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EFFECT OF COMPOST AND SOME BIO-STIMULANT TREATMENTS ON: A. GROWTH AND FRUIT YIELD PRODUCTION OF CUMIN (*CUMINUM CYMINUM*, L.) PLANTS

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ABSTRACT: A field experiment was carried out at the experimental farm of Fac. of Agric., Minia Univ. during two seasons (2012/2013 and 2013/2014) to study the effect of compost (0, 2.5, 5 and 7.5 ton/fed) and eight bio-stimulant treatments (salicylic acid (Sal.) at 100 and 200 ppm, ascorbic acid (Asc.) at 100 and 200 ppm, active yeast at 5 and 10 g/l, vit. E at 50 and 100 ppm and control) on growth and fruit yield production of cumin plants. The data showed that using 7.5 ton/fed compost significantly increased vegetative growth parameters (plant height, stem diameter, number of branches/plant and herb dry weight/plant) and yield and yield components characters (number of umbels/plant, fruit yield/plant and / weight of 1000 fruits) comparing with other treatments. Treating plants with Sal., Asc., active yeast and vit. E, each at two concentrations significantly increased vegetative growth parameters and yield and yield component characters comparing with control treatment, except Asc. at 100 ppm for weight of 1000 fruits during the first season. The best treatments were Sal. followed by Asc., then active yeast and vit. E, each at high concentrations in this concern.

Key words: Cumin, compost, salicylic acid, ascorbic acid, vitamin E and active yeast.

INTRODUCTION

Cumin (*Cuminum cyminum*) is regarded as the most important medical herb in the country. It is a small and annual umbellifera plant (Apiaceae family) that has a short growing season, low water consumption and a relatively high resistance to environmental tensions (Kafi, 2002), Its aromatic fruits and can be used in curing indigestion and dyspepsia and for increasing milk. It was also shown that cumin can affect gram-positive bacteria (Ani *et al*., 2006).

Organic material improve soil physical and chemical properties that important for plant growth (Synman *et al.,* 1998); Badran *et al*. (2007); Ahmadian *et al.* (2011), Asl and Moosavi (2012), Seghatoleslami (2013) and Patel *et al*. (2013) on cumin found that application of organic fertilization resulted in a significant increase in growth and yield characters.

Active yeast caused a significant increase in vegetative growth and yield production of crops such as cumin (Al-Doghachi *et al*., 2012), coriander (Rekaby, 2013), *Nigella sativa* (Ismail, 2008 and Abdou *et al*., 2013b), caraway (Botros, 2013).

Salicylic acid (Sal.) is an endogenous plant growth regulator. It is involved in various physiological processes of plant growth and development (Cleland, 1974). Furthermore, SA significantly enhance plant growth and yield of many medical plants such as cumin (Al-Shewailly, 2012 and Rahimi *et al.,* 2013), caraway (Shala, 2012, Botros, 2013), coriander (Rekaby, 2013 and Arzandi, 2014).

Some vitamins have been reported to induce significant adverse effects in environment stress (Khan *et al*., 2006). So, many authors concluded that some vitamins (vit. C and vit. E) had positive effect on growth and yield of medicinal and aromatic plants example: Botros (2013) on caraway and Badran *et al*. (2013) on coriander found that ascorbic acid increased all vegetative growth traits and yield production. Moreover, Ismail (2008) on black cumin and Abdou *et al.* (2013a) on caraway concluded that vit. E significantly increased all studied growth characters and fruit production.

The present investigation aimed to study the effect of compost, active yeast, some antioxidants (ascorbic and salicylic acids and vit. E) on vegetative growth and fruit yield of *Cuminum cyminum* plants.

MATERIALS AND METHODS

This field experiment was carried out during the two successive seasons of 2012/2013 and 2013/2014 at the Experimental Farm, Fac. of Agric. Minia Univ.

A randomized complete block design was used in a split plot arrangement with three replicates. The main plots (A) included four levels of compost (0, 2.5, 5 and 7.5 ton/fed), while nine treatments (salicylic acid (Sal.) at 100 and 200 ppm, ascorbic acid (Asc.) at 100 and 200 ppm, vit. E at 50 and 100 ppm, active yeast (*Saccharomyces cerevisiae*) at 5 and 10 g/l in addition to control) occupied the sub plots (B), therefore, the interaction treatments (A×B) were 36 treatments.

The fruits of cumin were sown on October, 5th in both seasons. The experimental unit (plot) was 3 × 3 m and containing 4 rows, 60 cm apart and seeds were cultivated in hills, 25 cm apart, therefore plot contained 48 hills and plant were thinned to two plants/hill after 5 weeks from sowing date. The physical and chemical analysis of the used soil is shown in Table (a).

Compost (called El-Neel compost) was obtained from the Egyptian company for solid waste utilization, El-Minia El-Gdeda City. This compost was added during preparing the soil to cultivation in both seasons. The physical and chemical analysis of the used compost were shown in Table (b).

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

Soil Character	Value	Soil Character		Value
Sand %	27.20	**Available P %**		15.12
Silt %	30.70	**Exch. K^+ (mg/100 g soil)**		2.11
Clay %	42.10	**Exch. Ca^{++} (mg/100 g soil)**		31.74
Soil type	Clayey loam	**Exch. Na^+ (mg/100 g soil)**		2.40
Organic matter %	1.65	**DTPA Ext. ppm**	**Fe**	8.34
$CaCO_3$ %	2.09		**Cu**	2.06
E.C. (mmhos/cm)	1.04		**Zn**	2.71
pH (1:2.5)	7.82		**Mn**	8.16
Total N %	0.08			

Table b. 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

The treatments used were applied as foliar spray twice for each season; the first spray was applied after 38 days from sowing date and after a month thereafter in both seasons. All other agricultural practices were carried out as usual in the two seasons.

Plants were harvested in the start of mature stage (70%) at the second week of April in both seasons.

Data were recorded as follows:

1- Vegetative growth parameters: plant height (cm), stem diameter (mm), number of main branches and herb dry weight (g)/plant.

2- Yield and yield components: number of umbels/plant, fruit yield/plant (g) and fruit yield per fed (kg) and weight of 1000 fruits.

The obtained data were subjected to the statistical analysis of variance MSTAT-C (1986) and L.S.D test at 0.05 was used to compare between average of treatments.

RESULTS AND DISCUSSION

1- Vegetative growth parameters:

Data presented in Tables (1 and 2) showed the response of growth of cumin plants to compost, salicylic acid, ascorbic acid, active yeast and vit. E, as well as, their interaction on vegetative growth (plant height, stem diameter, number of branches and herb dry weight/plant).

Effect of compost: The three levels of compost significantly increased growth parameters comparing with control in both seasons, except, low level (2.5 ton/fed) for stem diameter in the first season and low level for herb dry weight in the second season. Moreover, the data indicated that the obtained values were increased by increasing the level used of compost in the two growing seasons. Therefore, the application of high level of compost (7.5 ton/fed) gave the tallest plants (32.9 and 32.3 cm), the thickest stem diameter (2.68 and 2.99 mm), maximum branch number (4.56 and 4.94) and the heaviest herb dry weight (3.41 and 3.74 g/plant in both seasons, respectively). The promoting effect of compost on vegetative growth parameters may be due to physical and chemical properties of the soil, the microbial function and chelated of macro and microelements content that provide biological and mineral nutrition. These findings were in agreement with those obtained by Badran *et al.* (2007); Ahmadian *et al.* (2011) and Seghatoleslami (2013) on cumin.

Effect of spraying with bio-stimulants: It was clear that applying salicylic acid, active yeast, ascorbic acid (vit. C) and alpha-tocopherol (vit. E), each at two concentrations significantly increased all vegetative growth parameters in both seasons, except active yeast (5 g/l) in the two seasons and ascorbic acid (100 ppm) in the second season for number of branches/plant. Among eight treatments, salicylic acid at 200 ppm recorded the tallestplants (35.6 and 33.4 cm), the thickest stems (2.64 and 2.78 mm), more branches (4.62 and 4.38) and the heaviest herb dry weight (3.36 and 3.38 g/plant in both seasons, respectively), Salicylic acid as an endogenous growth regulators have been reported to induce significant adverse effects in environment stress and have important roles in plant growth and development (Behjou *et al.,* 2014). Our results are in some direction with that of Al-Shewailly (2012) and Rahimi *et al*. (2013) on cumin and Shala (2012) and Botros (2013) on caraway.

Effect of interaction: The combined treatment of compost at 7.5 ton/fed and salicylic acid at 200 ppm resulted in the highest values on most cases.

2- Yield and yield components:

Effect of compost: Data presented in Tables (3 and 4) indicated that the three levels of compost significantly increased umbels number/plant, fruit yield/plant and /fed, as well as, weight of 1000 fruits, in both seasons, as compared with control, except, low level for umbels number in both seasons.

Table 1. Effect of compost, salicylic acid, ascorbic acid, active yeast and vitamin E on plant height (cm) and stem diameter (mm) of *Cuminum cyminum*, L., during the first and second seasons.

Bio-stimulant treatments (B)	Compost levels (ton/fed) (A) 1st season (2012/2013) 0.0	2.5	5.0	7.5	Mean (B)	2nd season (2013/2014) 0.0	2.5	5.0	7.5	Mean (B)
Plant height (cm)										
Control	25.4	27.0	28.6	29.8	27.7	22.8	26.2	28.0	29.0	26.5
Sal. at 100 ppm	27.6	28.5	31.5	31.4	29.8	25.7	25.6	29.2	32.2	28.2
Sal. at 200 ppm	34.3	35.4	36.0	36.6	35.6	31.1	32.2	34.1	36.1	33.4
Asc. at 100 ppm	28.7	29.7	33.3	33.1	31.2	26.3	27.3	28.5	32.2	28.6
Asc. at 200 ppm	31.5	32.9	34.1	35.5	33.5	29.5	31.2	33.7	34.6	32.3
Active yeast at 5 g/l	30.1	30.5	32.3	32.1	31.2	24.2	28.0	30.0	31.2	28.4
Active yeast at 10 g/l	29.7	30.0	32.7	33.6	31.5	27.0	28.8	31.7	32.9	30.1
Vit. E at 50 ppm	27.0	27.4	30.3	30.9	28.9	27.0	28.4	29.8	30.6	28.9
Vit. E at 100 ppm	29.2	30.0	31.9	33.0	31.0	26.5	29.7	32.2	32.2	30.2
Mean (A)	29.3	30.2	32.3	32.9		26.7	28.6	30.8	32.3	
L.S.D. at 5 %	A= 0.51		B= 0.89	AB= 2.81		A= 1.42		B= 1.41	AB= 2.82	
Stem diameter (mm)										
Control	1.28	1.35	2.04	2.21	1.72	1.31	1.62	2.40	2.61	1.98
Sal. at 100 ppm	1.63	1.77	2.10	2.69	2.05	1.46	1.93	2.47	3.10	2.24
Sal. at 200 ppm	2.10	2.41	2.63	3.42	2.64	2.51	2.58	2.82	3.23	2.78
Asc. at 100 ppm	1.91	2.21	2.23	2.86	2.30	1.48	2.16	2.43	2.56	2.16
Asc. at 200 ppm	2.10	2.38	2.44	2.66	2.39	2.15	2.39	2.55	3.13	2.56
Active yeast at 5 g/l	1.79	1.90	2.03	2.53	2.06	2.18	2.25	2.44	3.03	2.48
Active yeast at 10 g/l	1.90	1.95	2.53	2.61	2.25	2.10	2.33	2.48	3.04	2.49
Vit. E at 50 ppm	1.83	2.04	2.28	2.48	2.16	1.82	2.32	2.59	2.90	2.41
Vit. E at 100 ppm	1.91	2.22	2.28	2.66	2.27	2.08	2.38	2.59	3.33	2.60
Mean (A)	1.83	2.02	2.29	2.68		1.90	2.22	2.53	2.99	
L.S.D. at 5 %	A= 0.24		B= 0.20	AB= 0.40		A= 0.24		B= 0.18	AB=0.36	

Sal.: Salicylic acid Asc.: Ascorbic acid Vit. E: Vitamin E

Table 2. Effect of compost, salicylic acid, ascorbic acid, active yeast and vitamin E on number of branches/plant and herb dry weight (g) of *Cuminum cyminum*, L., during the first and second seasons.

Bio-stimulant treatments (B)	Compost levels (ton/fed) (A) 1st season (2012/2013) 0.0	2.5	5.0	7.5	Mean (B)	2nd season (2013/2014) 0.0	2.5	5.0	7.5	Mean (B)
Number of branches/plant										
Control	3.28	3.49	3.96	4.26	3.75	3.25	3.85	3.98	4.6	3.92
Sal. at 100 ppm	3.31	3.54	4.10	4.96	3.98	3.41	3.93	4.37	5.14	4.21
Sal. at 200 ppm	4.01	4.32	4.62	5.53	4.62	3.83	4.21	4.56	5.93	4.38
Asc. at 100 ppm	3.46	3.86	3.96	4.87	4.04	3.39	3.8	3.95	4.57	3.93
Asc. at 200 ppm	3.64	3.86	3.99	4.37	3.97	3.76	4.15	4.35	5.12	4.35
Active yeast at 5 g/l	3.48	3.71	3.82	4.08	3.77	3.7	4.11	4.28	4.21	4.08
Active yeast at 10 g/l	3.73	3.95	4.29	4.50	4.12	3.8	4.21	4.37	5.06	4.36
Vit. E at 50 ppm	3.64	3.89	3.83	4.13	3.87	3.68	4.06	4.27	4.7	4.18
Vit. E at 100 ppm	3.31	3.81	3.98	4.30	3.85	3.83	4.19	4.25	5.01	4.32
Mean (A)	3.54	3.83	4.06	4.56		3.63	4.06	4.26	4.94	
L.S.D. at 5 %	A= 0.27		B= 0.10	AB= 0.20		A= 0.42		B= 0.26	AB= 0.52	
Herb dry weight (g)/plant										
Control	2.30	2.38	2.58	2.99	2.56	2.30	2.68	2.89	3.36	2.81
Sal. at 100 ppm	2.27	2.40	2.62	3.60	2.72	2.30	2.82	3.12	4.01	3.06
Sal. at 200 ppm	2.84	3.19	3.26	4.17	3.36	2.85	3.13	3.49	4.03	3.38
Asc. at 100 ppm	2.31	2.59	2.74	3.48	2.78	2.74	2.90	2.98	3.37	3.00
Asc. at 200 ppm	2.89	2.94	3.04	3.45	3.08	2.76	2.79	3.04	3.57	3.04
Active yeast at 5 g/l	2.35	2.45	2.74	3.25	2.70	2.93	3.03	3.11	3.88	3.24
Active yeast at 10 g/l	2.50	2.53	2.93	3.37	2.83	2.90	2.96	3.26	3.96	3.27
Vit. E at 50 ppm	2.15	2.83	2.94	3.28	2.80	2.65	3.23	3.35	3.62	3.21
Vit. E at 100 ppm	2.39	2.82	2.90	3.08	2.80	2.81	2.83	3.17	3.89	3.17
Mean (A)	2.44	2.68	2.86	3.41		2.69	2.93	3.16	3.74	
L.S.D. at 5 %	A= 0.21		B= 0.14	AB= 0.28		A= 0.47		B= 0.14	AB= 0.28	

Sal.: Salicylic acid Asc.: Ascorbic acid Vit. E: Vitamin E

Table 3. Effect of compost, salicylic acid, ascorbic acid, active yeast and vitamin E on umbels number/plant and fruit yield/plant (g/plant) of *Cuminum cyminum*, L., during the first and second seasons.

Bio-stimulant treatments (B)	Compost levels (ton/fed) (A) 1st season (2012/2013)					2nd season (2013/2014)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
Umbels number/plant										
Control	25.6	24.5	25.3	26.4	24.9	24.6	27.3	28.6	33.2	28.4
Sal. at 100 ppm	24.8	26.1	30.6	34.5	29.0	27.2	29.6	30.8	34.7	30.6
Sal. at 200 ppm	31.0	32.0	34.5	38.4	34.0	31.9	32.2	33.7	36.3	33.5
Asc. at 100 ppm	27.3	27.8	30.5	33.4	29.7	29.3	29.5	31.7	32.1	30.6
Asc. at 200 ppm	31.4	31.9	32.4	33.6	32.3	31.0	31.1	31.0	37.6	32.7
Active yeast at 5 g/l	24.7	25.8	28.5	30.8	27.5	28.3	29.1	30.6	35.1	30.8
Active yeast at 10 g/l	27.1	29.0	30.2	30.4	29.2	29.8	30.2	31.4	35.5	31.7
Vit. E at 50 ppm	28.1	29.0	29.3	30.1	29.1	30.1	30.8	31.1	34.7	31.7
Vit. E at 100 ppm	27.4	29.8	30.3	32.7	30.1	30.6	30.8	31.4	35.5	32.1
Mean (A)	27.3	28.4	30.2	32.2		29.2	30.1	31.1	35.0	
L.S.D. at 5 %	A= 1.4		B= 1.8	AB= 3.6		A= 1.5		B= 1.6	AB= 3.2	
Fruit yield/plant (g/plant)										
Control	6.96	7.64	8.88	10.08	8.39	7.12	7.40	9.64	12.72	9.22
Sal. at 100 ppm	7.95	8.44	9.92	13.19	9.87	9.60	10.48	11.17	14.60	11.46
Sal. at 200 ppm	10.64	11.40	12.76	15.00	12.45	11.76	11.92	13.16	15.16	13.00
Asc. at 100 ppm	8.73	10.07	9.32	12.88	10.25	10.00	10.20	10.45	12.32	10.74
Asc. at 200 ppm	11.08	11.64	11.92	12.72	11.84	11.60	11.68	12.04	14.21	12.38
Active yeast at 5 g/l	9.37	9.68	10.68	11.75	10.37	10.64	10.84	11.12	14.37	11.74
Active yeast at 10 g/l	10.16	10.40	10.69	11.69	10.74	10.68	11.61	12.76	14.72	12.44
Vit. E at 50 ppm	8.72	10.88	10.96	11.71	10.57	10.24	11.70	12.12	12.75	11.57
Vit. E at 100 ppm	9.36	10.65	10.92	12.47	10.85	10.64	11.88	12.24	14.63	12.35
Mean (A)	9.22	10.09	10.67	12.39		10.25	10.80	11.63	13.94	
L.S.D. at 5 %	A= 0.56		B= 0.65	AB= 1.30		A= 0.53		B= 0.63	AB= 1.26	

Sal.: Salicylic acid Asc.: Ascorbic acid Vit. E: Vitamin E

Table 4. Effect of compost, salicylic acid, ascorbic acid, active yeast and vitamin E on fruit yield/fed (kg/fed) and weight of 1000 fruits (g) of *Cuminum cyminum*, L., during the first and second seasons.

Bio-stimulant treatments (B)	Compost levels (ton/fed) (A) 1st season (2012/2013) 0.0	2.5	5.0	7.5	Mean (B)	2nd season (2013/2014) 0.0	2.5	5.0	7.5	Mean (B)
Fruit yield/fed (kg/fed)										
Control	296.96	325.97	378.88	430.08	357.97	303.79	315.73	411.31	542.72	393.39
Sal. at 100 ppm	339.20	360.11	423.25	562.77	421.12	409.60	447.15	476.59	622.93	488.96
Sal. at 200 ppm	453.97	486.40	544.43	640.00	531.20	501.76	508.59	561.49	646.83	554.67
Asc. at 100 ppm	372.48	429.65	397.65	549.55	437.33	426.67	435.20	445.87	525.65	458.24
Asc. at 200 ppm	472.75	496.64	508.59	542.72	505.17	494.93	498.35	513.71	606.29	528.21
Active yeast at 5 g/l	399.79	413.01	455.68	501.33	442.45	453.97	462.51	474.45	613.12	500.91
Active yeast at 10 g/l	433.49	443.73	456.11	498.77	458.24	455.68	495.36	544.43	628.05	530.77
Vit. E at 50 ppm	372.05	464.21	467.63	499.63	450.99	436.91	499.20	517.12	544.00	493.65
Vit. E at 100 ppm	399.36	454.40	465.92	532.05	462.93	453.97	506.88	522.24	624.21	526.93
Mean (A)	393.39	430.51	455.25	528.64		437.33	460.80	496.21	594.77	
L.S.D. at 5 %	A= 23.92		B= 26.95	AB= 53.90		A= 21.68		B= 26.43	AB= 52.86	
Weight of 1000 fruits (g)										
Control	2.74	2.91	3.36	3.87	3.22	2.88	2.93	3.46	3.76	3.26
Sal. at 100 ppm	3.06	3.41	3.58	3.97	3.51	3.31	3.85	4.27	5.06	4.12
Sal. at 200 ppm	3.86	4.27	4.69	5.36	4.55	4.23	4.60	4.69	5.23	4.69
Asc. at 100 ppm	3.15	3.24	3.37	3.95	3.43	3.51	3.70	3.88	3.93	3.76
Asc. at 200 ppm	3.89	4.17	4.46	5.43	4.49	3.91	4.08	4.31	5.01	4.33
Active yeast at 5 g/l	3.46	3.65	3.91	4.83	3.96	3.62	3.96	4.00	4.91	4.12
Active yeast at 10 g/l	3.72	3.93	4.17	4.62	4.11	3.74	4.11	4.39	5.17	4.35
Vit. E at 50 ppm	3.33	4.01	4.12	4.45	3.98	3.20	3.67	3.84	3.98	3.67
Vit. E at 100 ppm	3.62	3.97	4.25	4.38	4.06	3.49	3.82	3.96	5.14	4.10
Mean (A)	3.43	3.73	3.99	4.54		3.54	3.86	4.09	4.69	
L.S.D. at 5 %	A= 0.21		B= 0.23	AB= 0.46		A= 0.17		B= 0.27	AB= 0.54	

Sal.: Salicylic acid Asc.: Ascorbic acid Vit. E: Vitamin E

The highest values of four characters were obtained with the high level of compost (7.5 ton/fed). The obtained results indicated the favorable effect of compost on cumin plant productivity, these results might be due to the role of organic material for continues supply of nutrients, growth stimulants, disease suppressors, support biologically diverse and metabiologically dynamic process during the plant growth (Fliessbach *et al*., 2000).

The effect of compost agreed with the results of Asl and Moosavi (2012) and Patel *et al.* (2013) on cumin plants.

Effect of spaying with bio-stimulants: Data presented in Tables (3 and 4) indicated that all used eight treatments of bio-stimulants significantly increased yield parameters (umbels number/plant, fruit yield (g/plant and kg/fed) and weight of 1000 fruits) over the control in both seasons, except, the treatment of Asc. (100 ppm) for weight of 1000 fruits in the first season. The treatments of Sal. (200 ppm) followed by Asc. (200 ppm) resulted the highest values in the second season with significant differences between them regarding fruit yield/fed In the second season, the maximum values were obtained with Sal. (200 ppm), Asc. (200 ppm) and active yeast (10 g/l) treatments without significant differences among them in most cases. Salicylic acid plays an important role in plant defense response against pathogen attack and is essential for the plant development and biomass. Salicylic acid and ascorbic acid are considered as auxinic action since they have synergistic effect on growth and productivity of most aromatic plants. Similar results were obtained by Rahimi *et al*., 2013 on cumin, Botros (2013) on caraway. Rekaby (2013) and Arzandi (2014) on coriander regarding salicylic acid and Botros (2013) on caraway and Badran *et al*. (2013) on coriander in concern of ascorbic acid role.

Yeast is consider as a natural sources of cytokinins that stimulate cell division and enlargement, as well as, the synthesis of proteins, nucleic acids and chlorophyll. Application of active yeast caused significant increase in growth parameters and yield of medical plants such as cumin (Al-Doghachi *et al.,* 2012), coriander (Rekaby, 2013), caraway (Botros, 2013) and black cumin (Abdou *et al*., 2013b).

Effect of interaction: The interaction between compost and bio-stimulant treatments was significant, in both seasons, for four parameters as clear shown in Tables (3 and 4). The highest values were obtained due to compost (7.5 ton/fed) in combination with Sal. (200 ppm) for all studied parameters and with Asc. (200 ppm) for weight of 1000 fruits in the first season. While, in the second season, the best interaction treatments were compost at 7.5 ton/fed with Sal. and Asc., each at 200 ppm or active yeast at 10 g/l.

RECOMMENDATIONS

It may be recommended to use compost at the level of 7.5 ton/fed in combination with Sal. or Asc., each at 200 ppm to give the highest values of vegetative growth and fruit yield production of *Cuminum cyminum* plants.

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تأثير معـــاملات الكمبوست و بعض المنشطات الحيوية على:
أ. النمو وإنتاج محصول الثمار لنباتات الكمون

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أجري هذا البحث في مزرعة كلية الزراعة جامعة المنيا خلال موسمي ٢٠١٣/٢٠١٢ و ٢٠١٤/٢٠١٣ بهدف دراسة تأثير سماد الكمبوست (صفر، ٢,٥، ٥,٠ و ٧,٥ طن/فدان) وثمانية معاملات حيوية نشطة (حمض السالساليك ١٠٠ و ٢٠٠ جزء/مليون، حمض الأسكوربيك ١٠٠ و ٢٠٠ جزء/مليون، الخميرة النشطة عند ٥ و ١٠ جم/لتر، فيتامين هـ عند ٥٠ و ١٠٠ جزء/مليون و الكنترول) على النمو وإنتاج محصول الثمار لنباتات الكمون.

أوضحت النتائج أن استعمال الكمبوست (٧,٥ طن/فدان) زاد معنوياً صفات النمو الخضري (إرتفاع النبات وقطر الساق وعدد الفروع والوزن الجاف للعشب/نبات) والصفات المحصولية (عدد النورات/نبات ومحصول الثمار للنبات وللفدان ووزن ١٠٠٠ ثمرة) مقارنة بالمعاملات الأخرى.

معاملة النباتات بحمض السالساليك وحمض الأسكوربيك والخميرة النشطة وفيتامين هـ كل بالتركيزين أدى إلى زيادة معنوية في صفات النمو الخضري والصفات المحصولية مقارنة بمعاملة الكنترول عدا حمض الأسكوربيك عند ١٠٠ جزء/مليون على صفة وزن ١٠٠٠ ثمرة في الموسم الأول. وكانت أفضل المعاملات في هذا الشأن هي حمض السالساليك يليه حمض الأسكوربيك ثم الخميرة النشطة وفيتامين هـ كل عند التركيز العالي و يمكن التوصية باستخدام الكمبوست ٧,٥ طن/فدان مع حمض السالساليك أو حمض الأسكوربيك كل بمعدل ٢٠٠ جزء/مليون للحصول على أعلى القيم للنمو الخضري ومحصول الثمار لنباتات الكمون.