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Impacts of Using some Fertilization Treatments in Presence of Salicylic Acid Foliar Spray on Growth and Productivity of *Coriandrum sativum* L. Plant

Ghatas, Y. A. A.*

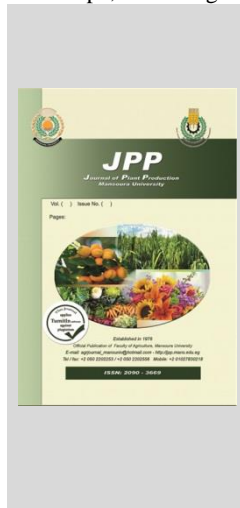


Hort. Dept., Fac. of Agric., Benha Univ., Egypt.

ABSTRACT

The present study was conducted during (2017-2018 and 2018-2019) seasons, at the Hort. Dept., Fac., of . Agric., Benha Univ., Egypt to study the effect of chemical fertilizers (NPK) as a full dose and biofertilization (Bio.) consisting of a mixture of (Nitrobein + Phosphorein) in the presence of Salicylic acid (SA) foliar spray at 150 ppm in a single or combinations inbetween them on vegetative growth ,grain yield ,chemical constituents parameters and oil productivity of coriander plants comparison with control plants in both seasons. The results indicated that different treatments of NPK mineral fertilizer, biofertilization and salicylic acid treatments , either alone or mixed among them, resulted in a significant increase in the growth ,chemical constituents parameters and oil productivity in both seasons. The use of 100% NPK achieved the highest results in the characteristics of growth, yield and chemical composition, followed by the use of the treatment of 75%NPK +Bio.+SA, where it achieved a significant maximize in this concern, whereas the treatment of 75% NPK + Bio. ranked the third in this context as compared with untreated plants in both seasons. Also, the combined treatment of 75% NPK + Bio. + SA gave the highest values of oil productivity. Consequently, in order to achieve the highest values of growth and chemical constituents ,it is preferable to treat coriander with NPK at 100% or 75%NPK + Bio. + SA. Also, it is possible to treat coriander plant with 75% dose NPK +Bio. + SA to improve oil productivity.

Keywords: *Coriandrum sativum**NPK* Biofertilizer*Salicylic acid*volatile oil *chemical compositions



INTRODUCTION

Medicinal and aromatic plants content spice group ,it is very important and widely used in many countries to raise the value of food and improve the taste and flavor. The spices are of great importance, as they are widely accepted by consumers in different foods because they are natural compounds that improve the taste and flavor of food compared with the industrial additives that harm human health. Also,they enter the manufacture of cosmetics and perfumes in addition to their uses in the pharmaceutical industries (Christine and Milner, 2008 and Snigdha and Monika, 2013).

Coriandrum sativum L., (coriander) is spread over a wide range in Egypt, Morocco, India, Russia, Central Europe and Bangladesh. The plant is cultivated worldwide,since, it is important for medicinal purposes and to obtain seeds that are used as spices or in order to obtain the volatile oil (Bhuiyan *et al.*, 2009 and Khan *et al.*,2014). The linalool compound is the main compound in the essential oil, which accounts more than 67.4% of the chemical composition of the aroma oil. In addition, many compounds such as geraniol ,linalyl acetate, α -pinene, β -pinene, β - myrcene, and α -terpinene and others are the antifungal . In addition to its medical properties and the oil of the coriander is considered to be anti-fungal and bacterial, antioxidant and has a distinctive aromatic aroma, beside its medicinal properties (Weiss ,2002 ; Matasyoh *et al.*, 2009 ; Asgarpanah and Kazemivash ,2012 and Władysław and Nowak,2015) .

These days it is preferable to reduce the use of chemical fertilizers, especially in the field of medicinal and aromatic plants because of the high cost , the environment pollution and the danger to human health . Therefore, the trend is to use bio or organic fertilizer. Bio-fertilization is safe for the environment than chemical fertilization and has a significant role in reducing the use of chemical fertilizers, thus reducing the pollution of the environment, Bio fertilizers are microbial inoculants consisting of micro-organism living cells like bacteria, algae and fungi alone or in combination which may help in increasing crop production . Bio-fertilization directly induce positive affects on plant growth through the production of phytohormones such as cytokinins , gibberellins and IAA, which act as growth regulators and its affect through the fixation of nitrogen and biological control and increase the metabolites, which is reflected in enhancing the vegetative growth and improvement of the meristematic tissue activity accompanied by plant growth enhancement (Glick, 2003 and Ahmed and Kibret, 2014). The effect of biofertilization on vegetative growth, yield and oil content has been demonstrated in many studies (Amran 2013 on *Pelargonium graveolens*; Farhood *et al.* , 2016 on Coriender ;Abdollahi *et al.*, 2016 on coriander and El-Tarawy *et al.*, 2017 on caraway).Salicylic acid (SA) is a phytohormones regulates the physiological and biochemical processes and improves the growth and productivity of the plant under different conditions and is enriched in the process of photosynthesis and chlorophyll content.In this respect ,The effect of SA on enhancing

* Corresponding author.

E-mail address: yasser.abdelaty@fagr.bu.edu.eg

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growth, fresh and dry weights, grain yield, No. of umbels, seed yield and volatile oil % was studied by Badran *et al.*, (2011 and 2013) and Rekaby, (2013) on coriander plants.

The objective of this study is to evaluate the effect of NPK chemical fertilization, bio-fertilization and salicylic acid and their interaction on some vegetative growth, yield traits, chemical components and production of the volatile oil for coriander plant.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of the Faculty of Agri., Benha Univ., Egypt during 2017/2018 and 2018/2019 seasons to study the influence of some fertilization forms and salicylic acid on growth, grain yield, chemical constituents and oil productivity of coriander plants. Seeds of Coriander plants were obtained from the Experimental Farm, Faculty of Agric., Benha Univ., Seeds were sown in clay loam soils on 15th November in two seasons in plots, the area of each plot was (1 m²), Each plot contained four plants and two rows (50 cm in between) every row contains two hills (50 cm apart) with two plants. Soil analyses (physical and chemical properties) of experimental soil were reported in (Table a), soil analyses were conducted according to the method described by Page *et al.*, (1982).

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

Properties	Value
Physical properties	
Coarse sand%	3.41
Fine sand%	15.11
Silt %	27.19
Clay %	54.29
Textural class	Clay loam
Chemical properties	
pH	7.30
EC dS/m	0.62
Organic matter %	1.86
Ca Co ₃ %	0.49
Total nitrogen %	0.33
Total phosphorus %	0.13
Total potassium %	0.25

Treatments

Mineral fertilizer

The plants were fertilized with full chemical fertilizer as recommended dose somewhere NH₄NO₃ (33.5%N) was added at 90 Kg N/ fed., calcium superphosphate (15.5 P₂O₅) was added at 60 Kg P₂O₅ and potassium sulphate (48.5 K₂O) at 60 Kg K₂O fed. The N and K fertilizer was rate divided into three equal doses at 30, 45, and 60 days after sowing in both seasons. However, P – fertilizer dose was added during preparing the soil.

Biofertilization

Coriander seeds were inoculated with a mixture of nitrobein + phosphorein contained bacteria namely, Azotobacter calcoaceticum and Bacillus megatherium phosphorus dissolving bacteria which supplied by ARC, Giza, Egypt. The inoculation, with a mixture of nitrobein and phosphorein (1 ml contain 10⁸ viable cell) for 30 min. was by coating coriander seeds using a sticking substance Arabic gum at 16% just before seed sowing. The

inoculated seeds were air dried at room temperature for one hour. While, another two applications were applied 1000 g / fed., as an aqueous solution for maximizing the power ability of bacteria i.e. the first one was applied after 45 days from planting. Whereas, the second was done after 90 days from planting date.

Salicylic acid (SA)

Salicylic acid solution was done as foliar sprays at 150 ppm four times a year at 20 days intervals, the first one was done after two months from planting date in both seasons.

Experimental layout:

Consequently, This experiment was set up in (CRBD) A complete randomized block design as 10 treatments for each treatment replicated three times and each replicate contained 3 plots, each plot contained 4 plants. The treatments were conducted as follows:

- 1- Control (untreated)
- 2- Biofertilization (Bio.)
- 3- NPK 100 %
- 4- Salicylic acid (SA)
- 5- NPK 75% + Bio. + SA
- 6- NPK 75% + Bio.
- 7- NPK 75% + SA
- 8- NPK 50% + Bio. + SA
- 9- NPK 50% + Bio.
- 10- NPK 50% + SA

At the starting of flowering stage, vegetative measurements were conducted and recorded (plant height (cm.), number of branches / plant, stem diameter (cm.), fresh and dry weights / plant (g), number of leaves / plant), while total chlorophylls (a&b) and carotenoids were determined in the fresh leaves of coriander plants after one month from the last treatment according to A.O.A.C. (1980). N, P and K, percentage and total carbohydrates were determined in the dry leaves at the flowering stage, according to Horneck and Miller (1998), Sandell (1950), Horneck and Hanson (1998) and Herbert *et al.* (1971), respectively. At harvesting time the following measurements were done and recorded; No. of umbels per plant, fruit yield per plant (g.), weight of 100 seeds (g) and seed oil percentage. The essential oil of each tested treatment was extracted by hydro-distillation according to Guenther (1961). Gas liquid chromatography analysis of essential oil (GLC) was carried out at the Medicinal and Aromatic Plant Laboratory, Dokki, Egypt.

Statistical analysis.

The obtained data was subjected to statistical analysis according to Snedecor and Cochran, (1989).

RESULTS AND DISCUSSION

I- Vegetative growth

Data presented in Tables, 1 and 2 indicate that the studied vegetative growth characteristics i.e. plant height, No. of branches/plant, stem diameter, fresh and dry weights/plant, and No. of leaves/plant were significantly responded to all treatments under the experimental (NPK, biofertilizer and salicylic acid) compared to the untreated plants (control) in both seasons. The full dose of NPK gave the highest values of these vegetative growth parameters in both seasons. Whereas, 75% NPK combined with biofertilizer and salicylic acid occupied the 2nd position in

this concern, while 75%NPK and Bio. took the third descending order in the two seasons. Conversely, the untreated plant provided with " control" gave the lowest values of this parameters in the two seasons. The positive effects of these treatments (NPK,biofertilization ,SA and their interactions) may be due to the important physiological role of N which inducing the plant constituents through the action of different enzymes activity and protein synthesis (Milica *et al.*, 2015)) that was reflected on an increase in growth parameters and chemical constituents of black seed plants. Moreover, the NPK fertilizers provide plants with macro-elements necessary for growth and yield. Nitrogen promotes vegetative growth, phosphorus is a main constituent of energy compounds, nucleic acids, phospholipids and co-enzymes and potassium increases plant resistance to diseases and prevents excessive water loss (Ezz El-Din and Hendawy, 2010). Abdollahi *et al.*, (2016).They demonstrated that using N chemical fertilizer enhancement plant height,stem diameter,number of branches/plant and fresh and dry weight for coriander plant.On the other side,,The role of bio-fertilizers may be due to their conents of symbiotic or non-symbiotic nitrogen-fixing bacteria in augmenting vegetative growth characters, yield and yield components, essential oil productivity and/or chemical composition (including chlorophyll a, b and carotenoids and/or N, P and K leaf percent and content on Marigold plant (Wondimkun and Belete,2017). The obtained results are confirmed by Mohammad *et al.*, (2012) on *Pimpinella anisum*; Abdel-Latif, (2002) on *Caruim carvi* ;Mohamed *et al.*,(2015) on *Ocimum basilicum* cv Genovese ; Ghatas and Abdallah(2016) on *Echinaceae pupurea* plant and Gendy *et al.*, (2013) on guar plant .They reported that bio-fertilizer can promote plant growth directly through fixation of nitrogen, facilitation of mineral uptake, solubilization of phosphorus, production of siderophores that solubilize and sequester iron, production of phytohormones, or reduction in soil ethylene levels. Moreover Ahmed, (2017) stated that application of bio-fertilization and NPK fertilizers induced an vegetative growth parameters of *Apium graveolens*L and *Anethum graveolens* L . Diminution of chlorophyll content is usual plant response to stress conditions and since SA plays role in stress induced signalling application of SA can result in reduction of chlorophylls (Farooq *et al.*, 2009). In most cases,(SA) encouraged plant growth,fruit yield and oil content on fennel plants (Ali *et al.*,2017) .

Physiological and biological processes in plants are strongly regulated hence SA plays significant role in this regulation. As such SA can be used to improve plant growth under un favourable environmental conditions, but the efficiency of exogenous SA can vary dependent upon the species, developmental stage, application method and SA concentration . Karalija and Parić. (2017), stated that foliar application of salicylic acid induced long-term changes in plant growth and metabolism.Also, they recorded increase in leaf area, secondary metabolites and peroxidase activity. The obtained results are in agreement with the findings of Khodary (2004) and Boroumand *et al.*, (2011) who reported that application of SA maximized the fresh and dry weight of shoot and roots under stress conditions and photosynthesis rate, stomatal conductivity

and transpiration could be affected by SA application of maize and *Brassica napus*,respectively.

Table 1. Effect of some fertilization treatments and salicylic acid on plant. height(cm) , number of branches/ plant and stem diameter (cm.) of Coriander plant during (2017- 2018 and 2018- 2019) seasons

Treatments	plant height (cm)		No. of branches / plant		Stem diameter (cm.)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
season	1 st	2 nd	1 st	2 nd	1 st	2 nd
Control	57.86	58.44	7.07	7.27	0.32	0.34
Biofertilization (Bio)	68.54	69.14	7.59	7.49	0.38	0.40
N P K100%	101.30	105.40	14.44	15.38	0.74	0.76
Salicylic acid (SA)at 150 ppm	65.12	65.61	7.44	8.10	0.36	0.38
NPK75%+Bio.+SAat 150ppm	96.00	96.55	12.75	13.00	0.65	0.68
N P K75%+ Bio.	92.03	92.66	11.07	11.16	0.59	0.62
N P K75%+ SA at 150 ppm	89.34	89.34	10.92	10.90	0.51	0.52
NPK50%+Bio.+SAat 150ppm	82.22	83.12	10.08	10.28	0.54	0.55
N P K50%+ Bio.	74.19	74.49	8.51	9.35	0.44	0.46
N P K50%+ SA at 150 ppm	72.15	72.18	8.37	9.08	0.43	0.44
LSD at 0.05%	3.24	3.61	1.30	1.18	0.053	0.054

Table 2. Effect of some fertilization treatments and salicylic acid on fresh , dry weight / plant(g) and number of leaves/ plant of Coriander plant during (2017- 2018 and 2018- 2019) seasons.

Treatments	Fresh weight / plant (g)		Dry weight / plant (g)		No. of leaves/ plant	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
season	1 st	2 nd	1 st	2 nd	1 st	2 nd
Control	70.77	70.99	8.70	10.08	37.26	37.24
Biofertilization (Bio)	80.67	80.99	9.92	10.37	39.25	39.43
N P K 100%	142.40	144.10	17.52	18.55	55.70	56.89
Salicylic acid (SA)at 150 ppm	80.11	80.66	9.85	10.32	38.15	38.26
N P K75%+ Bio.+ SA at 150 ppm	128.80	136.80	15.84	17.44	50.16	50.22
N P K75%+ Bio.	120.10	130.10	14.24	16.33	47.07	48.89
N P K75%+ SA at 150 ppm	115.40	120.20	14.18	15.39	44.23	44.01
N P K50%+Bio. + SA at 150 ppm	101.10	106.40	12.44	13.62	43.23	43.90
N P K50%+ Bio.	90.64	97.32	11.19	12.46	41.78	42.17
N P K50%+ SA at 150 ppm	90.11	95.11	11.39	12.17	40.12	41.34
LSD at 0.05%	5.31	4.36	1.58	0.95	1.63	0.89

II- Yield

In both seasons, No. of umbles /plant, fruit yield /plant and weight of 100 seeds (g) of *Coriandrum sativum* L.were listed in Table (3),showed that the highest values of these parameters were obtained by using full dose of NPK treatment in the both seasons. Besides, the combined treatments of NPK dose at 75%+Bio.+SA ranked the second value in this concern in the first and second seasons. Meanwhile the combination of 75%NPK+biofertilizer occupied the third order in the two seasons, Control treatment showed the lowest results in both seasons..In this study it seems that using NPK fertilization with biofertilization in presence of SA achieved the maximum yield traits i.e.No.of umbles/plant,fruit yield per plant and weight of 100 seeds of coriander plant when compared with control treatment, The obtained results are in harmony with the findings of Abdollahi *et al.*, (2016) ; Farhood *et al.*,

(2016); Rahimi *et al.*, (2009) on *Coriandrum sativum*; Ahmed (2017) on *Apium graveolens* L and *Anethum graveolens* L. and Mohammad *et al.*, (2012) on *Pimpinella anisum*. NPK fertilizers supply plants with macro-elements essential for growth and yield. Nitrogen promotes vegetative growth which is reflected on the increase of plant yield. Phosphorus is a main ingredient of energy compounds, nucleic acids, phospholipids and co-enzymes and potassium increases plant resistance to diseases and prevents excessive and leading to higher of plant yield and number of seeds per plant (Rahimi *et al.*, (2009) on coriander plants. In the same time, Ahmed, (2017)) on *Apium graveolens* L and *Anethum graveolens* L. stated that bio fertilizers may be credited to maximizing maentration in plant tissues.

Table 3. Effect of some fertilization treatments and salicylic acid on No. of umbles /plant, Seed yield / plant (g) and Weight of 100 seeds (g) of Coriander plant during (2017- 2018 and 2018- 2019) seasons.

Treatments season	No . of umbles/plant		Fruit yield / Feddan (kg)		Weight of 100 seeds (g)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
Control	25.41	26.37	403.60	404.70	1.14	1.17
Biofertilization (Bio)	37.00	37.66	470.40	472.30	1.20	1.21
N P K 100%	50.00	50.91	885.60	905.99	1.49	1.49
Salyclic acid (SA)at 150 ppm	36.53	37.12	417.00	418.20	1.19	1.20
N P K75%+ Bio.+ SA at 150 ppm	44.15	44.60	876.10	882.40	1.38	1.39
N P K75%+ Bio.	42.11	43.12	870.40	873.70	1.29	1.30
N P K75%+ SA at 150 ppm	41.44	43.55	741.70	808.20	1.27	1.30
N P K50%+Bio. + SA at 150 ppm	39.22	40.05	540.10	608.40	1.23	1.23
N P K50%+ Bio.	38.80	39.90	485.50	485.80	1.29	1.28
N P K50%+ SA at 150 ppm	37.54	39.32	485.10	485.30	1.22	1.24
LSD at 0.05%	1.85	1.46	4.19	7.56	0.05	0.08

As well, the phosphate solubilizing bacteria (phosphorein) and nitrogen fixing cerealine may enhancement synthesis of endogenous phytohormones i.e. IAA, GAs and CKs which play an important role in formation of a big active root system which allow more nutrients, uptake from the soil and finally accelerated . Farhood *et al* .,(2016) demonstrated that using SA enhanced grain yield of *Coriandrum sativum* and improved field performance of this plant ,hence salicylic acid is considered a phyto-hormone that regulates physiological and biological processes in plants and can be used to improve plant growth and productivity under different environmental conditions. (Badran *et al.*, (2011 and 2013) and Rekaby(2013) on coriander and Eshak (2013) on caraway,who mentioned that salicylic acid enhancing No.of umbles,seed yield , volatile oile and plant growth.

III-Leaf N%,P%,K%,total carbohydrates,chlorophylls (a&b) and carotenoids content

Tables 4 and 5 demonstrate that N%, P%, K%, total carbohydrates , chlorophylls(a&b) and carotenoids in leaves of *Corianderum sativum* L.plants were more exaggerated by using all treatments compared to control in the both seasons. However, using complete dose of NPK was the most effective fertilizer for increasing N%, P%, K%,total

carbohydrate , chlorophylls (a&b) and carotenoids, followed by the combination of 75 % NPK dose provided with Bio.and SA which occupied the second position in this concern in two seasons. whereas, the treatment of 75 % NPK dose combined with biofertilizer gave the third highest value in this respect in the two seasons.

Table 4. Effect of some fertilization treatments and salicylic acid on N,P,K% of Coriander plant during (2017- 2018 and 2018- 2019) seasons.

Treatments season	N%		P%		K%	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
Control	2.14	2.17	0.276	0.283	1.82	1.86
Biofertilization (Bio)	2.75	2.76	0.283	0.307	2.25	2.26
N P K 100%	3.62	3.70	0.385	0.397	2.73	2.76
Salyclic acid (SA)at 150 ppm	2.74	2.74	0.295	0.297	2.18	2.22
N P K75%+ Bio.+ SA at 150 ppm	3.50	3.52	0.373	0.375	2.61	2.65
N P K75%+ Bio.	3.33	3.40	0.366	0.377	2.53	2.55
N P K75%+ SA at 150 ppm	3.15	3.16	0.355	0.336	2.51	2.52
N P K50%+Bio. + SA at 150 ppm	2.90	2.95	0.338	0.337	2.48	2.50
N P K50%+ Bio.	2.80	2.82	0.308	0.323	2.38	2.44
N P K50%+ SA at 150 ppm	2.77	2.78	0.292	0.314	2.30	2.35
LSD at 0.05%	0.07	0.08	0.006	0.008	0.07	0.09

Table 5. Effect of some fertilization treatments and salicylic acid on total carbohydrate (%) , chlorophylls (a & b) mg/g. f.w.) and carotenoids (mg/g . f.w.) of Coriander plant during (2017- 2018 and 2018- 2019) seasons.

Treatments season	Total carbohydrates (%)		Chlorophylls (a & b) mg/g. f.w.)		Carotenoids (mg/g . f.w.)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
Control	9.05	9.17	1.270	1.270	0.310	0.353
Biofertilization (Bio)	10.90	11.48	1.280	1.282	0.367	0.394
N P K 100%	17.44	17.77	1.495	1.498	0.629	0.682
Salyclic acid (SA)at 150 ppm	10.60	11.00	1.285	1.318	0.361	0.368
N P K75%+ Bio.+ SA at 150 ppm	15.22	15.32	1.405	1.411	0.589	0.619
N P K75%+ Bio.	13.34	13.02	1.324	1.325	0.529	0.585
N P K75%+ SA at 150 ppm	13.66	12.80	1.320	1.319	0.479	0.523
N P K50%+Bio. + SA at 150 ppm	12.21	12.55	1.300	1.310	0.403	0.456
N P K50%+ Bio.	11.21	12.01	1.290	1.295	0.383	0.424
N P K50%+ SA at 150 ppm	11.00	11.66	1.285	1.288	0.375	0.403
LSD at 0.05%	1.72	1.43	0.054	0.054	0.04	0.03

In contrast,the lowest value wase regarded in the two seasons in case of untreated plants treatment . In this concern, Ahmed, (2017) stated that using NPK combined with biofertilizers maximized carotenoids in leaves of Celery and Dill.Mohamed and Ghatas (2016) on *Viola odorata* mentioned that full NPK dose enhanced N ,P and K ,total carbohydrates and total chlorophylls.Also, Mohamed *et al.*,(2015) demonstrated that bio- fertilizers application maximized N,P,K, chlorophyll a& b and carotenoids and total cabohydrate content of *Ocimum basilicum cv Genovese* leaves compared with control plants.

Essential oil percentage

Table.6, indicates that essential oil percentage of coriander was more positively affected by using the combined treatment between 75%NPK+Bio.+SA which gave the highest positive values of plant volatile oil (0.79%&0.85%) in the first and second season respectively ,followed by full dose of NPK which gave the second value of essential oil percentage (0.70%&0.74 %) in 1st and 2nd seasons respectively.

Table 6. Effect of some fertilization treatments and salicylic acid on essential oil . (%) of Coriander plant during (2017- 2018 and 2018- 2019) seasons.

Treatments	Essential oil (%)	
	1 st	2 nd
Control	0.38	0.36
Biofertilization (Bio)	0.46	0.48
N P K 100%	0.70	0.74
Salyclic acid (SA)at 150 ppm	0.42	0.46
N P K75%+ Bio.+ SA at 150 ppm	0.79	0.85
N P K75%+ Bio.	0.62	0.63
N P K75%+ SA at 150 ppm	0.49	0.49
N P K50%+Bio. + SA at 150 ppm	0.52	0.53
N P K50%+ Bio.	0.51	0.54
N P K50%+ SA at 150 ppm	0.49	0.52
LSD at 0.05%	0.05	0.10

On the other hand ,75%NPK+Bio. gave the third value (0.62%& 0.63%) in first and second seasons respectively, but the lowest value of essential oil percentage (0.38% & 0.36%) was produced by control plant in the both seasons.These results are in close with Abd El-kader and Ghaly (2003) on coriander ,Mohamed *et al* (2015) on *Ocimum basilicum* and ,Abdollahi *et al.*,(2016) on coriander.In addition , Mohamed and Ghatas (2016) revealed that the application of biofertilizer + 75 % NPK or full dose of NPK gave the maximum of oil yield productivity on *Viola odorata*. In the same context, Ahmed, (2017) demonstrated that application of biofertilization combined with NPK chemical fertilizer encouraged The highest productivity of the oil percentage on Celery and Dill in both seasons.

Essential oil composition

Table (7) and Figs. (1 - 4) demonstrate the effect of the assigned treatments of control, 75%NPK +bio+ SA, 100% of NPK and NPK75%+Bio on the composition of essential oil distilled from *Coriandrum sativum*.seven compounds were recognized in the essential oil constituents of coriander , i.e. a-Pinene, β-Myrcene, β- Pinene , β-Cymene , Linalool,Geraniol,Linalyl acetate.The major component was Linalool ,that ranged from (77.50 to 80.90%) followed by Linalyl acetate (3.60 to 5.60%), β- Pinene (3.80 to 4.80%), a-Pinene (3.00 to 3.48%).In addition , unknown component with values (1.42 to 8.79%). Therefore, NPK75% + Bio.+SA gave the maximum value of linalool (80.90%) followed by NPK100 % (79.92%),and NPK 75% +Bio. (78.64%).Furthermore,the lowest value of linalool (77.50) was scored by control.Also,NPK75% +Bio.+SA gave the maximum values (5.60%) , (4.80%) of linalyl acetate and β- Pinene respectively.Comparable result was stated by Szemplinski and Nowak (2015) who reported that the major component of *Coriandrum sativum*

was linalool compound which made up 67.4% of chemical composition of oil.

Table 7. Effect of some fertilization treatments and salicylic acid on essential oil constituents of Coriander plant during (2017- 2018 and 2018- 2019) seasons.

Peak No.	Component name	Area%			
		Control	NPK75% + Bio.+SA	Full dose of NPK	NPK75% +Bio.
1	a-Pinene	3.00	3.48	3.47	3.34
2	Myrcene	0.60	0.70	-	-
3	β-Pinene	3.80	4.80	3.90	4.59
4	β-Cymene	3.11	1.60	-	1.97
5	Linalool	77.50	80.90	79.92	78.64
6	Geraniol	0.80	1.50	-	0.94
7	Linalyl acetate	3.60	5.60	3.99	3.63
*	Unknown	7.55	1.42	8.79	6.89
Total		100.00	100.00	100.00	100.00

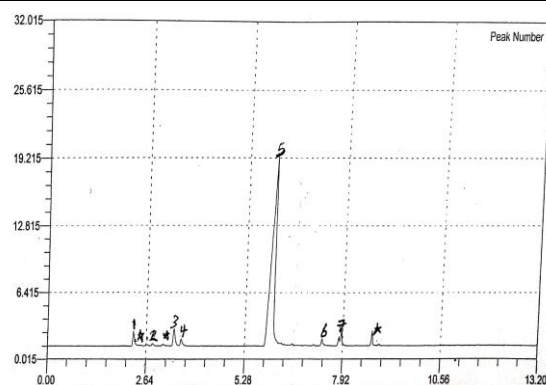


Fig.1. Effect of control treatment on essential oil composition.

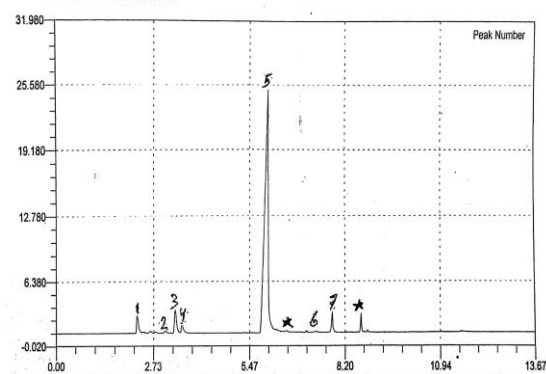


Fig. 2. Effect of NPK75%+Bio.+SA treatment on essential oil composition

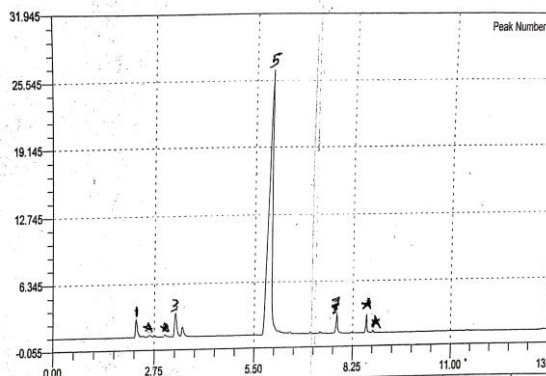


Fig. 3. Effect of NPK100 percentage treatment on essential oil composition.

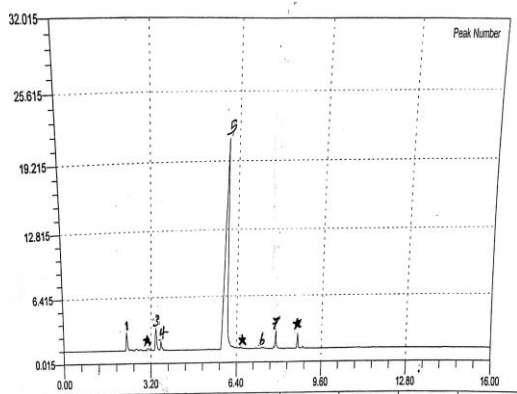


Fig. 4. Effect of NPK75%+Bio. treatment on essential oil composition.

Consequently, it is preferable to use NPK 100% to maximize growth, yield and chemical constituents. However, NPK75%+Bio.+SA achieved the greatest values of oil productivity on *Coriandrum sativum* plants. Therefore, the present study strongly admits the use of such treatments to provide good and high exportation characteristics due to its safety role on human health.

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تداعيات استخدام بعض معاملات التسميد في وجود الرش الورقي بحمض السلسيلك علي نمو وإنتاجية نبات الكسبرة ياسر عبد الفتاح عبد العاطي غطاس قسم البساتين – كلية الزراعة بمشهر – جامعه بنها – مصر.

أجريت هذه الدراسة خلال موسمين متتاليين (٢٠١٧-٢٠١٨ و ٢٠١٨-٢٠١٩) في قسم البساتين . كلية الزراعة جامعه بنها . مصر لدراسة تأثير الأسمدة الكيماوية المكونة من (النتروجين والفوسفور والبوتاسيوم) كجرعة كاملة والتسميد الحيوي المكون من خليط من (النتروجين + الفوسفورين) مع الرش الورقي بحامض السلسيلك عند تركيز ١٥٠ جزء في المليون في صورته مفردة أو التداخل بينهم على النمو الخضري، المحصول، المكونات الكيماوية وإنتاجية الزيت الطيار لنبات الكسبرة في كلا الموسمين. أوضحت النتائج أن المعاملات المختلفة للأسمدة المعدنية، ومعاملة التسميد الحيوي والرش بحامض السلسيلك، سواء بمفردها أو مختلطة فيما بينها، أدت إلى زيادة كبيرة في النمو الخضري والمحصول والمكونات الكيماوية ونسبة الزيت ومكوناته الكيماوية في كلا الموسمين. حقق استخدام الجرعة الكاملة من التسميد الكيماوي أعلى النتائج في صفات النمو الخضري والمحصول والمكونات الكيماوية وبلغها استخدام المعاملة المكونة من ثلاث أرباع الجرعة من التسميد الكيماوي مع التسميد الحيوي مدعوما بالرش بحمض السلسيلك، حيث حققت زياده معنوية كبيرة في النمو الخضري، والمحصول والمحتوي الكيماوي وحققت المعاملة المكونة من استخدام ثلاث أرباع الجرعة من التسميد المعدني + التسميد الحيوي المرتبة الثالثة في النتائج التي تم الحصول عليها عند المقارنه بنباتات الكنترول الغير معاملة في كلا الموسمين. من ناحية أخرى، فإن المعاملة المكونة من ثلاث أرباع الجرعة من التسميد المعدني + التسميد الحيوي + حمض السلسيلك عند تركيز ١٥٠ جزء في المليون اعطت أعلى نسبة من الزيت الطيار ومكوناته الكيماوية. وبناء على ذلك ومن أجل تحقيق أفضل قيم للنمو الخضري والمحصول والمكونات الكيماوية لنبات الكسبرة فإنه يفضل معاملة نبات الكسبرة بجرعة كاملة من التسميد المعدني أو المعاملة المكونة من ثلاثة أرباع جرعة من التسميد المعدني + التسميد الحيوي المكون من (النتروجين + الفوسفورين) + حامض السلسيلك رشا على الأوراق بتركيز ١٥٠ جزء في المليون. من ناحية أخرى، فإنه يفضل معاملة نبات الكسبرة بالمعاملة المكونة من ثلاث أرباع جرعة من التسميد الكيماوي + التسميد الحيوي + حامض السلسيلك رشا على الأوراق بتركيز ١٥٠ جزء في المليون للحصول على أعلى إنتاجية من الزيت الطيار ومكوناته.