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Effect of Fertilization and Foliar Applicaion Treatments on Coriander Plant (*Coriandrum sativum* L.)

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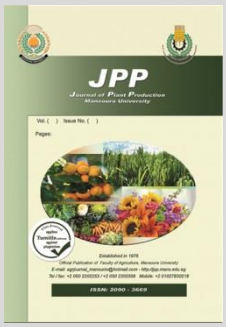

ABSTRACT

Now a day, finding alternatives to chemical fertilizers without reduction of yield becomes urgent need for saving the environment. So, two field experiments were performed at Experimental Farm of Gemmiza, Agricultural Research Station, El- Ghrbiah Governorate, Egypt during the two growing seasons of 2016 and 2017 to investigate the influence of different fertilizers types, i.e., mineral fertilizers (100 % as a control), organic fertilizers (plant compost and farmyard manure), bio-fertilizer and different applications of some stimulants on improving the vegetative growth, fruit yield and essential oil constituents of *Coriandrum sativum* L plant. The findings showed that coriander plants treated with compost plant had the highest values of all studied parameters as compared to the plants treated with farmyard manure. Within the foliar non-mineral applications; the best values of all studied traits of coriander plants were obtained by using compost before planting and Humic acid plus seaweeds which improved plant growth, yield and essential oil yields. In addition, the highest values of the main component (linalool) were associated with the same previous treatment.

Keywords: Humic acid, seaweeds**,** bio-fertilizer and coriander plant.

INTRODUCTION

Coriander plant (*Coriandrum sativum* L.) is an annual herb belonging to the *Apiaceae* family. Coriander is one of the most important introduced medicinal and aromatic crops in Egypt. Egypt occupies the second producing country in the world (Anitescu *et al.*, 1997). It has been recommended for dyspeptic complaints, loss of appetite, carminative, stomachic, rheumatism and against worms. Moreover, the essential oil and various extracts from coriander fruits possess anti-bacterial, antioxidant anti-diabetic, anti-cancerous and anti-mutagenic activities. New research studies have found that coriander helps in controlling blood sugar, cholesterol and free radical production (Dutta and Appelqvist, 1991). Nutritional requirements are one of the most important factors affecting growth and development of plants (EL-Nagger and EL-Nasharty, 2009). NPK fertilization plays the important role in several physiological processes in plant structural components (Devlin, 1975). Particularly nitrogen (N) is one of the greatest production inputs. Nitrogen is an essential nutrient in creating the plant dry matter, as well as many energy-rich compounds that regulate photosynthesis and plant production (Van Kessel and Reeves, 2002). Phosphorus is essential for cell division and for development of meristematic tissues and it is very important for carbohydrate transformation due to multitude of phosphorylation reaction and to energy rich phosphate bond (Lambers *et al*., 2002). Potassium is important for growth and elongation probably due to its function as an osmotic and may react synergistically with IAA. Moreover, it promotes CO_2 assimilation and translation of carbohydrates from the leaves to storage tissues (Mengel and Kirkby, 1987).

Organic matter, bovine manure and earthworm humus appear as important components in the formulation of organic fertilizers, because when mixed with the soil, they contribute with physical and chemical attributes, improving the soil structure and providing the necessary nutrients to the plant development (Costa *et al*., 2017). The use of these byproducts ends up reducing the cost of production of the horticulturists, providing an increase in the production of this important crop and linked to that, enable a more sustainable agricultural production (Da Costa *et al.*, 2019).

Beneficial microbial inoculants (bio-fertilizers) are presently attracting more attention in the context of sustainable agriculture. This is a consequence of the need to solve health and environmental problems caused by the excessive use of agrochemicals in traditional agriculture. Biofertilizers are the products which contain living cells of different types of microorganisms that can convert nutritionally important elements from unavailable to available form through biological processes and are known to help with the expansion of the root system and better seed germination.

Humic acid is water-soluble organic acid naturally present in soil organic matter. Humic substances have been reported to influence plant growth both directly and indirectly. The direct effects of Humic acid compounds may have various biochemical effects either cell wall, membrane level or in the cytoplasm, including increases photosynthesis. and respiration rates in plants, enhances protein and plant hormone like activity. The indirect effects of humic compounds on soil fertility include; (i) increases in the soil microbial population including beneficial microorganisms. (ii) Improves soil structure. (iii) increases

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in the cation exchange capacity and the PH buffering capacity of the soil (Akinremi *et al*.,2000).

Seaweeds extract (SW) play role as activator of cell division, give rise to antioxidants levels for protection against adverse environmental conditions stimulate the biosynthesis of tocopherol, ascorbic acid and carotenoids (anti-oxidants) in chloroplast which protect photosynthetic apparatus of PSII, protect plant cells from lipid per-oxidation and inactivation of enzymes that occur under stress (Smirnoff, 1995). The application of SW for different corps was great importance due to its contents of high levels of organic matter, micro-elements and vitamins. Also, it is rich in growth regulators such as axuins, cytokinins and gibberellins (Crouch and Van-Staden, 1994).

Owing to the previous mentioned knowledge, this investigation was carried out to study is decrease chemical fertilizers and low coast in addition improve production, quality and limit the environmental pollution. This work aims to evaluate the vegetative growth characteristics, fruits yield measurement, essential oil determinations, chemical constituents, and quality of coriander in response to different organic-fertilizers and foliar treatments (Humic acid, Seaweeds extract and bio-fertilizers) and their interaction.

MATERIALS AND METHODS

Two field experiments were carried out in the experimental farm of Gemmiza, Agricultural Research Station, El- Ghrbiah Governorate, Egypt during the two successive seasons of (2015/ 2016) and (2016/ 2017) to investigate the influence of organic fertilization (plant compost and FYM) with different applications of some stimulants on improving the vegetative growth, chemical constituents, essential oil determinations, fruit yield and quality of the coriander plant (*Coriandrum sativum* L.).Random samples of soil were taken from the experimental field area at a depth 0-30 cm before sowing to estimate physical and chemical soil properties according to Dewis and Feritas (1970) as shown in Table (1). Chemical analysis of used (CP) and (FYM) in both seasons are presented in Table (2)

Fourteen treatments were in a split-plot design with three replicates, which were the simple possible combination between two types of organic fertilization as main plots and seven stimulant applications as subplots.

Main plots were organic fertilizers treatments which included two forms.

1- Farmyard manure (FYM) was applied at the rate of 30m^3/ fad two weeks before sowing,
2- Compost plant (CP) was applied at the rate of 1.5 ton/ fad two weeks before sowing.

While, subplots were seven stimulant applications as follows;

1- N P K (added as recommended dose), 2- Biofertilizer, 3- Humic acid**,** 4- Seaweeds extract, 5- (Biofertilizer + Humic acid), 6- (Biofertilizer+ Seaweeds), 7- (Humic acid+ Seaweeds).

The mineral fertilizer (NPK) was added to the soil using the recommended dose. Nitrogen fertilizer was ammonium sulphate (20.5% N) and was applied at the rate of 400 kg N fad^{-1}. Phosphorus fertilizer was calcium super phosphate (15.5% P_2O_5) and was applied at the rate of 200 kg N fad^{-1}. Potassium fertilizer was potassium sulfate (39.84% K) and was applied at a rate of 50 kg K fad^{-1}. Calcium superphosphate was applied at one dose before planting during preparation of soil, while ammonium sulphate and potassium sulphate were divided into equal two doses. The first dose was added after thinning plants and the last one added at one month after the first dose. Bio fertilizer (a mixture between Bucillis. polymixa, Bucillis. magetirum and Bucillis. circulants in a ratio of (1:1:1) was obtained from Dept., of Agric. Microbiology and Biofertilizer Productivity, Inst. Agric. Res. Center, Ministry of Agriculture, Egypt. It was applied to the seeds before sowing at a rate of 4 g/ 100 seed. then it was added as a solution at a rate of 210 ml/ plot two times after 15 days of sowing with 15 days interval. Humic substances in the form of humate potassium; 85 % Humic acid was obtained as a pure powder from Tiba company for trading, Agency and Agric. Development. Stock solution of Humic acid (0.25g / L^{-1}) was prepared. It was foliar applied two times after 40 days of sowing and at first flowering stage. Seaweed extract (from Tiba Company for Trading) contained N (5.8. %), K (4.6%), Boron (0.17%), alginic acids (6.5%). p (3%), seaweeds. (20.5%). It was foliar applied at a rate of 3.0 cm^3/ L two times after 40 days of sowing with 15 days interval.

Planting date was on 16th of November during the both experimental seasons. Coriander Seeds were obtained from the Medicinal and Aromatic Plants (MAP) Dept. of Hort. Res. Inst., Agric. Res. Center. Seeds were sown in hills at 25 cm between them.

The experimental unit was 4.2 m^2 (2×2.10 m^2) every unit contained 24 hills in three rows at 70 cm between rows Plants were thinned to three plants per hill when seedlings grew to a height of at least 10cm. The plants were irrigated using flood irrigation system. The normal agricultural practices of coriander production were followed according to the recommendations of Egyptian Ministry of Agriculture. Plants were harvested on April in the both investigated seasons.

Data recorded:

Vegetative growth: At harvest at (maturing stage).: representative samples of 9 plants were randomly taken from each experimental sub plot to determine the following parameters: plant height (cm) and number of branches /$plant^{-1}$.

Fruits measurements: Seed per plants each plot was harvested at the proper maturing stage, counted and weighted and the following parameters were collected, Weight 1000 seeds (g), Fruits yield (g /plant) and (kg /fad).

Essential Oil constituents (%): was analyzed using Gas Liquid Chromatography (GLC): was carried out at the Medicinal and Aromatic Dept., Horti. Res. Inst., Agric. Res. Center, Dokki, using Ds Chrom 6200 Gas Chromatograph equipped with a flame ionization detector for separation of essential oil constituents. The obtained chromatogram of GLC analysis were analyzed to calculate the percentage of the main components by matching their retention time (RT) with those of authentic samples under the same conditions and the constituents of the essential oil were identified, according to Guenther and Joseph (1978).

Statistical Analysis.

Data were statistically analyzed according to Gomez and Gomez (1984) using GenStat (Version 6.303, Co Hort, USA, 1998–2004).

Table 1. Some characteristics of the experimental soil during 2015/2016 and 2016/2017 seasons.

Soil properties		Seasons 2015/2016	2016/2017
Physical analyses %	C. Sand	02.6	02.8
	F. Sand	19.1	19.3
	Silt	26.1	25.4
	Clay	52.2	52.5
Textural class		Clay	Clay
Chemical analyses	EC dSm^{-1*}	1.55	1.50
	pH^{**}	8.35	8.23
	$CaCO_3$ %	2.39	2.25
	O.M %	1.12	1.14
Hydro physical analyses	F.C %	36.0	36.0
	S.P %	72.0	72.0
Soluble anions and cations meq L^{-1}	CO_3^-	--------	----------
	HCO_3^{--}	0.90	0.80
	Cl^-	8.80	8.65
	SO_4^{--}	5.30	5.55
	Ca^{++}	5.70	5.90
	Mg^{++}	2.50	2.45
	K^+	3.20	3.20
	Na^+	3.60	3.45
Available element, mg kg^{-1}	Nitrogen	65.00	64.50
	Phosphorus	9.700	9.500
	Potassium	283.6	283.9

Table 2. Chemical analysis of the organic manures used at (2015/ 2016) and (2016/ 2017) seasons.

Organic manure properties		Farmyard manure (FYM) 2015/ 16	2016/ 17	Compost plant (CP) 2015/ 16	2016/ 17
pH 1:5		7.650	7.700	7.350	7.420
EC (1:10) (dSm^{-1})		4.090	4.000	2.180	4.750
Organic (%)	Matter	20.82	19.45	24.35	25.18
	Carbon	19.08	20.08	18.80	17.50
C/N ratio		15.70	16.87	15.10	14.00
Mineral %	nitrogen	1.220	1.190	1.240	1.250
	phosphorus	0.450	0.500	0.650	0.480
	potassium	0.650	0.700	1.650	2.460
	Calcium	0.750	0.800	0.910	0.930
	Magnesium	0.250	0.250	0.400	0.380
	Sodium	0.550	0.600	0.650	0.600

RESULTS AND DISCUSSION

Vegetative Growth Characteristics.

Plant height, number of branches and umbels plant $^{-1}$.

The response of plant height (cm), number of branches and umbels $plant^{-1}$ of coriander plant to different types of organic fertilizers, bio-fertilizer and different foliar applications and their interaction shown in Table(3).

Organic fertilization effect.

Data in Table(3) indicated that coriander plants treated with compost plant (CP) had the highest values of plant height (cm), number of branches and umbels plant $^{-1}$ in the two growing seasons. Comparing to the plants treated with farmyard manure(FMY).In this respect; the maximum values of plant height (cm), No. of branches and No. of umbels $plant^{-1}$ (99.35 cm, 7.57 branches and 31.81 umbels) were recorded by Compost at the rate of 1.5 ton fad-1 in the second season , while the minimum values of plant height (cm), No. of branches and umbels plant $^{-1}$ (90.64 cm, 6.52 branches and 24.62 umbels) were recorded in the first season by using FYM at the rate of $30m^3$ fad^{-1}. The superiority of plant treated with (CP) is may be due to its high contains organic matter and nutrients than (FYM) according to our analyses before planting (Table 2)and this finding are in agreement with Hammad *et al.*(2011) who reported that compost is considered an excellent source of organic matter and addition of compost will increase soil organic matter levels more quickly than another manures and slurries .Also these results are in harmony with the finding of Abdou *et al*.,(2015) who revealed that vegetative growth characters of coriander plant were significantly increased due to the application of all levels of compost.

NPK, Bio-Fertilizer and Foliar applications effect.

From the data in Table (3) it can be showed that the foliar applications treatments i.e., bio-fertilizer, Humic acid, seaweeds extract, (bio-fertilizer + Humic acid), (bio-fertilizer +seaweeds) and (Humic acid +seaweeds), all of them gained less vigor plant growth as compared to the application of the recommended doses of N, P and K fertilizers. On the other hand, within the foliar non-mineral applications; the best values of plant height (cm), number of branches and umbels plant $^{-1}$of coriander plants were obtained by coriander plants receiving (Humic acid +seaweeds) followed in descending order by that supplied with (bio-fertilizer +seaweeds), (bio-fertilizer + Humic acid), bio-fertilizer alone, seaweeds extract alone, and lately Humic acid alone. The statistical analysis of the obtained data revealed that the difference within different foliar applications treatments was great enough to be significant at 5% level. This trend was realized for both investigated seasons. The present results agree with those obtained by Al-Hatem (2018) and Da Silva *et al*., (2019).

Interactions effect.

The interaction effect between organic manures, bio-fertilizer and foliar applications under study are presented in Table (3). It could be observed that; the values of plant height (cm), number of branches and umbels plant $^{-1}$of coriander plants were significantly affected due to the addition of all investigated treatments.

In the 1st season, the highest values; 105.3, 9.33 and 34.33 for plant height (cm), number of branches and umbels plant $^{-1}$, respectively were recorded for the coriander plants treated with the combination of compost plant (CP) and recommended doses of N, P and K fertilizers (control), while the lowest values were recorded for the coriander plants treated with the combination of farmyard manure (FYM) and Humic acid alone, it were 80.71, 3.33 and 17.33 for plant height (cm), number of branches and umbels plant $^{-1}$, respectively. In consideration of foliar application under both compost and (FYM), the highest values were recorded with compost and Humic acid plus sea weeds.

Data at the same Table also reveal that; bio-fertilizer and all foliar applications under compost plant (CP) gave plant height (cm), number of branches and umbels plant $^{-1}$ of coriander plants higher than under farmyard manure (FYM). For example, under combination of CP and seaweeds treatment, the values of plant height (cm), number of branches and umbels plant $^{-1}$ of coriander plants in 1st season were 86.65, 5.0 and 20.67, respectively, while under combination of FYM and seaweeds treatment, the values in the same season were 84.15, 4.67 and 19.0, respectively. This trend was found under both studied seasons. A similar result was obtained by Badran *et al.* (2018) and Al-Hatem (2018).

Table 3. Effect of organic fertilizers, bio-fertilizer, some foliar applications and their interactions on plant height, No. of branches and umbels /plant of coriander plant at 2015/2016 and 2016/2017 seasons.

Treatments		Plant height (cm)		No. of / plant			
				Branches		Umbels	
		2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Organic fertilizers (FYM and compost)							
FYM		90.64	94.41	6.52	7.10	24.62	30.48
Compost		94.07	99.35	6.71	7.57	26.10	31.81
LSD at 5%		1.71	1. 64	0.20	n.s	n.s	0.74
NPK, Bio-Fertilizer and Foliar applications treatments							
Control (NPK)		104.44	105.00	9.17	10.17	34.17	43.33
Bio		89.45	95.09	6.17	6.50	22.67	26.67
Humic		81.60	90.50	3.50	4.50	17.67	19.00
Seaweeds		85.40	92.90	4.83	5.67	19.83	21.50
Bio + Humic		89.63	96.44	6.83	7.33	24.83	30.83
Bio+ Seaweeds		94.91	98.22	7.50	8.17	27.67	36.50
Humic+ Seaweeds		101.06	100.0	8.33	9.00	30.67	40.17
LSD at 5%		1.90	0.59	0.97	0.90	3.73	3.06
Interactions							
Control (NPK)		103.6	102.0	9.00	10.00	34.00	43.00
FYM	Bio	85.59	91.00	6.00	6.33	22.00	26.33
	Humic	80.71	88.66	3.33	4.33	17.33	19.00
	Seaweeds	84.15	92.30	4.67	5.33	19.00	20.67
	Bio + Humic	88.41	94.00	6.67	7.00	24.00	29.67
	Bio+ Seaweeds	91.64	95.90	7.33	8.00	27.00	35.33
	Humic+ Seaweeds	100.4	97.00	8.67	8.67	29.00	39.33
Control (NPK)		105.3	108.0	9.33	10.33	34.33	43.67
Compost	Bio	90.48	94.81	6.33	6.67	23.33	27.00
	Humic	82.49	92.33	3.67	4.67	18.00	19.00
	Seaweeds	86.65	97.88	5.00	6.00	20.67	22.33
	Bio + Humic	93.67	98.88	7.00	7.67	25.67	32.00
	Bio+ Seaweeds	98.17	100.3	7.67	8.33	28.33	37.67
	Humic+ Seaweeds	101.7	100.5	8.00	9.33	32.33	41.00
LSD at 5%		2.68	1.26	1.37	1.27	n.s	4.33

Fruits Measurements.

Statistical analysis of the data presented in Table (4) indicate the values of weight of 1000 seeds (g) and fruit yield (g plant^{-1} and Kg fad^{-1}) of coriander plant as affected by the different types of organic fertilizers, different foliar applications and their interactions during the seasons of (2015/ 2016) and (2016/ 2017).

Organic fertilization effect.

Regarding the effect of organic fertilization, data in Table (4) revealed that; the values of weight of 1000 seeds (g) and fruit yield (g plant $^{-1}$ and Kg fad^{-1}) of coriander plant treated with compost plant (CP) were significantly increased compared with the coriander plant treated with farmyard manure (FYM) .On other words; the highest values obtained in the first season [8.52,15.41 and 352.22 for weight of 1000 seeds (g), fruit yield (g plant^{-1}) and fruit yield (Kg fad^{-1}),respectively] were realized for the plants treated with compost plant (CP) and the same trend was the same in the 2nd season . Generally, the treatments sequence from top to less was the (CP) > (FYM). The present results agree with those obtained by; Abdou *et al*., (2019) and Da Costa *et al*., (2019).

NPK, Bio- fertilizer and Foliar applications effect.

Concerning the effect of foliar applications, data in the same Table illustrated that; Among the different types of foliar applications using of (Humic acid +seaweeds) was significantly superior for recording the highest values of all the aforementioned traits during the two seasons, following in descending order with (bio-fertilizer + seaweeds), (bio-fertilizer + Humic acid), bio-fertilizer alone, seaweeds extract alone, and lastly Humic acid alone. For example, the maximum values for the weight of 1000 seeds obtained in the second season were 11.69, 11.16, 10.58, 9.99, 9.44 and 8.63 (g plant^{-1}) for the treatments of (Humic acid +seaweeds), (bio-fertilizer +seaweeds), (bio-fertilizer + Humic acid), bio-fertilizer, seaweed extract and Humic acid, respectively. The same trend was realized for the other fruit measurements (fruit yield g plant^{-1} and Kg fad^{-1}). But it is matter of important to mention that when comparing foliar application with the control treatment (recommended doses of N, P and K fertilizers); the highest significant values of all aforementioned traits for the plants treated were obtained with control treatment (recommended doses of N, P and K fertilizers). The present results agree with those obtained by Beyzi, E; A.Gunes and B.Gurbuz . (2017), Al-Hatem (2018) and Da Silva *et al*., (2019).

Interactions effect.

Statistical analysis of the data in Table (4) showed the values of the weight of 1000 seeds (g) and fruit yield (g plant^{-1} and Kg fad^{-1}) of coriander plant as affected by the combination of the various treatments under investigation. Results illustrated that the most suitable treatment which recorded the highest values of weight of 1000 seeds (g) and fruit yield (g plant^{-1} and Kg fad^{-1}) was connected with the plants treated with (CP) + (100 % NPK RD). On the other hand, the lowest values were realized for the coriander plants treated with (FYM)+ Humic acid alone.

Generally, it was noticed from the previous data that values under the combination of compost plant (CP) and any foliar applications was greater than combination of (FYM) and any foliar applications. Also, the both organic fertilizer treatments (CP and FYM), the best foliar treatment for all the aforementioned traits was obtained with (Humic acid +seaweed), following in descending order with (bio-fertilizer +seaweeds), (bio-fertilizer + Humic acid), bio-fertilizer alone, seaweeds extract alone, and lastly Humic acid alone This trend was found under both studied seasons. A similar result was obtained by Badran *et al.* (2018) and Al-Hatem (2018).

Table 4. Effect of organic fertilizers, bio- fertilizer, some foliar applications and their interactions on weight of 1000 seeds and fruit yield (g plant^{-1} and Kg fad^{-1}) of coriander plant at 2015/2016 and 2016/2017 seasons.

Treatments		Weight of 1000 seeds (g)		Fruit yield (g) /plant		Fruit yield Kg /fad	
		2015/16	2016/17	2015/16	2016/17	2015/16	2016/17
Organic fertilizers (FYM and compost)							
FYM		8.31	10.37	14.77	18.33	337.59	418.96
Compost		8.52	10.72	15.41	19.11	352.22	436.79
LSD at 5%		0.04	0.06	0.30	0.04	6.80	6.89
NPK, Bio- fertilizer and Foliar applications treatments							
Control (NPK)		9.85	12.33	18.69	23.70	427.19	541.71
Bio		7.88	9.99	13.99	17.25	319.76	394.28
Humic		7.01	8.63	11.30	14.05	258.28	321.14
Seaweeds		7.50	9.44	12.89	15.49	294.62	354.05
Bio + Humic		8.40	10.58	15.09	18.55	344.91	423.99
Bio+ Seaweeds		8.92	11.16	16.20	20.25	370.28	462.85
Humic+Seaweeeds		9.34	11.69	17.48	21.78	399.54	497.82
LSD at 5%		0.13	0.15	0.11	0.13	2.48	2.97
Interactions							
FYM	Control (NPK)	9.66	12.13	18.35	23.03	419.43	526.39
	Bio	7.82	9.83	13.74	16.84	314.05	384.91
	Humic	6.95	8.36	10.82	13.83	247.31	316.19
	Seaweeds	7.37	9.32	12.54	15.13	286.62	345.82
	Bio + Humic	8.26	10.43	14.85	18.14	339.42	414.62
	Bio+Seaweeds	8.85	10.97	15.86	19.94	362.51	455.76
	Humic+Seaweeds	9.24	11.55	17.23	21.43	393.83	489.82
COMPOST	Control (NPK)	10.04	12.53	19.04	24.36	435.19	556.79
	Bio	7.94	10.15	14.23	17.67	325.25	403.88
	Humic	7.07	8.91	11.78	14.26	269.25	325.94
	Seaweeds	7.63	9.55	13.23	15.85	302.39	362.28
	Bio + Humic	8.54	10.74	15.32	18.96	350.16	433.36
	Bio+Seaweeds	8.99	11.34	16.54	20.57	378.05	470.16
	Humic+Seaweeds	9.44	11.84	17.73	22.13	405.25	505.82
LSD at 5%		0.18	0.21	0.15	0.18	3.51	4.20

Essential oil constituents Percentage %.

Data in Table (5) and illustrated in Fig(1) and (2) showed the different components separated and identified from coriander oil samples produced from plants fertilized with (FYM) or compost under different foliar applications.

Table 5. G.L.C. of coriander essential oil constituents % as affected by the interaction between organic, bio-fertilizer and some foliar applications at second season 2016/2017.

Components	Essential oil constituents %													
	FYM							Compost						
	Control (NPK)	Bio	Humic	Seaweeds	Bio + Humic	Bio+Seaweeds	Humic+Seaweeds	Control (NPK)	Bio	Humic	Seaweeds	Bio + Humic	Bio+Seaweeds	Humic+Seaweeds
α-pinne	5.14	6.21	4.66	2.95	4.54	4.66	4.93	5.23	4.49	4.87	4.46	5.29	5.00	5.74
Sabinene	1.01	0.91	0.86	0.57	0.67	0.61	1.02	1.08	0.50	2.14	1.13	0.92	1.04	1.11
Myrcene	1.91	2.19	1.96	0.51	1.51	1.34	1.85	0.17	1.56	1.85	2.33	2.15	0.85	0.83
β-pinene	6.6	7.62	6.43	4.85	6.72	6.85	6.35	7.45	8.89	6.00	8.72	7.91	6.45	8.43
p-cymene	3.30	2.04	3.34	2.27	3.92	3.57	3.25	3.44	4.14	3.00	4.10	2.02	3.20	1.90
Linalool	65.53	58.74	47.01	48.99	59.40	59.58	64.75	68.49	64.99	64.29	64.59	65.60	65.76	67.07
geraniol	1.05	0.42	1.92	4.51	1.80	2.28	0.92	1.18	1.14	0.96	1.15	0.43	0.94	0.49
Borneol	1.11	1.06	4.39	1.43	1.54	1.90	0.89	0.66	0.87	0.99	0.84	1.02	0.79	1.06
Linalyl acetate	5.38	5.67	7.85	13.50	8.15	8.39	4.72	4.49	3.90	5.00	3.72	5.74	4.89	4.26
Geranyl acetate	4.63	4.99	4.08	7.21	4.79	4.28	4.32	3.15	4.30	5.87	3.76	4.99	4.37	5.35
Known	95.70	89.85	82.50	86.79	93.04	93.46	93.00	95.34	94.78	94.97	94.80	96.07	93.29	96.24
U. K	4.30	10.15	17.5	13.21	6.96	6.54	7.00	4.66	5.22	5.03	5.20	3.93	6.71	3.76

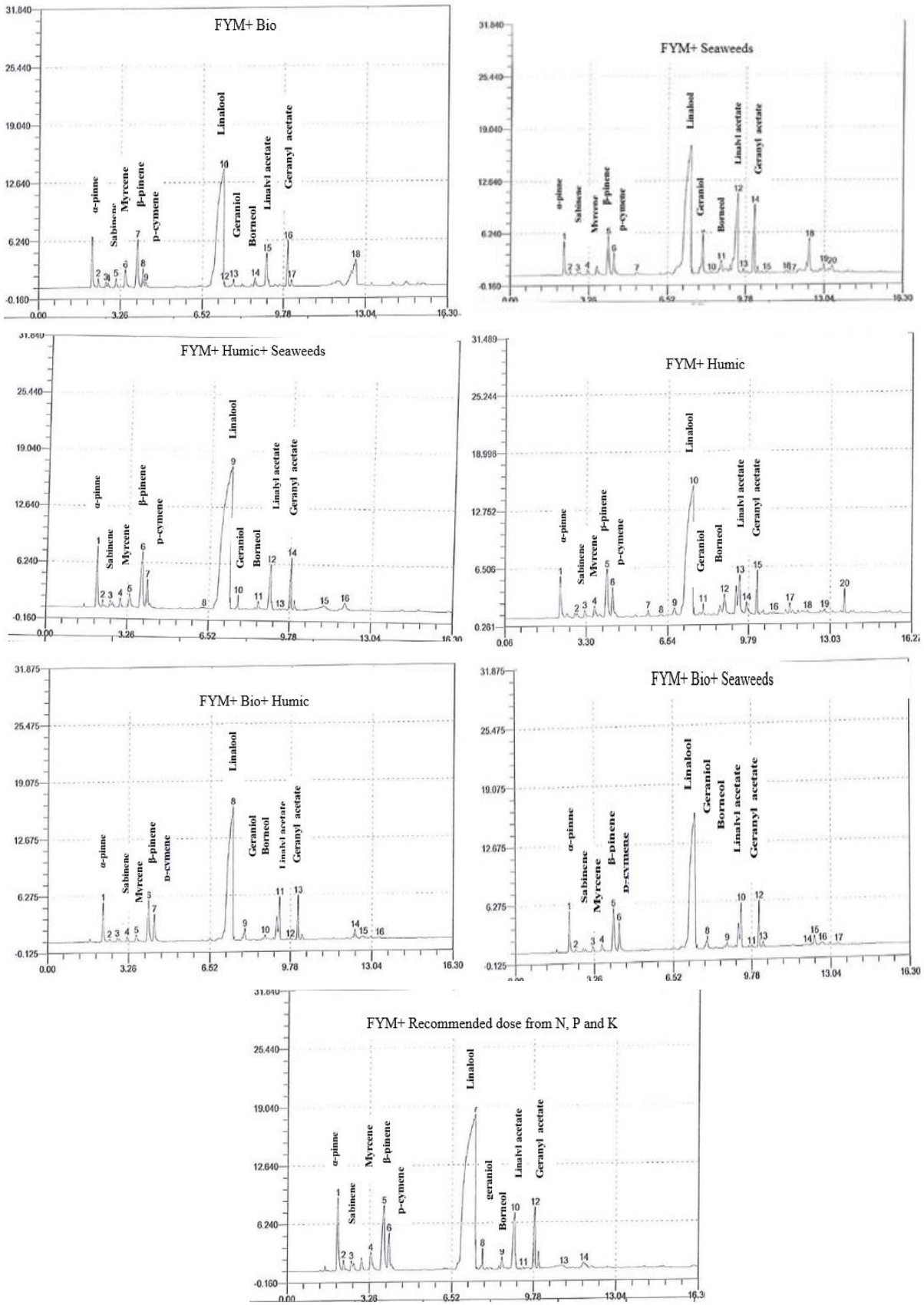

Fig. 1. G. L.C. chromatogram analysis of coriander oil constituents % under FYM with different foliar applications

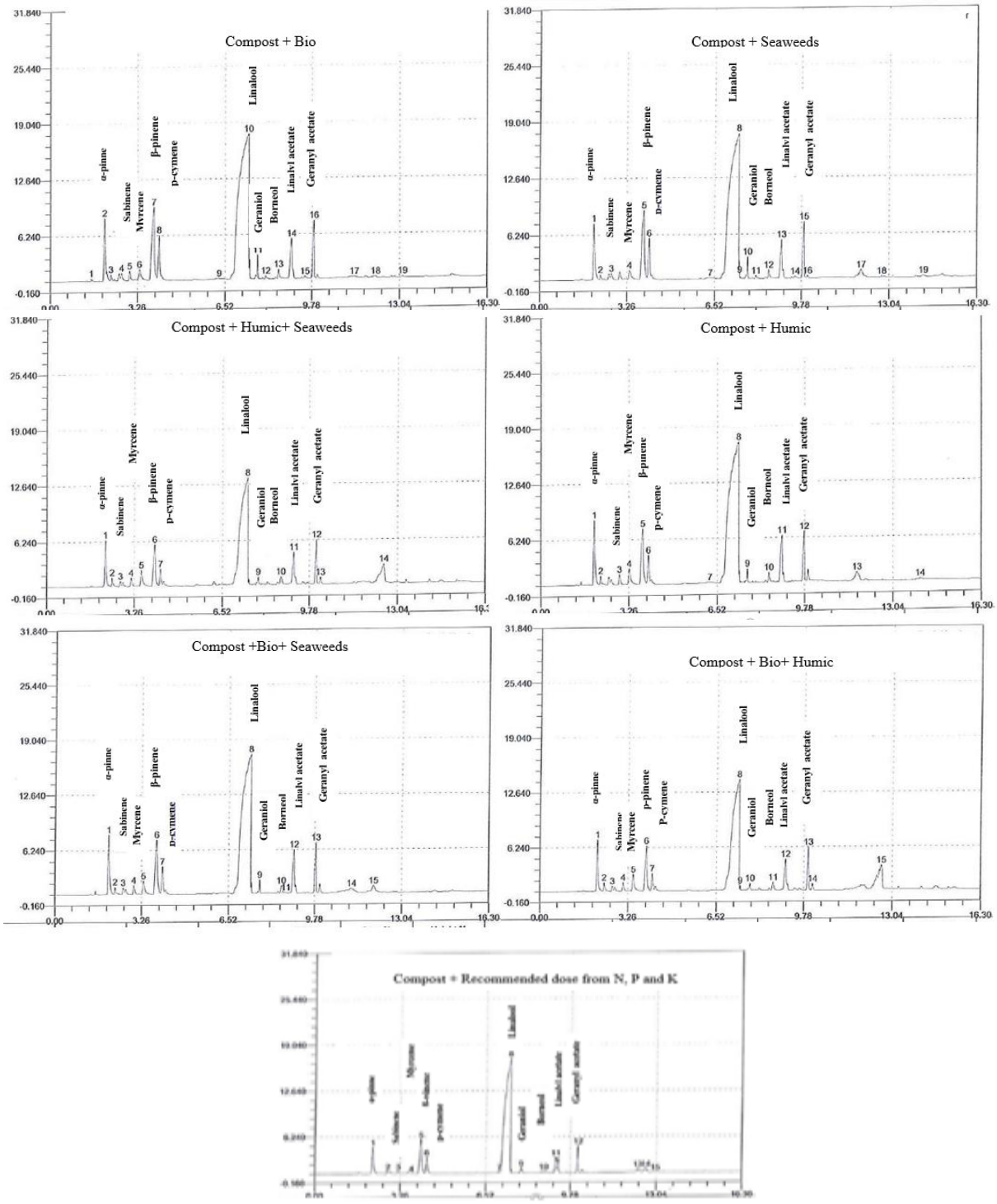

Fig. 2. G. L.C. chromatogram analysis of coriander oil constituents % under compost with different foliar applications

According to G.L.C, illustrated showed that ten compounds were identified in all treatment, α- pinne, sabinene, myrcene, β-pinene, p-cymene, linalool, geraniol, borneol, linalyl acetate and geranyl acetate. The main component was linalool and its highest value was recorded with the plants treated with compost plus 100 % NPK from recommended dose compared to other foliar applications, it was 68.49%. While the lowest value of the main component (linalool) produced from the plants fertilized by (FYM) and treated with humic (47.01%). On the other hand, all treatments under compost gave linalool higher than that under (FYM). In consideration of foliar application under both compost and (FYM), the highest values of the main component (linalool) were associated with the coriander plants supplied with compost and Humic acid plus seaweed (67.07%) followed by (bio-fertilizer +seaweeds) followed by (bio-fertilizer + Humic acid) followed by bio-fertilizer alone followed by seaweeds extract alone and lately Humic acid alone.

CONCLUSION

The aim of this study was to find out alternatives to chemical fertilizers which will lead to decrease using expensive chemical fertilizers and also to considerable reduction in both production cost and pollution rates. In this study the results cleared that, treating coriander plant with compost before planting and Humic acid plus seaweeds improved plant growth, fruit quality and essential oil yields.

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تأثير التسميد وبعض معاملات الرش الورقية على نبات الكزبرة

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حاليا، يتم إيجاد بدائل للأسمدة الكيماوية دون حدوث نقص بالمحصول أصبح حاجة ملحة من اجل الحفاظ على البيئة. لذلك تم إجراء تجربتين حقليتين بالمزرعة التجريبية بالجميزة ـمحطة البحوث الزراعية ـمحافظة الغربية ـمصر خلال موسمي 2016 و2017 لدراسة تأثير أنواع مختلفة من الأسمدة وهي الأسمدة المعدنية بنسبة 100 % (الكنترول) التسميد العضوي (كومبوست نباتي وسماد بلدي) السماد الحيوي مع الإضافات الورقية لبعض المنشطات على تحسين النمو الخضري، المحصول ومكونات الزيت الطيار لنباتات الكزبرة. اشارت النتائج الي ان نباتات الكزبرة التي تمت معاملتها بالكومبوست النباتي كان لها أعلى قيم بالنسبة لكل القياسات المدروسة مقارنة بالنباتات المعاملة بالسماد البلدي. بالنسبة للإضافات الورقية غير المعدنية؛ تم الحصول على أفضل القيم لجميع الصفات المدروسة لنباتات الكزبرة عند معاملتها بالكومبوست النباتي قبل الزراعة مع الرش بحمض الهيوميك و الأعشاب البحرية. و ايضا لقد سجلت نفس المعاملة اعلى قيمة للمركب الرئيسي (اللينانول).