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EFFECT OF COMPOST, MINERAL NPK, EFFECTIVE MICROORGANISMS AND SOME VITAMIN TREATMENTS ON GROWTH, FRUIT YIELD AND ESSENTIAL OIL CONTENT OF CORIANDER (*CORIANDRUM SATIVUM*, L.) PLANTS

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ABSTRACT: Two field experiments were carried out during 2013/2014 and 2014/2015 seasons at the Experimental Farm, Fac. Agric., Minia Univ. to investigate the effect of compost (0, 5, 7.5 and 10 ton/fed), mineral NPK, effective microorganisms (E.M.), vit. E, vit. B_1, E.M. + vit. E. and E.M. + vit. B_1 on the growth and productivity (fruits and essential oil) of coriander plants.

The obtained data revealed that vegetative growth characters (plant height, stem diameter and herb dry weight/plant), yield components (number of umbels/plant, fruit yield/plant and /fed) and all studied oil production (oil %, oil yield/plant and /fed) were significantly increased due to the application of all levels of compost over those of control treatments. The maximum values were recorded at the high level of compost (10 ton/fed). Vegetative growth characters, fruit yield and essential oil productivity parameters were significantly augmented as a result of using the different six treatments. The most effective treatments in this concern were mineral NPK (full dose) followed by E.M. + vit. E without significant difference between such superior treatments.

While, E.M. plus either vit. E or vit. B_1 gave the highest essential oil %. Moreover, E.M. + vit. E followed by NPK (full dose) recorded the highest essential oil yield/plant and /fed.

It could be recommended to supply *Coriandrum sativum* plants with compost at 10 ton/fed in combination with E.M. + vit. E. to alternative to compost (10 ton/fed) with mineral NPK (full dose) to ensure the safety, not only for human but also for the environment in which we live.

Key words: *Coriandrum sativum*, compost, E.M., NPK, vitamins, growth, essential oil.

INTRODUCTION

Coriander (*Coriandrum sativum*) belongs to the Apiaceae family. It is herbaceous annual plant, which is native to Mediterranean region. The coriander seeds have essential oil as an active substance, while linalool and pinene are the most important constituents of coriander which are used in pharmaceutical, food, perfumery and flavoring industry (Stary and Jirasck, 1975).

It is well known that the chemical fertilizers promote plant growth and productivity of medicinal and aromatic plants such as, Ayat (2007) and Rekaby (2013) on coriander, Al-Shareif (2006) and Abd El-Naeem (2008) on caraway.

Organic material improve soil physical and chemical properties of soil that important for plant growth and improved the volatile oil in coriander (Osman, 2000; Khattab and Gomaa, 2004; Abdalla, 2009 and Rekaby, 2013) and khilla (Abdou *et al*., 2014) and black cumin (Ismail, 2008 and Shoor *et al*., 2010).

Effective microorganisms (E.M.) has been shown to be well for growth and able to increase the production of crops i.e. borage (Abdou *et al*., 2009); *Calendula officinalis* (Ali, 2013) and *Ammi visnaga* (Ibrahim, 2014).

Many authors concluded that some vitamins, as antioxidant materials had positive effects on the growth, yield and oil production such as Ramraj *et al.* (1997) on mustard, Refaat and Balbaa (2001) on lemongrass, Ismail (2008) on black cumin, Ayad *et al.* (2009) on geranium, Hendawy and Ezz El-Din (2010) on fennel, Abdou *et al.* (2013) on caraway and Abdou *et al.* (2014) on khilla.

Production of medicinal and aromatic plants using biofertilizers and natural substances became an essential process to ensure the safety, not only for human, but also for the environment in which we live. Therefore, it would be beneficial to use alternatives to chemical fertilizers. So, the present study was carried out to investigate the effect of compost, effective microorganisms and some antioxidants (vit. E and vit. B_1) on growth, fruit yield and oil production of coriander plants.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive seasons of 2013/2014 and 2014/2015 at the Nursery and Laboratory, Fac. Agric. Minia Univ. Seeds of coriander plants were sown on September 20th for both seasons, in 2.1×2.1 m plots with 70 cm distance between the rows and 30 cm between hills within each raw. So, each plot contained 3 rows and 21 hills. Physical and chemical characters of the used soil are shown in Table (1).

Plants were thinned twice, the first one after one month from planting date and the second one after two weeks from the first one. All other agricultural practices were followed as usual.

A complete randomized block design following the split plot arrangement, in three replicates, was executed in this experiment with four compost treatments (0, 5, 7.5 and 10 ton/fed) in the main plots and six treatments [NPK, effective microorganisms (E.M.), alpha-tocopherol (vit. E), thiamine (vit. B_1), E.M. + vit. E and E.M. + vit. B_1] in the sub plots. Compost amounts, for each treatment, were added to the soil during preparation. Physical and chemical properties of the compost are shown in Table (2).

The full dose of mineral NPK (200 kg

Table 1. Physical and chemical analysis of the experimental soil.

Soil Character	Value	Soil Character		Value
Sand %	28.30	**Available P %**		15.12
Silt %	30.70	**Exch. K^+ (mg/100 g soil)**		2.11
Clay %	41.00	**Exch. Ca^{++} (mg/100 g soil)**		31.74
Soil type	Clayey loam	**Exch. Na^+ (mg/100 g soil)**		2.41
Organic matter %	1.62	**DTPA Ext. ppm**	**Fe**	8.54
$CaCO_3$ %	2.09		**Cu**	2.06
E.C. (mmhos/cm)	1.04		**Zn**	2.75
pH (1:2.5)	7.83		**Mn**	8.26
Total N %	0.08			

Table 2. Physical and chemical properties of the used compost.

Properties	Values	Properties	Values
Dry weight of 1 m^3	450 kg	**C/N ratio**	14.1-18.5
Fresh weight of 1 m^3	650-700 kg	**NaCl %**	1.1-1.75
Moisture (%)	25-30	**Total P %**	0.5-0.75
pH (1:10)	7.5-8	**Total K %**	0.8-1.0
E.C. (m mhose/cm)	2-4	**Fe ppm**	150-200
Total N %	1-1.4	**Mn ppm**	25.56
Org. matter %	32-34	**Cu ppm**	75-150
Org. carbon %	18.5-19.7	**Zn ppm**	150-225

ammonium nitrate + 300 kg calcium superphosphate + 100 kg potassium sulphate /fed) was applied as follows : Total amounts of P fertilizer was added during preparing the soil to cultivation, while all amounts of NK were applied at three batches, after 45 days from planting date at one month intervals thereafter. E.M. was applied three times to the soil beside the plants at 50 ml/hill while, vit. E and vit. B_1 were applied by hand sprayer three times. The first dose (for E.M., vit. E and vit. B_1) was added after 53 days from planting date at one month thereafter.

At the end of experiment, the following data were recorded:

- Vegetative growth characters: Plant height (cm), stem diameter (mm) and herb dry weight/plant (g).
- Yield and yield component parameters: number of umbels/plant, fruit yield/plant (g) and fruit yield per fed (kg).
- Essential oil determination: Essential oil %, essential oil yield/plant (ml) and /fed (liter).

Statistical analysis: The obtained data were tabulated and statistically analyzed according to MSTAT-C (1986) and L.S.D. test at 5 % was followed to compare between the means.

RESULTS

1- Vegetative growth parameters:

Data presented in Table (3) indicates that the three levels of compost had significantly a positive effect on vegetative growth characters i.e. plant height, stem diameter and herb dry weight/plant compared with the control. It is appeared that compost used at 10 ton/fed gave the maximum mean values of plant height (116.97 and 122.45 cm), stem diameter (15.00 and 16.17 mm) and herb dry weight/plant (55.23 and 55.72 g) for both seasons, respectively. Obtained results agreed with those of Rekaby (2013) on coriander and Ibrahim (2014) on khilla plants. Also, the obtained results indicated that all used treatments of mineral NPK, effective microorganisms (E.M.) and/or vit. E or vit. B_1 had remarkably positive effect on vegetative growth characters (plant height, stem diameter and herb dry weight/plant). The treatments of mineral NPK (full dose) followed by E.M. + vit. E. results the best values of vegetative growth traits comparing with other used treatments in both seasons (Table, 3). The roles of mineral NPK on plant growth were obtained by Abd El-Kader and Ghaly (2003), Ayat (2007) and Rekaby (2013) on coriander while biofertilizer as E.M. had positive effect on vegetative growth parameters as reported by Abdou *et al.* (2009) on borage, Ali (2013) on *Calendula officinalis* and Ibrahim (2014) on khilla plants. Also, vitamins as antioxidant increased plant growth characters as mentioned by Ramraj *et al.* (1997) on mustard, Ismail (2008) on black cumin and Abdou *et al.* (2013) on caraway.

The interaction between main and sub plots (A×B) was significant for plant height, stem diameter and herb dry weight/plant

Table 3. Effect of compost, NPK, E.M. and some vitamins (vitamin E and vitamin B_1) on plant height (cm), stem diameter (mm) and herb dry weight/plant (g) of coriander (*Coriandrum sativum*, L.) plants, during the first and second seasons.

NPK, E.M. and some vitamins (vitamin E and vitamin B_1) (B)	Compost levels (ton/fed) (A)									
	1st season (2013/2014)					2nd season (2014/2015)				
	0.0	5.0	7.5	10.0	Mean (B)	0.0	5.0	7.5	10.0	Mean (B)
Plant height (cm)										
NPK	107.1	112.5	118.4	123.2	115.30	112.5	118.1	124.0	129.0	120.90
E.M.	101.1	106.2	111.9	116.4	108.90	106.1	111.5	117.1	121.8	114.13
Vitamin E	98.2	103.1	108.4	112.7	105.60	103.2	108.4	113.8	118.4	110.95
Vitamin B_1	95.6	100.4	105.5	109.7	102.80	99.4	104.4	109.7	114.2	106.93
E.M. + Viamin E	105.6	110.9	116.6	121.3	113.60	110.8	116.3	122.1	126.9	119.03
E.M. + Vitamin B_1	103.2	108.4	113.9	118.5	111.00	108.4	113.8	119.5	124.4	116.53
Mean (A)	101.80	106.92	112.45	116.97		106.73	112.08	117.70	122.45	
L.S.D. at 5 %	A= 4.11		B= 3.71		AB= 7.42	A= 4.73		B= 3.55		AB= 7.10
Stem diameter (mm)										
NPK	13.8	14.5	15.2	16.0	14.88	14.7	15.5	16.3	17.0	15.88
E.M.	12.8	13.4	14.1	14.8	13.79	13.8	14.5	15.3	16.0	14.90
Vitamin E	12.6	13.2	13.9	14.6	13.58	13.6	14.3	15.0	15.8	14.68
Vitamin B_1	12.3	12.9	13.5	14.2	13.23	13.4	14.1	14.7	15.5	14.43
E.M. + Viamin E	13.2	13.8	14.5	15.3	14.20	14.2	14.9	15.7	16.5	15.33
E.M. + Vitamin B_1	13.0	13.6	14.3	15.1	14.00	14.0	14.8	15.4	16.2	15.10
Mean (A)	12.95	13.57	14.25	15.00		13.95	14.68	15.40	16.17	
L.S.D. at 5 %	A= 0.52		B= 0.60		AB= 1.20	A= 0.75		B= 0.55		AB= 1.10
herb dry weight/plant (g)										
NPK	36.9	44.2	52.1	60.1	48.33	42.3	49.9	57.3	65.8	53.83
E.M.	33.9	40.6	48.0	55.2	44.43	36.2	42.4	48.9	56.3	45.95
Vitamin E	32.6	39.2	46.2	53.1	42.78	34.2	40.4	46.4	53.0	43.50
Vitamin B_1	29.6	35.7	42.0	48.4	38.93	30.7	36.3	41.7	48.5	39.30
E.M. + Viamin E	36.2	43.0	51.0	58.6	47.20	40.1	47.2	54.2	55.8	49.33
E.M. + Vitamin B_1	34.5	41.2	48.7	56.0	45.10	37.8	44.4	51.8	54.9	47.23
Mean (A)	33.95	40.65	48.0	55.23		36.88	43.43	50.05	55.72	
L.S.D. at 5 %	A= 2.21		B= 2.40		AB= 4.80	A= 2.82		B= 2.90		AB= 5.80

(Table, 3). The highest values were obtained due to addition compost at 10 ton/fed in combination with mineral NPK (full dose) or E.M. + vit. E.

2- Yield and yield components:

Data presented in Table (4) revealed that compost, mineral NPK, E.M. and some vitamins and their interaction had significant positive effect in number of umbels/plant, fruit yield/plant and /fed. The three levels of compost (5, 7.5 and 10 ton/fed) significantly increased number of umbels/plant, fruit yield per plant and per fed compared with control treatment. However, compost at 10 ton/fed resulted the highest increase of yield and yield components compared with control and other treatments.

Similar results were obtained by Osman (2000) and Abdalla (2009) on coriander and Abdou *et al.* (2014) on *Ammi visnaga*.

All six used treatments had significant effects on number of umbels/plant, fruit yield/plant and /fed (Table, 4). The lowest number of umbels (46.09 and 46.93) fruit yield per plant (23.03 and 24.61 g) and fruit yield/fed (843 and 938 kg) were obtained under thiamine (vit. B_1), while the highest number of umbels/plant (49.18 and 53.56), fruit yield/fed (1230 and 1477 kg) were obtained under mineral NPK (full dose) followed by the treatment of E.M. + vit. E which gave number of umbels (48.01 and 52.61), fruit yield/plant (30.28 and 35.68 g) and fruit yield/fed (1154 and 1359 kg) without significant differences between such two superior treatments. The other three treatments gave intermediate values.

These results are in agreement with those of Abd El-Kader and Ghaly (2003) on coriander, Abdou and Mohamed (2003) on fennel regarding the effects of mineral NPK. While, Abdou *et al.* (2009) on borage, Ali (2013) on *Calendula officinalis* and Ibrahim (2014) on *Ammi visnaga* concluded that E.M. biofertilizer had significantly increased yield of such plants. On the same time, similar findings were obtained by Hendawy and Ezz El-Din (2010) on fennel and Abdou *et al.* (2013) on caraway regarding the effects of some vitamins on yield and yield components.

The interaction treatments was significant for number of umbels/plant, fruit yield/plant and /fed in both seasons as indicated in Table (4).

The highest values were obtained with compost at high level (10 ton/fed) in combination with mineral NPK (full dose) or with E.M. + vit. E.

3- Essential oil productivity:

Essential oil percentage, oil yield/plant and oil yield/fed respond were significantly with compost, mineral NPK, E.M. and/or vit. E or vit. B_1 treatments. Also, interaction between treatments had significant effects on this traits. The highest oil percentages (0.37% and 0.40% in the first and second seasons, respectively), oil yield/plant (0.143 and 0.177 ml in both seasons, respectively) and oil yield/fed (5.728 and 7.072 liter in both seasons, respectively) Table (5) were obtained at 10 ton/fed compost. Similar results were obtained by Osman (2000), Khattab and Gomaa (2004), Abdalla (2009) and Rekaby (2013) on coriander plants.

Mean comparison for mineral NPK (full dose), effective microorganisms and/or vit. E and vit. B_1 showed that E.M. plus either vit. E or vit. B_1 gave the highest oil % while, E.M. + vit. E followed by mineral NPK (full dose) then E.M. + vit. B_1 had the highest essential oil yield/plant and /fed (Table, 5).

Chemical fertilizers promote the essential oil production of coriander (Abd El-Kader and Ghaly, 2003, Ayat, 2007 and Rekaby, 2013). Biofertilizer able to increase the production of crops i.e. Hellal *et al.* (2011) on dill and Zand *et al.* (2013) on anise while, many authors found that some vitamins had positive effects on oil yield such as Refaat and Balbaa (2001) on lemongrass, Hendawy and Ezz El-Din (2010) on fennel.

Table 4. Effect of compost, NPK, E.M. and some vitamins (vitamin E and vitamin B_1) on number of umbels/plant, fruits yield /plant (g/plant) and fruits yield/fed (ton/fed) of coriander (*Coriandrum sativum*, L.) plants, during the first and second seasons.

NPK, E.M. and some vitamins (vitamin E and vitamin B_1) (B)	Compost levels (ton/fed) (A)									
	1st season (2013/2014)					2nd season (2014/2015)				
	0.0	5.0	7.5	10.0	Mean (B)	0.0	5.0	7.5	10.0	Mean (B)
Number of umbels/plant										
NPK	36.48	39.76	43.34	46.87	41.62	37.93	41.34	45.07	48.67	43.25
E.M.	33.10	36.08	39.22	42.47	37.72	34.45	37.55	40.98	44.21	39.30
Vitamin E	31.18	33.99	37.05	40.01	35.56	32.17	35.07	38.29	41.18	36.68
Vitamin B_1	29.68	32.35	35.26	38.08	33.84	30.36	33.09	36.18	38.96	34.65
E.M. + Viamin E	36.11	39.22	42.56	46.23	41.03	37.21	40.56	44.22	47.75	42.44
E.M. + Vitamin B_1	34.06	37.13	40.17	43.51	38.72	35.95	39.19	42.73	46.13	41.00
Mean (A)	33.44	36.42	39.60	42.86		34.68	37.86	41.25	44.48	
L.S.D. at 5 %	A= 2.19		B= 2.01		AB= 4.02	A= 2.55		B= 2.22		AB= 4.44
Fruits yield /plant (g/plant)										
NPK	19.58	26.68	36.08	46.78	32.28	23.55	34.77	42.57	54.15	38.76
E.M.	16.26	22.17	29.89	36.69	26.25	18.55	25.29	34.24	41.83	29.98
Vitamin E	15.11	20.62	21.85	34.52	23.03	17.01	23.18	31.42	38.32	27.48
Vitamin B_1	13.69	18.67	25.26	30.94	22.14	15.21	20.74	28.12	34.35	24.61
E.M. + Viamin E	18.81	25.56	34.41	42.35	30.28	22.08	30.10	40.66	49.87	35.68
E.M. + Vitamin B_1	17.29	23.60	33.66	40.89	28.86	20.56	28.04	37.91	46.67	33.30
Mean (A)	16.79	22.88	30.19	38.70		19.49	27.02	35.82	44.20	
L.S.D. at 5 %	A= 3.91		B= 3.43		AB= 6.68	A= 3.67		B= 3.18		AB= 6.36
Fruits yield /fed (ton/fed)										
NPK	0.746	1.016	1.374	1.782	1.230	0.897	1.325	1.622	2.063	1.477
E.M.	0.619	0.845	1.139	1.398	1.000	0.707	0.963	1.304	1.594	1.142
Vitamin E	0.576	0.786	0.832	1.315	0.877	0.648	0.883	1.197	1.460	1.047
Vitamin B_1	0.522	0.711	0.962	1.179	0.843	0.579	0.790	1.071	1.309	0.938
E.M. + Viamin E	0.717	0.974	1.311	1.613	1.154	0.841	1.147	1.549	1.900	1.359
E.M. + Vitamin B_1	0.659	0.899	1.282	1.558	1.099	0.783	1.068	1.444	1.778	1.269
Mean (A)	0.640	0.872	1.150	1.474		0.742	1.029	1.365	1.684	
L.S.D. at 5 %	A= 0.225		B= 0.131		AB= 0.262	A= 0.236		B= 0.120		AB= 0.240

Table 5. Effect of compost, NPK, E.M. and some vitamins (vitamin E and vitamin B_1) on oil percentage, oil yield /plant (ml) and oil yield /fed (liter) of coriander (*Coriandrum sativum*, L.) plants, during the first and second seasons.

NPK, E.M. and some vitamins (vitamin E and vitamin B1) (B)	Compost levels (ton/fed) (A) 1st season (2013/2014) 0.0	5.0	7.5	10.0	Mean (B)	2nd season (2014/2015) 0.0	5.0	7.5	10.0	Mean (B)
Oil percentage										
NPK	0.28	0.30	0.32	0.35	0.31	0.29	0.31	0.34	0.37	0.33
E.M.	0.27	0.29	0.31	0.34	0.30	0.27	0.31	0.32	0.35	0.31
Vitamin E	0.29	0.31	0.34	0.37	0.33	0.33	0.34	0.40	0.41	0.37
Vitamin B1	0.29	0.31	0.33	0.36	0.32	0.31	0.33	0.37	0.38	0.35
E.M. + Viamin E	0.30	0.33	0.36	0.39	0.35	0.32	0.37	0.41	0.44	0.38
E.M. + Vitamin B1	0.30	0.32	0.34	0.38	0.34	0.31	0.35	0.40	0.44	0.37
Mean (A)	0.29	0.31	0.33	0.37		0.31	0.34	0.37	0.40	
L.S.D. at 5 %	A= 0.02		B= 0.01		AB= 0.02	A= 0.03		B= 0.01		AB= 0.02
Oil yield/plant (ml)										
NPK	0.055	0.080	0.115	0.164	0.100	0.068	0.108	0.145	0.200	0.128
E.M.	0.044	0.064	0.093	0.125	0.079	0.050	0.078	0.110	0.146	0.093
Vitamin E	0.044	0.064	0.074	0.128	0.076	0.056	0.079	0.126	0.157	0.102
Vitamin B1	0.040	0.058	0.083	0.111	0.071	0.047	0.068	0.104	0.131	0.086
E.M. + Viamin E	0.056	0.084	0.124	0.165	0.106	0.071	0.111	0.167	0.219	0.136
E.M. + Vitamin B1	0.052	0.076	0.114	0.155	0.098	0.064	0.098	0.152	0.205	0.123
Mean (A)	0.049	0.071	0.100	0.143		0.060	0.092	0.133	0.177	
L.S.D. at 5 %	A= 0.021		B= 0.008		AB= 0.016	A= 0.028		B= 0.011		AB= 0.022
Oil yield /fed (liter)										
NPK	2.193	3.202	4.618	6.549	4.003	2.732	4.311	5.790	8.014	5.116
E.M.	1.756	2.572	3.706	4.990	3.150	2.003	3.136	4.383	5.856	3.718
Vitamin E	1.753	2.557	2.972	5.109	3.040	2.245	3.152	5.027	6.284	4.067
Vitamin B1	1.588	2.315	3.334	4.455	2.834	1.886	2.738	4.162	5.221	3.445
E.M. + Viamin E	2.257	3.374	4.955	6.607	4.239	2.826	4.455	6.668	8.777	5.423
E.M. + Vitamin B1	2.075	3.021	4.578	6.215	3.925	2.549	3.926	6.066	8.214	4.928
Mean (A)	1.948	2.837	3.985	5.728		2.417	3.675	5.301	7.072	
L.S.D. at 5 %	A= 0.311		B= 0.315		AB= 0.630	A= 0.375		B= 0.322		AB= 0.644

The combination treatments between compost (10 ton/fed) and mineral NPK (full dose) or E.M. + vit. E gave the highest values in both seasons.

DISCUSSION

The obtained results indicated the favorable effect of compost on coriander plant growth and productivity. Organic fertilizer improves the soil texture. The structural improvement can encourage the plant to have a good root development by improving the aeration in the soil, which leads to a higher plant growth. Also, the obtained results indicated the favorable effect of compost on coriander plant productivity, this result might be due to the role of organic material for continues supply of nutrients, growth stimulants, disease suppressors and support biologically diverse and metabolically dynamic process during the plant growth plays an essential role in the biosynthesis of the organic substances (Weltzien, 1990 and Fliessbach *et al*., 2000).

Generally, NPK fertilizers were applied to promote growth in different ways. Nitrogen is responsible for vegetative growth plant above ground and rapid maturity, while, Phosphorus is essential for strong roots and greater resistance to diseases. Potassium protects plant from cold condition and preventing excessive water loss (David Ojo, 1998). While, potassium functions as an osmoticum, reacts synergistically with IAA and carbohydrates translocation, (Mengel and Kirkby, 1987).

Effect of effective microorganisms on plant growth and biological yield was due to increased nutrient uptake and phytohormones. Also, adding of E.M. as biofertilizer to vitamins improve plant growth and increased the fruit yield and oil yield, the combined treatment resulted in maximum improvement of growth and yield of coriander. This improvement may be due to the direct effect of microorganisms (fix nitrogen, release certain phytohormones of GA_3 and IAA) or indirect through the antioxidant activity of vit. E, since they have synergistic effect on growth and productivity. In addition in catching or chelating the free radical which playing toxic role during the plant development (Rao *et al*., 2000).

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تأثير معـــاملات الكمبوست و السماد المعدني والميكروبات الدقيقة النشطة وبعض الفيتامينات على نمو والمحصول ومحتوى الزيت الطيار لنباتات الكزبرة

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تم إجراء تجربة حقلية خلال موسمي ٢٠١٤/٢٠١٣ و٢٠١٥/٢٠١٤ بمزرعة كلية الزراعة – جامعة المنيا لاختبار تأثير الكمبوست (صفر، ٥، ٧,٥ و ١٠ طن/فدان) والسماد المعدني NPK، الميكروبات الدقيقة النشطة، فيتامين هـ، فيتامين ب١، الميكروبات الدقيقة النشطة + فيتامين هـ و الميكروبات الدقيقة النشطة + فيتامين ب١ على نمو وإنتاجية (الثمار والزيت الطيار) للكسبرة. وقد أظهرت النتائج أن صفات النمو الخضري (ارتفاع النبات، سمك الساق والوزن الجاف للعشب للنبات) ومكونات المحصول (عدد النورات للنبات ومحصول الثمار للنبات وللفدان) وكل صفات إنتاج الزيت (النسبة المئوية ومحصول الزيت للنبات وللفدان) زادت معنوياً نتيجة استعمال كل معاملات الكمبوست مقارنة بالكنترول. وكانت أعلى القيم سجلت نتيجة استعمال المستوى العالي من الكمبوست (١٠ طن/فدان).

وقد سجلت النتائج زيادة معنوية في قيم صفات النمو الخضري ومحصول الثمار وإنتاجية الزيت نتيجة استعمال الـ ٦ معاملات المختلفة وكانت أكثرها كفاءة هي السماد المعدني NPK (جرعة كاملة) والميكروبات الدقيقة النشطة + فيتامين هـ بدون فروق معنوية بينهما.

معاملة التسميد الحيوي (E.M.) + إما فيتامين هـ أو فيتامين ب١ أعطت أعلى نسبة مئوية للزيت الطيار بالإضافة إلى أن معاملة التسميد الحيوي (E.M.) + فيتامين هـ تليها معاملة التسميد الكيماوي (جرعة كاملة) سجلت أعلى محصول زيت للنبات وللفدان.

يمكن التوصية بإمداد الكسبرة بالكمبوست عند ١٠ طن/فدان مع الميكروبات الدقيقة النشطة + فيتامين هـ كبديل للكمبوست عند ١٠ طن/فدان مع السماد المعدني NPK (جرعة كاملة) لتأكيد الأمان ليس فقط للإنسان ولكن أيضاً للبيئة التي يعيش فيها الإنسان.