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Effect of Mineral Fertelizer and Compost on Vegetative Growth and Essential Oil Content of Yarrow (*Achillea millefolium* l.) Plant.

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ABSTRACT

Two pot experiments were carried out at the Experimental Farm of Medicinal and Aromatic Plants, Faculty of Agric., El-Mansoura Univ., Egypt during the two successive seasons of 2012-2013 and 2013-2014 to investigate the effect of NPK fertilizer and compost treatments on vegetative growth and essential oil of yarrow plant (*Achillea millefolium* L.). Treatments were arranged in a split block design with 3 replicates, which were the simple possible combinations between compost rates (0, 11, 22 and 33 g/ pot) as main plots and NPK rates (0, 1, 2 and 3 g/ pot) as sub plots. The effect of treatments on vegetative growth parameters, inflorescences production ,essential oil percentage and content of the inflorescences were recorded. Data revealed that increasing compost levels significantly increased all the pre-mentioned parameters. The highest values recorded for compost treatments were those using compost at a rate of 33g/ pot. As for NPK fertilization, data also showed that plants received 3 g /pot produced the highest values of all the previously mentioned parameters of yarrow plants. On the same way, the interaction between compost treatments and NPK fertilization significantly affected all traits. The highest values of all parameters in both seasons were recorded from plants received the interaction treatment of compost at 33 g/ pot plus NPK at 3 g/pot.

Keywords: Compost, NPK, Essential oil, Yarrow plant.

INTRODUCTION

Achillea millefolium L., known as Yarrow, Thousand-leaf and Angel flower belongs to the family Asteraceae. Yarrow is a perennial herb that produces one to several stems (20 to 35 cm tall) from underground horizontal rootstock (rhizome) (Bartram, 1995). For medicinal purposes, it is used for treating wounds, colds, fevers, kidney diseases, and for stopping the flow of blood and menstrual pain (Moerman, 1998). The whole plant is used, both fresh and dried (Foster and Duke, 1990). To increase the crops quality especially medicinal and aromatic plants, compost is more acceptable than chemical fertilizers, and organic farming is a quality standard to be matched well by small farmers in Egypt (Abou El-Fadl *et al*., 1990).

One of the most important management techniques is increasing the use of compost and reducing chemical inputs to the soil, especially in newly reclaimed lands under cultivation of medicinal plants. Compost plays a vital role in the soil fertility and productivity and act as a reservoir of plant nutrients especially nitrogen, phosphorous, potassium and micronutrients and, as well, prevents leaching of nutrients. Compost is also important for agricultural specialists due to its characteristics such as high porosity, absorption and storage of mineral elements and their gradual liberalization, its water-holding capacity, and improving growth and quality of horticultural crops and development of sustainable agriculture (Kocabas *et al*., 2010).

Nutrition plays a key role in the growth and development of all crop plants and NPK fertilization is essential for plant growth and development. In the case of medicinal plants that synthesize essential oils, nutrients can effectively increase oil yield and quality (Aziz *et al*., 2010, Zheljazkov *et al*., 2010 and 2011). Nitrogen is used by plants to build many organic compounds: amino acids, proteins, enzymes, and nucleic acids.

Amino acids and enzymes play a key role in the biosynthesis of numerous compounds which are essential oil constituents (Koeduka *et al*., 2006). Phosphorus and potassium also play vital roles in the development of essential oil-producing plants and in essential oil biosynthesis (Prasad *et al*., 2011).

The main objective of the present study was to investigate the effect of compost and NPK fertilization on vegetative growth and essential oil content of *Achillea millefolium* L. plant.

MATERIALS AND METHODS

Two pot experiments were carried out at the Experimental Farm of Medicinal and Aromatic Plants, Faculty of Agric., El-Mansoura Univ. during the two successive seasons of 2012-2013 and 2013-2014 to investigate the effect of mineral fertilizers and compost treatments on growth and essential oil of yarrow (*Achillea millefolium* L.) plant.

Uniform divisions from Yarrow mother plants were taken on 20th October of each seasons and planted in plastic pots (40 cm diameter and 35 cm in depth). Each pot was filled with 10 kg air dried soil taken from the surface layer (0-30cm) of the experimental farm soil. The soil used was analyzed for some physical and chemical properties as shown in Table (A). The electrical conductivity and soil reaction (pH) were measured according to the method of Jackson, (1967). Mechanical analysis and total calcium carbonate were determined by the method of Dewis and Fertais, (1970),Organic matter content was determined according to Mathieu and Pieltain, (2003). Available N, P and K were determined according to Bremner and Mulvany (1982), Olsen and Sommers(1982) and Black(1965), respectively

Compost was obtained from Delta Biotech. Company, Cairo, Egypt, and its chemical properties are presented in Table (B). For treatments containing compost, the top 15 cm of the pot soil was mixed with compost at rates of 0, 11, 22 and 33 g per pot at, watered and left after irrigation for 15 days before cultivation.

Table (A): Some chemical properties of the compost used in the both seasons of 2012-2013 and 2013-2014.

Soil characters		2012-2013	2013-2014
Mechanical analysis (%)	Coarse sand	5.97	5.13
	Fine sand	79.81	80.15
	Silt	8.10	7.45
	Clay	6.12	7.27
	Texture class	Sandy soil	Sandy soil
E.C. $dS.m^{-1}$(1:5)		0.88	0.95
pH (1:2.5)		8.13	8.07
Organic matter (OM %)		0.76	0.83
T. $CaCO_3$ %		4.66	4.49
Available (mg / kg)	N	28.6	29.5
	P	4.77	4.92
	K	136.5	139.6

Table (B): Some physical and chemical properties of the experimental soil during both seasons of 2012-2013 and 2013-2014.

Chemical properties	OM %	OC %	T.N %	C/N Ratio %	SP %	T.P %	T.K %	EC 1:10	PH 1:5
2012-2013	44.95	26.13	1.79	14.6	192	1.37	1.29	3.75	7.03
2013-2014	47.53	27.63	1.83	15.1	188	1.42	1.26	3.87	6.98

Icctafull chemical fertilizer (20:20:20 +TE), a product of Chemical Cid Inc., 6th October, Cairo, Egypt, distributed by of the International Co. for Chemicals and Trade Agencies (ICCTA), Mansoura, Egypt was used in this experiment at rates of 0, 1, 2, and 3 g/pot. Composition of the fertilizer (according to company label) is presented in Table (C). The amount of each fertilizer treatment was divided to ten equal doses. The first dose was added starting from the 1st of November each year, and the rest were added in 20 days intervals between doses.

Table (C): Composition of Icctafull chemical fertilizer.

Elements	N %	P %	K %	Zn ppm	Fe ppm	Mn ppm	Cu Ppm	Mo Ppm	B ppm
Concentration	20	20	20	140	700	420	160	140	220

Experimental design: Sixteen treatments were arranged in split block design with 3 replicates (pots), which were the simple possible combination between compost rates (0, 11, 22 and 33 g/ pot) as main plots and NPK rates (0, 1, 2 and 3 g/ pot) as sub plots. Thus, the total number of pots used for each season was 48 pots.

Soil moisture was kept at 70 % of field capacity by watering to the constant weight every 5-7 days. During the growing seasons, all agricultural practices were performed according to the Ministry of Agriculture and Land Reclamation recommendations

Data collection:

When plants started to flower (starting from the 2nd week of May) in both seasons, inflorescences showed up on the plants were collected throughout the flowering season. Their fresh weights were immediately recorded, and the inflorescences were; then, air dried in the laboratory at room temperature (24 ± 2 °C) and 60-70 % air humidity until constant weight and their dry weights were recorded.

At the end of the experiment in each season, On 1st week of August, 5-8 plants were cut 5 cm above the soil level and their average shoot length (cm) and the fresh weights of the herbs (g) were recorded. The herbs were; then, air dried in a similar way as the inflorescences in the laboratory and their dry weights were recorded.

Essential oil determination:

The essential oil percentage was determined in the inflorescences dried samples (50 g each) in both seasons by subjecting to hydro distillation in Clevenger apparatus according to method described by the Egyptian Pharmacopoeia (1984). The essential oil content per plant was calculated in proportion to the inflorescences dry weight (Oil content / plant = inflorescences dry weight/plant x oil percentage).

Statistical analysis:

All data were statistically analyzed according to the technique of analysis variance (ANOVA) and the least significant difference (L.S.D) method was used to compare the deference between the means of treatment values to the methods described by Gomez and Gomez, (1984). All statistical analyses were performed using analysis of variance technique by means of CoSTATE Computer Software.

RESULTS AND DISCUSSION

Effects of mineral fertilizer and compost on vegetative growth, essential oil percentage and contents of Yarrow (*Achillea millefolium*) plant during two consecutive seasons 2012-2013 and 2013-2014 could be enlightened as follow:-

A. Effects on vegetative growth parameters:

1. Average shoot length:

Data in Table (1) revealed that; in both seasons, compost treatments significantly increased the average shoot length of yarrow plant compared with the control treatment (without compost).

In addition, application of 3 g NPK produced longest average shoot length (60.33 and 63.28 cm in the

first and second seasons, respectively) in comparison with either control plants or all other NPK treatments.

Going along with combination treatments between compost and NPK fertilization, it was obvious from the same table that the treatment combination of 33 g compost + 3 g NPK resulted in significant increase in the average shoot length (62.43 and 65.13 cm in the first and second seasons, respectively) over all other combined treatments. Moreover, it was noteworthy that, during the two growing seasons, the combination treatments of compost + NPK produced significant differences in comparison with control plants.

2. Fresh weight (g/ plant):

Data in Table (1) showed that the treatments of composts at different rates significantly increased the plant fresh weight. The highest mean values recorded were recorded with the addition of compos 33 g/pot (1204.96 and 1276.86 g/plant, respectively during 1st and 2nd seasons) when compared with the control treatment (without compost) which gave 1073.54 and 1105.53 g/plant, respectively during both seasons.

On the other side, it was clear that increasing levels of NPK produced more fresh weight of Yarrow plant. The highest mean values were realized with 3 g NPK (1268.74 and 1362.76 g/plant) in the first and second seasons respectively compared with control and all other NPK treatments.

Concerning other combination treatments between compost and NPK levels, it was distinguished from the same table that the treatment combination of 33 g compost + 3 g NPK resulted in significant increase in the plant fresh weight (1318.73 and 1425.33 g/plant in the first and second seasons, respectively) over all other combined treatments. Moreover, it worth noting that, during the two growing seasons, the combination treatments of compost + NPK produced significant differences in comparison with control plants.

3. Dry weight (g/plant):

Data present in Table (1) showed the effect of compost at three levels on dry weigh of Yarrow plant. Data revealed that increasing compost levels significantly increased dry weight per plant. This increase was true during both seasons. The highest values of dry weight, (325.75 and 398.10 g/ plant) at the first and second season respectively, was recorded using compost at the rate of 33 g/ pot (Compost3).

Table (1) : Effect of compost, NPK fertilizer and their interactions on vegetative growth parameters of yarrow plant during 2012-2013 and 2013-2014 seasons.

Treatments		Average shoot length (cm)		Fresh weight (g / plant)		Dry weight (g /plant)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
Compost							
Control		52.95	55.38	1073.54	1105.53	288.97	292.88
Compost (11g/ pot)		56.14	58.85	1161.57	1220.43	313.28	313.10
Compost (22 g/ pot)		57.03	60.01	1182.76	1246.69	319.26	317.92
Compost (33g/ pot)		57.82	60.24	1204.96	1276.86	325.75	398.10
LSD at 5%		0.30	1.23	0.77	0.90	0.66	2.13
NPK							
Control		51.70	53.86	1041.63	1061.12	279.98	361.19
NPK 1g		54.39	57.20	1113.32	1156.43	299.55	302.01
NPK 2g		57.52	60.13	1199.14	1269.22	323.65	321.28
NPK 3g		60.33	63.28	1268.74	1362.76	344.08	337.51
LSD at5%		0.55	0.99	1.33	1.36	1.43	1.27
Compost × NPK							
Control	Control	49.90	52.10	987.13	998.03	265.97	273.13
	1 g	50.77	52.93	1016.47	1023.30	272.43	279.33
	2 g	53.93	56.10	1102.53	1141.33	296.90	299.73
	3 g	57.20	60.37	1188.03	1259.47	320.57	319.30
Compost (11g)	Control	51.47	53.50	1038.50	1052.73	278.47	285.87
	1 g	54.70	57.63	1123.73	1172.53	302.83	304.67
	2 g	57.93	61.07	1210.50	1287.53	326.33	323.30
	3 g	60.47	63.20	1273.53	1368.93	345.50	338.57
Compost (22g)	Control	52.37	54.47	1059.53	1081.37	284.67	290.33
	1 g	55.80	58.60	1145.60	1199.57	308.60	309.47
	2 g	58.73	62.53	1231.23	1308.53	332.60	328.37
	3 g	61.23	64.43	1294.67	1397.30	351.17	343.50
Compost (33g)	Control	53.07	55.37	1081.33	1112.33	290.83	595.43
	1 g	56.30	59.63	1167.47	1230.30	314.33	314.57
	2 g	59.47	60.83	1252.30	1339.47	338.77	333.73
	3 g	62.43	65.13	1318.73	1425.33	359.07	348.67
LSD at 5%		1.09	1.98	2.66	2.72	2.86	2.54

With regard to the effect of NPK fertilization on dry weight, it is clear from data in Table (1) that plants fertilized with NPK had significantly more dry weights compared to the control. The highest mean values were realized with 3 g NPK (344.08 and 337.5 g/plant) in the first and second seasons respectively compared with control and all other NPK treatments.

Concerning other combination treatments between compost and NPK levels, it was distinguished from the same table that the treatment combination of 33 g compost + 3 g NPK resulted in significant increase in the plant dry weight (359.07 and 348.67 g/plant in the first and second seasons, respectively) over all other combined treatments. Moreover, it worth noting that, during the two growing seasons, the combination

treatments of compost + NPK produced significant differences in comparison with control plants.

Data presented in Table (1) declared that the interaction between compost treatments and NPK fertilization was significantly affected Yarrow dry weights. The highest values of the interactions fertilizer treatments were recorded in general in the plant treated with all compost levels 11, 22 and 33 g/ pot plus 3 g/ pot NPK during the first and second seasons.as compared to untreated plants.

The favorable effects of compost may be explained based on the beneficial effects of both of its effects on the improvement soil physical and biological properties and also, the chemical characteristics resulting from the release of available nutrient elements These results confirmed by Hendawy *et al*. (2010) on *Thymus vulgaris*, Ferraz *et al*. (2014) on *Achillea*.

Increasing vegetative growth due to application of NPK fertilization is a result of the important role of N in plants. N is found in proteins, nuclic acids and co-enzymes, phosphorus also has a role in N_2 fixation, enhance nodulation of plant and increase photosynthesis of plant. Potassium activates some enzymes and K^+ ions play an important role in the control stomatal guard cells of leaves and as well increase photosynthesis (Khalid and Shedeed, 2015).

The results are in agreement with those obtained by Sharma *et al*. (2006) on *Curcuma zedoria*, Mahfouz and Shams-Eldin (2007) on fennel and Chaves *et al*. (2015) on sunflower.

B. Effects on inflorescences production

1. Fresh weight (g/ plant):

Data in Table (2) showed that the treatments of composts at different rates significantly increased inflorescences fresh weight per plant. The highest mean values recorded were recorded with the addition of 33 g of compost (361.5 and 383.1 g/plant, respectively during 1st and 2nd seasons) when compared with the control treatment (without compost) which gave 322.1 and 331.7 g/plant, respectively during both seasons.

As for NPK effect, it was clear that increasing levels of NPK produced more fresh weight of Yarrow plant inflorescences. The highest mean values were realized with 3 g NPK (380.6 and 408.8 g/plant) in the first and second seasons, respectively compared with control and all other NPK treatments.

Concerning other combination treatments between compost and NPK levels, it was distinguished from the same table that the treatment combination of 33 g compost + 3 g NPK resulted in significant increase in the inflorescences fresh weight (395.6 and 427.6 g/plant in the first and second seasons, respectively) over all other combined treatments. Moreover, it worth noting that, during the two growing seasons, the combination treatments of compost + NPK produced significant differences in comparison with control plants.

Table (2): Effect of compost, NPK fertilizer and their interactions on fresh and dry weights of inflorescences (g/plant) of yarrow plant during 2012-2013 and 2013-2014 seasons.

Treatments		Fresh weight of inflorescences (g / plant)		Dry weight of inflorescences (g / plant)	
		1st season	2nd season	1st season	2nd season
		Compost			
Control		322.1	331.7	41.9	43.1
Compost (11g/ pot)		348.5	366.1	45.3	47.6
Compost (22g/ pot)		354.8	374.0	46.1	48.6
Compost (33g/ pot)		361.5	383.1	47.0	49.8
LSD at 5%		5.9	7.85	0.85	0.80
		NPK			
Control		312.5	318.3	40.6	41.4
NPK 1g		334.0	346.9	43.4	45.1
NPK 2g		359.7	380.8	46.8	49.5
NPK 3g		380.6	408.8	49.5	53.1
LSD at 5%		7.55	7.9	0.83	0.75
		Compost× NPK			
Control	control	296.1	299.4	38.5	38.9
	1 g	304.9	307.0	39.6	39.9
	2 g	330.8	342.4	43.0	44.5
	3 g	356.4	377.8	46.3	49.1
Compost (11g)	control	311.6	315.8	40.5	41.1
	1 g	337.1	351.8	43.8	45.7
	2 g	363.2	386.3	47.2	50.2
	3 g	382.1	410.7	49.7	53.4
Compost (22g)	control	317.9	324.4	41.3	42.2
	1 g	343.7	359.9	44.7	46.8
	2 g	369.4	392.6	48.0	51.0
	3 g	388.4	419.2	50.5	54.5
Compost (33g)	control	324.4	333.7	42.2	43.4
	1 g	350.2	369.1	45.5	48.0
	2 g	375.7	401.8	48.8	52.2
	3 g	395.6	427.6	51.4	55.6
LSD at 5%		5.41	5.80	6.53	0.96

C. Dry weight (g/ plant):

Data in Table (2) showed that the treatments of composts at different rates significantly increased inflorescences dry weight per plant. The highest mean values recorded were recorded with the addition of 33 g of compost (47-0 and 49.8 g/plant, respectively during 1st

and 2nd seasons) when compared with the control treatment (without compost) which gave 41.9 and 43.1 g/plant, respectively during both seasons.

As for NPK effect, it was clear that increasing levels of NPK produced more dry weight of Yarrow plant inflorescences. The highest mean values were realized with 3 g NPK (49.5 and 53.1 g/plant) in the first and second seasons respectively compared with control and all other NPK treatments.

Concerning other combination treatments between compost and NPK levels, it was distinguished from the same table that the treatment combination of 33 g compost + 3 g NPK resulted in significant increase in the inflorescences dry weight (51.4 and 55.6 g/plant in the first and second seasons, respectively) over all other combined treatments. Moreover, it worth noting that, during the two growing seasons, the combination treatments of compost + NPK produced significant differences in comparison with control plants.

Increasing inflorescences production due to application of NPK fertilization is a result of the increased growth of the plant caused by nitrogen and phosphorus roles in photosynthesis of plant. Potassium also activates some enzymes and plays an important role the control of stomatal opening as well increase photosynthesis (Khalid and Shedeed, 2015). The results are in agreement with those obtained by Abdelwahab (2005) on rosemary (*Rosmarinus officinalis*) plant.

Compost plays an important role in the soil fertility and productivity since it act as a reservoir of plant nutrients and their gradual liberalization in addition to improving soil chemical and physical characteristics of the soil (Kocabas *et al*., 2010). The results are in agreement with those obtained by Harb and Mahmoud (2009) on Yarrow (*Achillea millefolium*) and Naguib *et al*. (2007) on *Tagetes erecta* plant.

D. Effects on essential oil (%) and essential oil content (ml/ plant):

Data in the Table (3) noticed that essential oil (%) and essential oil content (ml /plant) were significantly affected under all compost treatments during both seasons. The effect of compost on essential oil (%) and essential oil content (ml/ plant) was increased with increasing compost rates. The highest values of essential oil (%) and essential oil content (ml/ plant) were (0.24 and 25 %) and (2.85 and 3.18 ml /plant) treated with compost at 33 g/ pots compared with the untreated plant which was (0.19 and 0.20 %) and (2.05 and 2.24 ml/ plant) for essential oil (%) and essential oil content (ml/ plant) respectively, during the 1st and 2nd seasons.

Table (3): Effect of compost, NPK fertilizer and their interactions on essential oil (%) and content (ml/ plant) on yarrow plant during 2012-2013 and 2013-2014 seasons.

Treatments		Essential oil (%)		Essential oil/ content (ml / plant)	
		1st season	2nd season	1st season	2nd season
			Compost		
Control		0.19	0.20	2.05	2.24
Compost (11g/ pot)		0.22	0.23	2.60	2.83
Compost (22g/ pot)		0.23	0.24	2.73	2.98
Compost (33g/ pot)		0.24	0.25	2.85	3.18
LSD at 5%		0.007	0.003	0.08	0.04
			NPK		
Control		0.17	0.19	1.82	2.03
NPK 1g		0.20	0.21	2.27	2.45
NPK 2g		0.24	0.24	2.84	3.09
NPK 3g		0.26	0.27	3.31	3.67
LSD at 5%		0.005	0.004	0.05	0.04
			Compost× NPK		
Control	Control	0.16	0.17	1.57	1.72
	1g	0.17	0.18	1.69	1.85
	2 g	0.20	0.21	2.19	2.43
	3 g	0.23	0.24	2.75	2.98
Compost (11g)	Control	0.18	0.19	1.83	1.99
	1 g	0.21	0.22	2.32	2.52
	2 g	0.24	0.25	2.91	3.15
	3 g	0.26	0.27	3.35	3.68
Compost (22g)	Control	0.18	0.20	1.94	2.12
	1 g	0.25	0.22	2.46	2.64
	2 g	0.27	0.25	3.05	3.29
	3 g	0.270	0.28	3.50	3.86
Compost (33g)	Control	0.18	0.20	1.94	2.27
	1 g	0.22	0.23	2.60	2.81
	2 g	0.26	0.26	3.21	3.48
	3 g	0.28	0.29	3.67	4.16
LSD at 5%		0.011	0.007	0.10	0.09

Data in Table (3) observed a significant increase in essential oil (%) and essential oil content (ml/ plant) in response to increased rates of NPK treatments 0, 1, 2 and 3 g/pot. Concerning the effect of NPK application, the highest values of essential oil% and essential oil/plant were of plants treated with 3 g/pot NPK application during both seasons compared with the untreated plants.

The interaction between compost and NPK application on essential oil % and essential oil content (ml/ plant) in the Table (3) clearly showed that the highest values were (0.28, 0.29% and 3.67, 4.16 ml/plant)

recorded from the interaction treatment using compost at 33 g/ pot plus 3 g/ pot NPK application during the both seasons

The increment increase in essential oil productivity with treatment of compost could be explained on the basis of available elements, vitamins, gibberellins, cytokines, hormone like substances, amino acids and sugars that lead to an increase in biochemical processes within the plant (luxury of metabolism), consequently an increase in volatile oil content. These results are coincided with those of Santos *et al*. (2009) on *Melissa officinalis*, Hendawy *et al*. (2010) on *Thymus vulgaris* and Valiki *et al*. (2015) on rosemary.

The positive effect of different fertilizer treatments stated that essential oils are terpenoides compounds and biosynthesis of their manufacturer part (Isoprenoids) required the ATP and NADPH. This is due to the fact that the presence of elements such as nitrogen and phosphorus are essential for the formation of the latter compound, so it can be concluded that the use of chemical fertilizers would increase plant essential oil (Loomis and Corteau, 1972).

These results are in agreement with those obtained by several authors, Abdel El-Latif (2006) on *Salvia officinalis*, Ozgoven *et al*. (2008) on Artemisia, Pourhadi (2011) on peppermint and Rahimzada *et al*. (2011) on *Dracocephalum moldavica*.

CONCLUSION

The present work reflected the perceptive effect of compost and NPK fertilization either alone or in combination on yarrow plant. Also enlighten the importance of compost application in newly reclaimed lands to increase soil water holding capacity and available nutrients to plant, which is considered the main factors required for soil reclamation.

In this respect, with reference to growth characters of yarrow plant *Achillea millefolium* (shoot length, fresh and dry weight of plant as well as oil percentage and content), increased in NPK fertilized plants over the untreated plants. Compost either alone or in combination with other treatments on yarrow plants grown in newly reclaimed soil, will improve the physical and chemical properties of treated soil.

As a consequence, the combination of compost plus NPK fertilization could replace the extensive use of mineral fertilizers for the production of yarrow plants and diverseness of other crops. Safety and economic value should be taken into consideration for the production of plants using less of chemical fertilizers which in turn minimize environmental pollution as well as the agricultural costs. As a conclusion, the best vegetative growth and highest essential oil content along with the best oil quality of yarrow plants resulted from application of compost at 33 g plus NPK at 3g/pot.

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تأثير التسميد المعدنى والكمبوست على صفات النمو الخضرى ومحتوى الزيت الطيار لنبات الأشيليا

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اجريت تجربتين اصص فى المزرعه الخاصه بالنباتات الطبيه والعطرية بكليه الزراعه جامعه المنصوره خلال موسمى النمو ٢٠١٢-٢٠١٣ و ٢٠١٣-٢٠١٤ لدراسه تاثير الاسمده المعدنية والكمبوست على النمو الخضرى ومحصول الزيت الطيار لنبات الاشيليا.اشتملت التجربه على ١٦ معامله صممت فى قطاعات منشقه فى وجود ٣ مكررات تمثل التفاعلات الممكنه بين ٣ معاملات من الكمبوست (١١، ٢٢ و ٣٣ جم) للاصيص كمعاملات رئيسيه و ٣ مستويات من التسميد المعدنى للاصيص (١، ٢ و ٣ جم) كمعاملات تحت رئيسيه. تم تقدير تاثير الكمبوست بثلاث مستويات على قياسات النمو الخضرى ووزن الازهار و نسبة و كمية الزيت الطيار.اظهرت النتائج ان زيادة مستويات الكمبوست ادى الى زيادة معنوية لهذة الصفات و كانت اعلى القيم التى تم تقديرها ناتجة من استخدام الكمبوست بمعدل ٣٣جم للاصيص و بالنسبة للتسميد المعدنى اظهرت النتائج ان النباتات المعاملة بمعدل ٣جم للاصيص اعطت اعلى القيم لتلك القياسات لنبات الاشيليا وقد أدى التفاعل بين معاملات الكمبوست بمعدل ٣٣جم و التسميد المعدنى بمعدل.٣جم للاصيص لزيادة معنوية على كل الصفات حيث أعطى اعلى معدل من الكمبوست والتسميد المعدنى أعلى القيم لجميع الصفات التى تم قياسها فى كلا الموسمين .سجلت مستويات السماد العضوى فى صوره كمبوست تاثير معنوى على النمو الخضرى ووزن الازهار ومحصول الزيت للنبات حيث ادت زياده مستويات التسميد العضوى الى زياده فى الصفات المدروسه وسجلت اعلى القيم عند استخدام ٣٣ جم. للاصيص اما بالنسبه لاضافه التسميد المعدنى بمستويات مختلفه فقد ادى الى زياده معنويه فى الصفات المدروسه وسجلت اعلى القيم عند استخدام ٣ جم للاصيص. وتحت نفس التجربه وجد ان الاضافات المشتركه للمعاملات تحت الدراسه ادت الى وجود زياده معنويه وسجلت اعلى القيم بصفه عامه عند استخدام جميع مستويات التسميد العضوي و,اضافه ٣ جم للاصيص من التسميد المعدنى خلال كلا الموسمين.