
	50	36	39	35

cotton compost treatment at the rate of 50%. On the other hand, it could be noticed that zinc content in basil plant herb tended to decrease generally with the used different organic manures treatments comparing with the control. Similar findings were obtained by Jacoub (1999) on basil and thyme plants.

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Table 9: Effect of some organic manures on the content of macro and microelements in sweet basil herb during the first season of 2000.

% of organic manures mixed with sand growing media		Macroelements (%)								
		N			P			K		
		1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
	0	3.04	3.20	3.51	0.16	0.20	0.23	3.00	3.25	3.25
Buffalo	12.5	3.16	3.34	3.62	0.21	0.25	0.23	3.25	3.25	3.50
manure	25	3.16	3.42	3.66	0.29	0.30	0.32	3.25	3.50	3.75
	50	3.27	3.54	3.92	0.27	0.34	0.33	3.50	3.75	3.75
Cotton	12.5	3.27	3.51	3.57	0.22	0.21	0.23	3.25	3.25	3.50
compost	25	3.51	3.74	3.92	0.24	0.34	0.38	3.50	4.00	4.25
	50	2.92	3.16	3.30	0.18	0.20	0.22	2.75	3.00	3.25
		Micro elements (ppm)								
		Fe			Zn			Mn		
	0	630	645	701	175	211	238	75	81	87
Buffalo	12.5	641	645	711	176	210	238	78	86	85
manure	25	683	692	733	175	203	251	83	86	89
	50	698	713	790	171	201	248	91	94	101
Cotton	12.5	652	667	728	169	208	240	77	87	92
compost	25	711	780	814	173	215	237	93	98	112
	50	641	644	698	164	183	201	76	79	93

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تأثير بعض الأسمدة العضوية على النمو وإنتاج الزيت الطيار والتركيب الكيماوى لنبات الريحان

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أجرى هذا البحث على نبات الريحان بمزرعة التجارب بكلية الزراعة – جامعة عين شمس – شبرا الخيمة – مصر خلال موسمى ٢٠٠٠ ، ٢٠٠١ . وقد أستخدم فى هذا البحث نوعين من الأسمدة العضوية هما : سماد الجاموس العضوى ، مكمورة القطن (كمبوست القطن) .. وقد أضيف كل نوع من هذه الأسمدة بثلاث مستويات هى : ١٢,٥ ، ٢٥ ، ٥٠% الى التربة الرملية المستخدمة فى الزراعة بالإضافة الى بيئة التربة الرملية (كتجربة للمقارنة) وقبل الزراعة تم خلط المستويات المختلفة من الأسمدة العضوية جيداً مع الرمل كنسب حجمية وتم تعبئتها فى أصص رقم ٣٠ .

وأوضحت النتائج أن إضافة سماد الجاموس العضوى بنسبة ٢٥ أو ٥٠% من بيئة الزراعة أدى ذلك الى الحصول على زيادة معنوية فى صفات النمو المختلفة للنبات ، كما أدت الى زيادة النسبة المئوية للزيت الطيار بدرجة معنوية مقارنة مع الكنترول .

وقد لوحظ أن التربة الرملية المضاف اليها مكمورة القطن بنسبة ١٢,٥ أو ٢٥% أدت الى الحصول على زيادة معنوية لصفات نمو النبات المختلفة فى حين تناقصت القيم المتحصل عليها عند رفع النسبة الى ٥٠% .

وعند استخدام مكمورة القطن بنسبة ٢٥ أو ٥٠% أدى الى الحصول على زيادة معنوية فى نسبة الزيت الطيار مقارنة مع الكنترول ، وقد تم الحصول على أعلى قيم للمحصول السنوى للزيت الطيار الناتج من النبات الواحد وبدرجة معنوية من النباتات التى زرعت فى بيئة تحتوى على ٢٥% مكمورة القطن ، يليها سماد الجاموس العضوى بنسبة ٥٠% . وقد لوحظ أن كلا النوعين من الأسمدة العضوية والمضافة بمختلف المستويات أدى الى إنخفاض تركيز كلاً من اللينالول وألفا تربنيول مقارنة مع الكنترول بينما تزايد تركيز الميثيل شافيكول نتيجة لإضافة أياً من الأسمدة العضوية وخاصة مكمورة القطن بالمعدل المرتفع والذى وصل الى ٥٠% ، فى حين لم يتأثر تركيز الأوسيمين بوضوح بالنسبة لجميع المعاملات . وقد أدى إضافة كلاً النوعين من الأسمدة العضوية إلى زيادة محتوى أوراق النبات من الكلوروفيل ، كما أدت الى زيادة كمية كل من : النتروجين ، والفوسفور ، والبوتاسيوم ، والحديد ، والمنجنيز ، بينما أدت إلى خفض كمية الزنك فى عشب النبات .

ومن خلال نتائج هذا البحث فإنه يمكن التوصية بإضافة سماد مكمورة القطن بنسبة ٢٥% أو سماد الجاموس العضوى بنسبة ٥٠% الى التربة الرملية المستخدمة لانتاج نبات الريحان .