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Response of (*Petroselinum sativum* Hoffm.) To Organic, Bio-Fertilizer and some Foliar Application

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ABSTRACT

This study was planned to reduce or replace chemical fertilizer with organic and bio-fertilizers in parsley productivity. Three FYM rates (2 t./fed, 4 t./fed and 6 t./fed) and four biofertilizers treatments (zero, yeast extract, biofertilizers mix, S.mix +bio+yeast) and Super mix foliar application were studied compared to recommended NPK during the two successive winter seasons of 2014/2015 and 2015/2016. The obtained results indicated that vegetative growth, seed yield and essential oil %, total carbohydrates, vitamin c, total chlorophyll and NPK contents were increased with increasing FYM rate to reach the maximum values in 6t./fed rate. On the other hand, biofertilizers treatments improved vegetative growth, seed yield and essential oil % with the superiority of (S.mix +bio+yeast) treatment during the two growing seasons. It could be recommended with 6 t./fed. FYM and (S.mix +bio+yeast) or yeast biofertilization treatments to obtain best growth, seed yield and essential oil percentage, as well as, reducing pollution and keep human health.

Keywords : *Apiaceae* family, organic manures, biofertilization, Parsley, yield, essential oil.

INTRODUCTION

Recently, many of consumers have incorporated natural healthy products and the functional foods into the daily nutrition for achieving optimal health and wellness.

Apiaceae family plants as a functional food are rich in fatty oils, proteins, crude, carbohydrates and essential oils. Nowadays, these plants are usually grown in order to obtain a controlled quality of raw materials. Functional properties of *Apiaceae* plants stem from or are determined by the roles and functions of their essential oils (Jamwal *et al.;* 2013 and Aćimović and Dojčinović 2014).

The studying of the natural products has been the single most successful strategy to discover new medicines for treat a great number of diseases. The hypolipidemic, antioxidant and antidiabetic activities exhibited by *Apiaceae* family are a result of the synergistic action between the bioactive compounds present in the seeds (Rajeshwari *et al.;* 2011)

Parsley (*Petroselinum sativum* Hoffm.) is an important, very common and popular member of *Apiaceae* family which originated in the Mediterranean region and cultivated in many parts of the world. In Egypt, the flat-leaf parsley type is the most common type and is cultivated in a commercial scale for local consumption and export.

It is a 'powerhouse' of nutrition, and is rich in B (b2, b3 and b6) vitamins, vitamin C (exceeds the amount of lemon by three times), β-carotene and zinc; it is an important dietary component for strengthening bone due to its high content of boron and fluorine. It is also contains iron (in a high percentage) and calcium in an absorbable form. Parsley has anti-inflammatory, antimicrobial, diuretic and hypoglycaemic properties due to its content of essential oil and phenolic compounds (Taiz and Zeiger, 1998). Yoshi- kawa *et al.;* (2000) reported several flavone glycosides with oestrogenic activity from the aerial parts of parsley, along with a new monoterpene glucoside, petroside.

The leaves contain about 0.04–0.4% of volatile oil, and this includes as major constituents α-pinene, β-pinene, myrcene, β-phellandrene,1,3,8-*p*-menthatriene and myristicin. While seeds contain about 2–8% of volatile oil and 13–22% of fixed oil, and the major compounds found in the volatile oil are α-pinene, β-pinene, myristicin, elemicin, 2,3,4,5-tetramethoxy-allylbenzene and apiol (Charles, 2004). Apiol (or apiole) is a phenylpropene responsible for parsley abortifacient properties, so it may be used for treating menstrual dis-orders (Castleman, 2009).

Mineral fertilization contributed to the accumulation of the highest content of harmful nitrates in the leaf and root of parsley (Rahimie *et al.;* 2018), so there is a need for organic farming system in parsley production.

Application the organic manures has led to eliminate using of mineral fertilizers and providing maximum quality products which free of harmful agrochemicals for the safety of humans. Also, they have many beneficial impacts for soil fertility (chemical and physical properties) as well as providing the plants with a better source of available nutrients (Darzi, 2012). E U regulations recommended organic farming (Khalil *et al.;* 2008), Also FAO and WHO (Khalil *et al.;* 2007) ensure

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the safety products for better human health and environment.

In sustainable organic farming, the priority is for product quality than product quantity, so the production of medicinal and aromatic plants which their quality has the considerable importance is desirable in organic farming systems (Arun, 2002). Also, one of the main purposes of these systems is eliminating or reducing the use of chemical inputs and replacing them with organic and biofertilizers to overcome environmental problems and improve the health and agricultural products (Sharma 2002)

Biofertilizers have been proposed as an alternative option for different chemical fertilizers to increase soil fertility in sustainable agricultural production (Wu *et al.;* 2005). In recent decades, a broad spectrum of soil bacteria in the rhizosphere was identified, that could improve the growth of most medicinal plants. Some of these bacterial species, that are capable of aiding the plant, belong to the genus Azotobacter, Azospirillum, Bacillus and Pseudomonas (Tilak *et al.;* 2005).

In addition, active dry yeast is one of natural and safe bio-fertilizer that causes various enhancement effects.

This may attributed to its richness in protein, B-vitamin and cytokinins. It contains many nutrient elements and semi growth regulator compounds like auxins, gibberellins and cytokinins (Glick, 1995). Also it releases CO2 which may reflect on improving net photosynthesis (Idso *et al.;* 1995).

The mixed application of different fertilizer sources influences trace elements (Zn, Fe and Cu) uptake optimally (Rahimi *et al.;* 2019).

Hence it is highly encouraging to use of organic and biological inputs in replacement of chemical fertilizers to achieve improving plant efficiency and quality with the aim of alleviating pollution and accomplishing sustainable agriculture.

Many researchers achieved best growth, yield, oil percentage and yield and constituents when used organic manures and different biofertilizers for several medicinal and aromatic plants, like (Toaima *et al.;* 2014) and (Tursun *et al.;* 2019) on parsley, (Rahimie *et al.;* 2018) on parsley,(Patel *et al.;* 2010) and (Badran *et al.;* 2017) on fennel, (Khalil *et al.;* 2008) on Fennel and Salvia, (El-Tarawy *et al.;* 2017) on Caraway.

This research a trial aimed to study the possibility of replacement the chemical fertilizers with organic and bio-fertilizers in parsley productivity and quality

MATERIALS AND METHODS

Two field experiments were located at El-Magzar (31° 01'35.6''N31°21'52.4''E), Bashtamer, Dakhalia Governorate, Egypt, during two successive winter seasons of 2014/2015 and 2015/2016. The sample of soil was taken (0-30 cm) from the soil surface, dried, sieved and analyzed for chemical and physical properties according to Jackson (1967). Analysis results are presented in Table (1)

Table 1. Soil physical and chemical properties of the experimental field during the two seasons.

Soil characters		2014-2015	2015-2016
Mechanical analysis (%)	Coarse sand	2.87	2.69
	Fine sand	16.31	15.82
	Silt	32.47	33.83
	Clay	48.35	47.66
	Texture class	Clayey	Clayey
E.C. $dS.m^{-1}$(1:5)		1.17	1.26
pH (1:2.5)		8.03	7.95
S.P. %		62.70	61.30
O.M. %		1.71	1.59
T. $CaCO_3$ %		3.91	3.49
Available (mg/kg)	N	54.80	52.70
	P	5.21	5.03
	K	177.50	168.40

Parsley seeds were provided from Medicinal and Aromatic Plants Department, HRI, ARC., Egypt. The experimental field was ploughed and divided for the total number of 46 plots (45 plot for different farmyard manure, 1 plot for NPK control). Each plot was 2.5 m x3.5 m with three planting ridges (in 3 m long, 60 cm width, and 20 cm space between ridges). Seeds of parsley were sown (in hills) at 30 cm distance between hills, and the thinning for one plant per hill was done one month after sowing.

All plots (except control plot) were received the different rates of farmyard manure (FYM: 50% green waste manure + 50% chicken manure) in 2, 4 and 6 ton / fed. during field preparation. Agricultural practices were done as recommended by Egyptian Ministry of Agriculture. FYM was analyzed and analysis are presented in Table (2).

Table 2. FYM Chemical analysis

Organic manure properties	FYM	
	2014-2015	2015-2016
pH 1:5	6.45	6.51
EC (1:10)(dSm^{-1})	4.12	3.95
Organic matter (%)	28.57	26.06
Organic carbon (%)	16.61	15.15
Total nitrogen (%)	1.13	1.09
C/N ratio	1:14.7	1:13.9
Total Phosphorus (%)	0.53	0.55
Total Potassium (%)	1.03	0.98

Biofertilizers (*Azotobacter chroccoccum* (AZ), Microhiza and *Bacillus circulans* (KSB) were provided from the biofertilizers unit of, Fac. Agric. Ain shams Univ. Egypt. A mixture of them was proposed at equal parts (10^8 CFU). Also, the mixture was applied at rate of 10 ml per plant 2 times after 15 days of sowing with 7 days intervals.

Foliar application of yeast extract was used at a concentration of 4 g/L. As for Super Mix (essential nutrient and amino acids provided by the General Organization for Agriculture Equalization Fund (G.O.A.E.F.), Ministry of Agriculture) at the rate of 7ml/L water.

Preparation of yeast extract from baking yeast:

Yeast extract was prepared using (Khedr and Farid 2000) technique that stimulate yeast cells growth and multiplied its efficiency during favorable aerobic and nutritional conditions. As well as producing the beneficial bioconstituents i.e. sugars, carbohydrates, fatty acids, amino acids, hormones, etc. Then the growth media was

subjected to deep freezing and complete preparing action by blender to induce the release of different bioconstituents outside yeast cells.

Control treatment was 200 kg ammonium sulfate (20.5 % N), 200 kg super phosphate (15 % P_2O_5) and 100 kg potassium sulfate (48 % K_2O) per fed. as a recommended doses of N, P and K by Min. of Agric. and Soil Reclamation (MASL). Full dose of P was added to the soil before sowing while; N and K were added in three equal doses one after 15 days from sowing, after 30 days and after 45 days (After 30 for 1st cut and 45 days for the 2nd one from parsley sowing).

Experiment layout:

1- The experimental design was a split plot in randomized complete block design with three replicates, main plots were received FYM rates as follows:
2- 2 ton / feddan.
3- 4 ton / feddan.
4- 6 ton / feddan

While sub plots were for five biofertilization treatments with three replicates (which compared with the untreated treatment (control) 100% NPK) as follows:

1- Zero (0) = only FYM without biofertilization.
2- Super Mix (S. mix)
3- Yeast extract (yeast)
4- Biofertilizers mix (Bio)
5- S. mix +bio+yeast

Data recorded:

After 30 days (1st cut) and 45 days (2nd one) from sowing parsley during each growing season 5 plants/ replicate, were randomly selected for various vegetative data e.g. plant height (cm), fresh and dry weights (g/plant).In addition of quantitative analysis for NPK, photosynthetic pigments and total carbohydrates and vitamin C were estimated on fresh weight basis. At harvest stage number of umbels per plant, seed yield per plant, 1000 seed weight and essential oil percentage were recorded.

Analytical Methods:

NPK: Nitrogen, Phosphorus, and Potassium according to the methods described by Cottenie *et al.*, 1982.

Chlorophyll Determinations: Chlorophyll a, b and total chlorophyll (Ch) were determined in the blade of the third leaf of the plant tip (terminal leaflet) according to the methods described by Saric *et al.*, 1976.

Total carbohydrates in fresh leaves was determined according to the method described by Sadasivam and Manickam, (1996).

Vitamin C (in fresh leaves) was determined according to the method described by Mazumdar and Majumder (2003).

The volatile oil percentage was determined in the air dried seeds (were subjected to hydro-distillation for 3 hours) using a modified Clevenger apparatus according to method described by Guenther, 1961.

The GC analysis of the volatile oil samples were carried out using Gas chromatography instrument estimated in the Dept. of Medicinal and Aromatic Plants Laboratory, HRI., with the following specifications: DsChrom 6200 Gas Chromatograph equipped with a flame ionization detector, Column: BPX-5, 5% phenyl (equiv.) polysillphenylene-siloxane 30m x 0.25mm ID x 0.25µm film., Sample size: 1µl, Temperature program ramp increase with a rate of 10º C / min from 70º to 200º C, Detector temperature (FID): 280 °C, Carrier gas: nitrogen, Flow rate: N2 30 ml/min; H2 30 ml/min; air 300 ml/min. Main compounds of the volatile oils were identified by matching their retention times with those of the authentic samples injected under the same conditions. The relative percentage of each compound was calculated from the area of the peak corresponding to each compound.

Statistical analysis

The obtained data were subjected to analysis of variances, and the significant differences among treatment means were determined by Duncans' multiple range test at P<5% as published by Duncan (1965).

RESULTS AND DISCUSSION

Vegetative growth:

It is evident from data in Tables (3) and (4) that the differences were significant between plant height (cm), plant fresh and dry weights (g/ plant) as affected by FYM rates, biofertilizers and foliar application treatments and their interactions in both cuts during the two seasons.

The highest values of previously mentioned growth characters were of the highest FYM dose (6t./fed) plants followed by the values of the mid dose (4 t./fed.) plants. On the other hand, the lowest values were of the lowest dose (2t./fed) plants. The highest values of plant height (45.42 and 47.60 cm) and (41.08 and 42.74 cm), plant fresh weight (34.88 and 36.04 g) and (31.52 and 33.80 g) and plant dry weight (4.87and 5.50 g) and (4.33and 5.57 g) were obtained from plants treated with FYM at 6t./fed for the two cuts of both seasons respectively, but with significant differences when compared to other treatments . While lowest values were of 2 t./ fed FYM plants.

Organic manures are essential for plant growth, because it has been suggested that the humic substances can have a direct effect on plant growth, assuming a hormonal action of humic substances (Varanini and Pinton, 1995). In addition, soil organic matter can increase water holding capacity and cation exchange capacity as well as supplying nutrients, buffering against pH change, preventing their leaching, promoting microbial breakdown of toxic substances and supporting micro-organisms that recycle nutrients and soil formation (Varanini and Pinton, 1995).

On the other hand, the results of biofertilizers treatments showed significant improved in vegetative growth characters of parsley plants, but with the superiority of (S. mix+bio+yeast) treatment which gave the highest records plant height (43.23 and 45.33cm), plant fresh weight (31.53 and 33.13 g) and plant dry weight (4.42 and 4.99 g) in the two cuts of both seasons respectively, followed by yeast foliar application which recorded means closely near to those of (S. mix+bio+yeast) treatment. Actually, the increase in vegetative growth means achieving a preferable and superior quality.

Table 3. Effect of FYM rates, biofertilizers and S. mix on parsley vegetative growth characters in the 1st cut during 2014/2015 and 2015/2016 seasons.

1st cut							
Treatments		**Plant height (cm)**		**Fresh weight (g/plant)**		**Dry weight (g/plant)**	
		1st Season	**2nd Season**	**1st Season**	**2nd Season**	**1st Season**	**2nd Season**
Organic fertilization							
FYM 2 t/fed.		37.06c	39.12c	22.30c	24.46c	3.13c	3.53c
FYM 4 t/fed.		41.26b	43.70b	28.64b	30.36b	4.02b	4.51b
FYM 6 t/fed.		45.42a	47.60a	34.88a	36.04a	4.87a	5.50a
Bio-fertilization							
0		39.20d	41.43c	25.57e	27.37e	3.58e	4.04e
S.mix		40.27c	42.50c	27.20d	28.90d	3.81d	4.30d
Bio		41.37b	43.80b	28.77c	30.50c	4.02c	4.52c
Yeast		42.17b	44.30ab	29.97b	31.53b	4.19b	4.71b
S.mix +bio+yeast		43.23a	45.33a	31.53a	33.13a	4.42a	4.99a
Interaction							
NPK		45.10abc	47.50bc	35.50b	35.30c	4.79d	5.44b
	0	35.40l	37.60k	19.90m	22.30m	2.81o	3.16m
	S.mix	36.20kl	38.40jk	21.10lm	23.40lm	2.98n	3.34l
FYM 2t/fed.	Bio	37.10jk	39.20ij	22.30kl	24.70kl	3.14m	3.52k
	Yeast	37.90ij	39.80hi	23.50jk	25.50jk	3.28l	3.73j
	S.mix+bio+yeast	38.70hij	40.60gh	24.70ij	26.40ij	3.46k	3.92i
	0	39.50ghi	41.30fg	25.90hi	27.80hi	3.62j	4.12h
	S.mix	40.30fgh	42.20f	27.10gh	29.10gh	3.81i	4.30g
FYM 4t/fed.	Bio	41.10efg	44.10e	28.40fg	30.30fg	3.99h	4.42g
	Yeast	41.90def	44.70e	29.70ef	31.20ef	4.16g	4.63f
	S.mix+bio+yeast	43.50cd	46.20cd	32.10cd	33.40cd	4.50e	5.06d
	0	42.70cde	45.40de	30.90de	32.00de	4.32f	4.84e
	S.mix	44.30bc	46.90bc	33.40c	34.20c	4.65d	5.27c
FYM 6t/fed.	Bio	45.90ab	48.10ab	35.60b	36.50b	4.93c	5.63b
	Yeast	46.70a	48.40a	36.70ab	37.90b	5.14b	5.76b
	S.mix+bio+yeast	47.50a	49.20a	37.80a	39.60a	5.29a	5.98a

- Means having the same letter (s) in a column are not significant at 5% level.

Table 4. Effect of FYM rates, biofertilizers and S. mix on parsley vegetative growth characters in the 2nd cut during 2014/2015 and 2015/2016 seasons.

2nd cut							
Treatments		**Plant height (cm)**		**Fresh weight (g/ plant)**		**Dry weight (g/ plant)**	
		1st Season	**2nd Season**	**1st Season**	**2nd Season**	**1st Season**	**2nd Season**
Organic fertilization							
FYM 2 t/fed.		33.28c	35.52c	19.46c	22.70c	2.68c	2.99c
FYM 4 t/fed.		37.06b	38.98b	25.42b	28.52b	3.48b	3.76b
FYM 6 t/fed.		41.08a	42.74a	31.52a	33.80a	4.33a	4.57a
Bio-fertilization							
0		35.17d	37.33e	22.50d	25.67d	3.09e	3.39e
S.mix		36.17cd	38.13d	24.10cd	27.07c	3.30d	3.59d
Bio		37.17bc	39.03c	25.63bc	28.77b	3.51c	3.78c
Yeast		38.10ab	39.87b	26.80ab	29.33b	3.68b	3.96b
S.mix+bio+yeast		39.10a	41.03a	28.30a	30.87a	3.90a	4.16a
Interaction							
NPK		40.60c	42.20bc	31.10abc	33.20bc	4.25bc	4.47cd
	0	31.70m	34.20m	17.20k	20.50m	2.38m	2.72m
	S.mix	32.50lm	34.80lm	18.30jk	21.60lm	2.52lm	2.86lm
FYM 2t/fed.	Bio	33.30kl	35.50klm	19.50ijk	22.70kl	2.68kl	2.98kl
	Yeast	34.10jk	36.20jkl	20.60hij	23.90jk	2.85jk	3.13jk
	S.mix+bio+yeast	34.80ij	36.90ijk	21.70ghi	24.80ij	2.99ij	3.28j
	0	35.50hi	37.60hij	22.90fgh	26.20hi	3.14hi	3.44i
	S.mix	36.20gh	38.10ghi	24.20efg	27.10gh	3.29gh	3.59hi
FYM 4t/fed.	Bio	36.90fg	38.80fgh	25.10ef	28.30fg	3.45fg	3.73gh
	Yeast	37.60ef	39.50efg	26.30de	29.60ef	3.61ef	3.87fg
	S.mix+bio+yeast	39.10cd	40.90de	28.60cd	31.40cd	3.93cd	4.17de
	0	38.30de	40.20def	27.40cde	30.30de	3.76de	4.02ef
	S.mix	39.80c	41.50cd	29.80bc	32.50c	4.10c	4.32d
FYM 6t/fed.	Bio	41.30b	42.80bc	32.30ab	35.30ab	4.41b	4.63c
	Yeast	42.60a	43.90ab	33.50a	34.50b	4.57b	4.87b
	S.mix+bio+yeast	43.40a	45.30a	34.60a	36.40a	4.79a	5.03a

- Means having the same letter (s) in a column are not significant at 5% level.

The positive effect of organic and bio fertilizers on parsley vegetative growth characters may be due to that, the mixed application of different sources of fertilizers influences trace elements (Zn, Fe and Cu) uptake optimally, has useful effects on soil physical and chemical properties and leads to maximum plants quality with a good source of nutrients (Rahimi *et al.;* 2019 and Darzi, 2012). Also, Toaima *et al.;* 2014 on parsley, Khalil *et al.;* 2008 on Fennel and Salvia reported that, the increase in organic fertilization rates significantly increased the vegetative growth and quality characters plants.

Similarly, El-Tarawy *et al.;* 2017 on caraway, mentioned that compost in combinations with active dry yeast significantly enhanced plant growth. The increase

noticed in growth characters may be attributed to the different enzymes, hormones, amino acids, Vit.C etc., which the yeast extract possesses effect on photosynthesis process (Khedr and Farid 2000).

Results in the same tables (3 and 4) indicated that the different growth characters were significantly affected with the interaction between FYM rates and different biofertilizers treatments. The plants supplied with 6 t./fed FYM and treated with (S. mix+ bio+ yeast), yeast , and bio treatments scored the highest values of plant height (47.50 and 49.20 cm),(46.70 and 48.40 cm) ,(45.90 and 48.10 cm), plant fresh weight (37.80 and 39.60 g), (36.70 and 37.90 g), (35.60 and 36.50 g) and plant dry weight (5.29 and 5.98 g), (5.14 and 5.76 g), (4.93 and 5.63 g) compared to the NPK control treatment (45.10 and 47.50 cm), (35.50 and 35.30 g), (4.79 and 5.44 g) for plant height, fresh weight and dry in the first cut of both season respectively. The results of the second cut followed the same trend of the first one. Zero biofertilizers and super mix foliar application had the lowest values of vegetative growth characters.

Many researchers pointed out efficacy of organic manures and biofertilizers on increasing the plant vegetative growth and yield and recommend that completely or partial replacement of NPK mineral fertilization like Toaima *et al*.; (2014) and Rahimie *et al*.; (2018) on parsley, Azzaz *et al.;* 2009 on Fennel, Mohsen *et al.;* 2014 on *Cymbopogon citratus,* Abdollahi *et al.;* 2016 on coriander and Kusuma *et al.;* (2019) on Fennel and El-Sayed *et al.;*(2017) on dill.

Number of umbels /plant, seeds yield/plant, Seed index (1000- seed weight) and essential oil %:

Dealing with the effect of different FYM rates, biofertilizers and their interaction treatments on number of umbels/plant, seed yield/plant, seed index and essential oil percentage in both seasons data were shown in Table (5)

Table 5. Effect of FYM rates, biofertilizers and S. mix on parsley yield characters and essential oil% during 2014/2015 and 2015/2016 seasons.

Treatments		No. of umbels/plant		Seed weight g/plant		Seed Index (g)		Essential oil %	
		1st Season	2nd Season	1st Season	1st Season	2nd Season	1st Season	1st Season	2nd Season
Organic fertilization									
FYM 2 t/fed.		9.60c	9.87c	8.89c	9.60c	1.42c	1.54c	2.34c	2.52c
FYM 4 t/fed.		11.93b	12.73b	10.99b	12.01b	1.76b	1.92b	3.24b	3.69b
FYM 6 t/fed.		15.27a	16.33a	13.57a	14.74a	2.17a	2.36a	3.72a	4.32a
Bio-fertilization									
0		11.22d	11.56d	10.19d	11.06c	1.63c	1.77d	3.00a	3.40c
S.mix		11.89c	12.44c	10.76c	11.80bc	1.72bc	1.89c	3.04a	3.46c
Bio		12.44bc	13.33b	11.30b	12.32ab	1.81b	1.97bc	3.16a	3.55b
Yeast		12.56b	13.22b	11.47b	12.38ab	1.83ab	1.98b	3.13a	3.52b
S.mix+bio+yeast		13.22a	14.33a	12.04a	13.02a	1.93a	2.08a	3.18a	3.61a
Interaction									
NPK		8.33k	8.33k	7.32j	8.09o	1.17m	1.29m	2.81de	3.13ji
	0	8.67k	8.67k	7.83j	8.60n	1.25lm	1.38lm	1.95g	2.07m
	S.mix	9.00jk	9.33jk	8.37ij	9.12mn	1.34klm	1.46kl	2.23fg	2.37l
FYM 2t/fed	Bio	9.33jk	10.00ijk	8.91hij	9.61lm	1.43jkl	1.54jk	2.51ef	2.72jk
	Yeast	10.00ij	10.33ij	9.42ghi	10.09kl	1.51ijk	1.61jk	2.46ef	2.63k
	S.mix+bio+yeast	11.00hi	11.00hi	9.93fgh	10.57jk	1.59hij	1.69ij	2.57ef	2.81j
	0	11.00hi	11.33hi	10.36fgh	11.09ij	1.66ghi	1.77hi	2.86de	3.19i
	S.mix	11.33gh	12.00gh	10.36fgh	11.55hi	1.66ghi	1.85ghi	3.11cd	3.52h
FYM 4t/fed	Bio	12.00fgh	13.00fg	10.88efg	11.98gh	1.74fgh	1.92fgh	3.46abc	3.98ef
	Yeast	12.33fg	13.33efg	11.41ef	12.47fg	1.83efg	2.00fg	3.23bcd	3.67g
	S.mix+bio+yeast	13.00ef	14.00def	11.95de	12.96ef	1.91def	2.07ef	3.52abc	4.08de
	0	14.00de	14.67cde	12.39cde	13.50de	1.98cde	2.16de	3.55abc	3.93f
	S.mix	14.33cd	15.33cd	13.06bcd	14.10cd	2.09bcd	2.26cd	3.65ab	4.18d
FYM 6t/fed	Bio	15.33bc	16.00bc	13.55abc	14.72bc	2.17abc	2.36bc	3.80a	4.51b
	Yeast	16.00ab	17.00b	14.10ab	15.36ab	2.26ab	2.46ab	3.71a	4.33c
	S.mix+bio+yeast	16.67a	18.67a	14.75a	16.01a	2.36a	2.56a	3.91a	4.65a

- Means having the same letter (s) in a column are not significant at 5% level.

The results revealed that the previous yield characters were significantly affected by the different FYM doses in both seasons. The largest number of umbels per plant (15.27 and 16.33), heaviest seed yield/plant (13.57 and 14.74 g), 1000-seed weight (2.17 and2.36g) and essential oil percentage (3.72 and 4.32%) in the two seasons, respectively were of 6 t./fed treatment plants followed by 4 t./fed plants.

On the other hand, it was evident from results that biofertilizers treatments had significant increments in the previous yield characters when compared with non-fertilized ones and NPK control. The largest number of umbels per plant (13.22 and 14.33), heaviest seed yield/plant (12.04 and 13.02 g), 1000-seed weight (1.93 and 2.08g) and essential oil percentage (3.18 and 3.61%) were of plants treated with (S. mix+ bio+ yeast) in the two seasons, respectively followed by treated with (bio) treatment. While yeast foliar application recorded means closely near to those of (bio) treatment in both seasons, respectively.

Such a response for active dry yeast application may be due to its stimulatory effect, which act as coenzymes of photosynthesis and metabolism of carbohydrates and other metabolites in seeds. Also, active dry yeast application is very effective in releasing CO2 which improves net photosynthesis (Idso *et al*., 1995, Dewick, 2000 and Naguib and Khalil. 2002).

It has been reported that, the highest 1000-seed weight, higher seed yield were when the plants were fertilized with a mixture of organic, biological and chemical fertilizers (Rahimi *et al.;* 2019). In addition, others indicated that application of Nitroxin and chemical N fertilizer improves the anise yield and reduces N fertilization rate considerably (Awad *et al.;* 2005). With

respect to the impact of mixed application of organic, biological and chemical fertilizers on the biological yield of Syrian cephalaria, it can be argued that this S. mixture improves soil organic content and contributes to higher yield components including the number of auxiliary branches by affecting moisture and nutrient uptake, retention and availability (Darzi, *et al.;* 2012 and Eghball, *et al.;* 2002) thereby enhancing the biological yield. The application of organic manure with biological fertilizer contributes to improving nutrient availability to plants and maintaining soil moisture and, thereby increasing assimilate synthesis, and helps in increasing plant yields by enhancing the photosynthate synthesis (Darzi, *et al.;* 2012). As well, the yield improvement in integrated nutritional methods may be attributed to the increasing microbial level and enzymatic activities (Gryndler, *et al.;* 2008,and Vessey,2003).

It was clear from the same table that a significant interaction effect was observed from the combination between FYM rates and biofertilizers treatments on plant umbels number, seed yield/plant, and 1000 seed weight in both seasons. The results were obtained from the combination between highest FYM dose and treating with all biofertilizers treatments, as this combination scored the highest means in the two seasons followed by the combination between the second FYM dose and biofertilizers compared to the first dose and NPK control.

The general assumption amongst those using mixture of organic and biological fertilizers and as a result nutrient availability at the seed filling phase enhances the harvest index because their availability affects the current photosynthesis favorably. Thus, the deficiency of nutrients, which may occur in plant growth medium, can change the partitioning of photosynthates among plant organs. What is important in dictating the harvest index is plant responses to resource limitations (Goldberg, 1990 and Yasari and Patwardhan 2007).

Our results agreed, with the findings reported by Toaima *et al*.; (2014) and Rahimie *et al*.; (2018) on parsley, Azzaz *et al.;*(2009) on fennel, Darzi *et al*.; (2012), Shirkhodaei *et al*.; (2014) and Abdollahi *et al*.; (2016) on coriander, Badran *et al*.; (2017) on fennel, El-Sayed *et al.;*(2017) on dill and El-Tarawy *et al*.; (2017) on Caraway

Essential oil analysis

GLC analysis of parsley essential oil samples for the second season plants from the different treatments was illustrated in Table (6) and Figures (1&2). Twelve components were identified, most of them were hydrocarbons with low values compared to the oxygenated ones those had the high values. The main components with high values of parsley essential oil were Myristicin, Apiol, α– p- Dimethylstrene, 1,3,8- p – menthatriene, and B-pinene. .

The highest percentages of Myristicin (66.9% and 70.36%) were recorded from plants received the second and third FYM dose and treated with (S.mix+bio+yeast) treatment. Followed by the combination between the high FYM dose and (bio) treatment (62.55%). In other words increasing FYM dose with biofertilizers inoculation had the high Myristicin followed by control plants (60.35%).

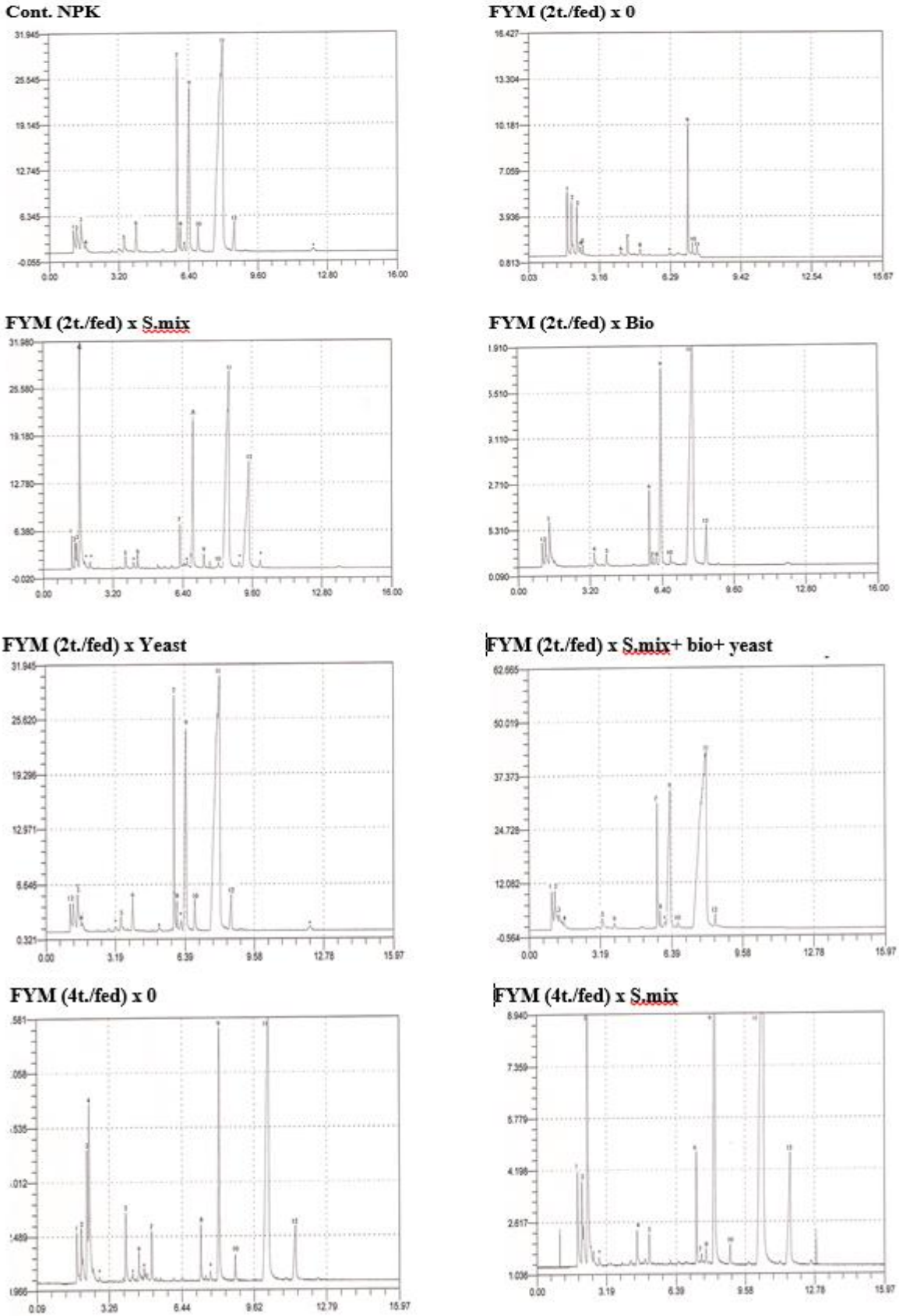
On the other hand, S. mix foliar application had high percentages of Apiol (11.59%, 7.84 and 4.14%), α– p- Dimethylstrene (17.45, 3.77 and 5.32) and 1,3,8- p – menthatriene (20.49, 21.23 and 16.90) in the first, second and third FYM rates, respectively. In addition, the different biofertiliers had promoting effects on these compounds. Other essential oil constituents took the same trend of Apiol, α– p- Dimethylstrene and 1,3,8- p – menthatriene.

It could be observed that spraying with S. mix stimulated the formation of hydrocarbons which are from compounds responsible for parsley aroma. While different FYM doses and biofertilizers stimulated the formation of oxygenated compounds which are responsible for the pharmaceutical or medicinal activity.

In these regards, Azzaz *et al.;* (2009) on fennel and El-Sayed *et al.;* (2017) on dill. They revealed that, the percentages of fennel and dill essential oil constituents were affected by bio-organic fertilization treatments.

Table 6. Effect of FYM rates and biofertilizers on parsley essential oil constituents % (2015/2016) season.

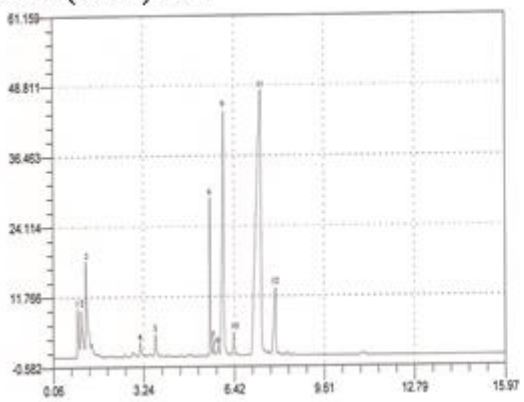
Treatments		α– pinene	Myrcene	B-pinene	B-phellandrene	ρ̄ Cymene	α– Terpinene	Linalool	α– p-Dimethylstrene	1,3,8- p – menthatriene	Elemene	Myristicin	Apiol
NPK		1.77	2.27	2.55	0.94	1.20	1.81	1.32	7.82	16.02	1.62	60.35	2.33
FYM 2t/fed.	0	6.53	1.41	15.30	2.37	0.98	1.53	0.28	15.45	15.06	2.87	34.83	3.39
	S.mix	1.24	1.30	1.52	1.71	0.99	1.31	0.37	17.95	20.49	1.70	39.82	11.59
	Bio	2.51	3.59	6.71	0.82	1.31	0.59	1.13	4.25	17.71	1.42	54.70	5.26
	Yeast	2.72	3.97	6.59	0.76	1.37	1.54	0.30	2.15	21.33	0.69	54.49	4.08
	S.mix +bio+yeast	1.41	2.24	4.98	0.32	0.74	1.54	0.99	4.55	19.76	1.38	56.23	5.86
FYM 4t/fed.	0	2.03	4.47	7.27	1.86	3.00	1.18	2.07	9.92	17.37	1.14	45.59	4.09
	S.mix	2.39	3.34	9.41	0.95	0.73	0.51	0.65	2.65	21.23	1.31	48.99	7.84
	Bio	3.17	4.11	5.75	1.15	0.94	0.54	0.75	3.77	18.56	0.68	56.91	3.66
	Yeast	1.31	2.21	5.94	0.67	1.29	1.02	1.25	5.68	17.54	1.46	56.07	5.56
	S.mix +bio+yeast	2.42	2.75	1.92	0.63	0.87	0.50	0.76	5.06	15.76	1.24	66.19	1.90
FYM 6t/fed.	0	3.33	3.89	9.38	1.23	1.65	1.72	1.51	5.61	15.15	1.25	47.83	7.44
	S.mix	4.26	5.60	5.84	0.61	0.53	0.58	0.32	5.31	16.90	0.47	55.43	4.14
	Bio	1.14	0.98	2.99	0.90	0.75	0.37	0.57	3.35	21.63	0.63	62.55	4.13
	Yeast	1.60	2.30	3.17	1.42	1.47	2.51	1.69	7.24	15.42	2.09	58.24	2.85
	S.mix +bio+yeast	1.09	1.11	1.29	0.68	0.75	0.63	0.44	1.85	19.05	0.62	70.36	2.13



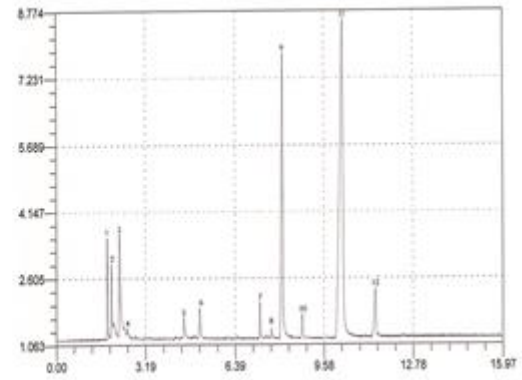
1= α– pinene 2= Myrcene 3= B- pinene 4= B- phellandrene
5= ρ¯Cymene 6= α– Terpinene 7= Linalool 8= α– p- Dimethylstrene
9= 1,3,8- p – menthatriene 10= Elemene 11= Myristicin 12= Apiol *= Unknown compounds

Figure 1. Effect of FYM rates and biofertilizers (1-8) on the essential oil components (%) of parsley during 2015/2016 season.

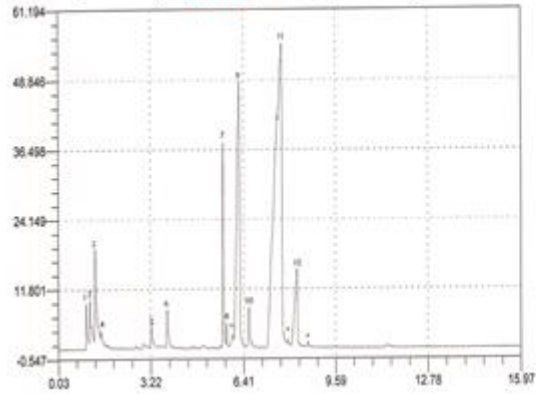
FYM (4t./fed) x Bio



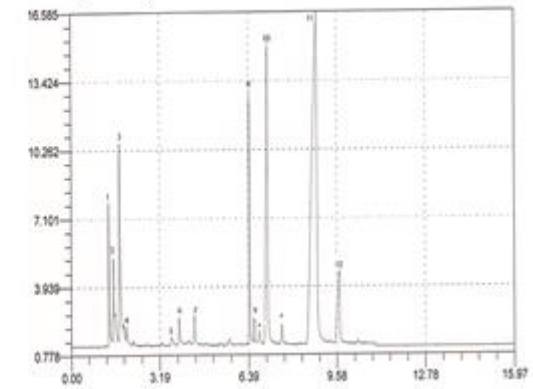
FYM (4t./fed) x Yeast



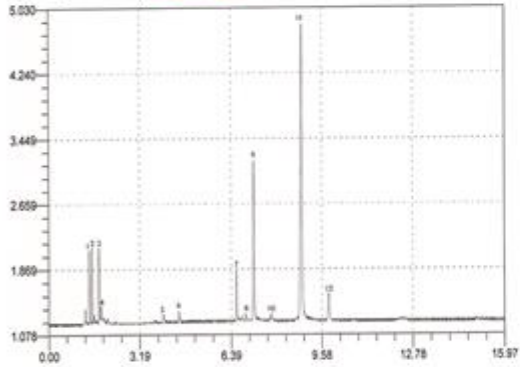
FYM (4t./fed) x S.mix+ bio+ yeast



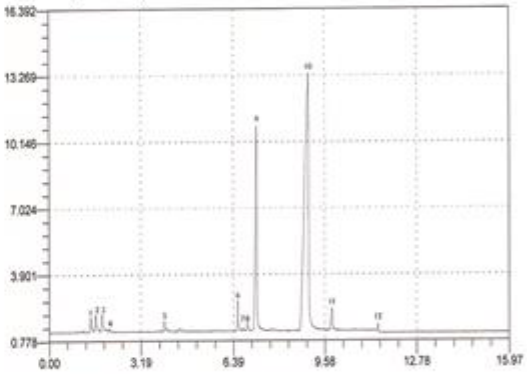
FYM (6t./fed) x 0



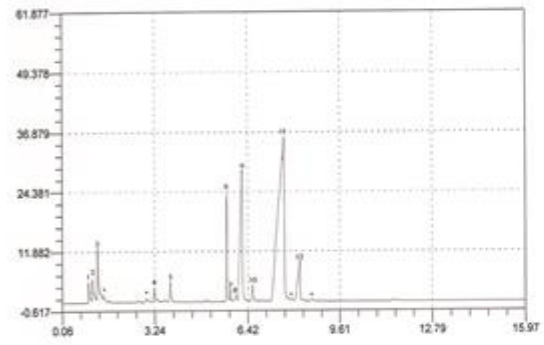
FYM (6t./fed) x S.mix



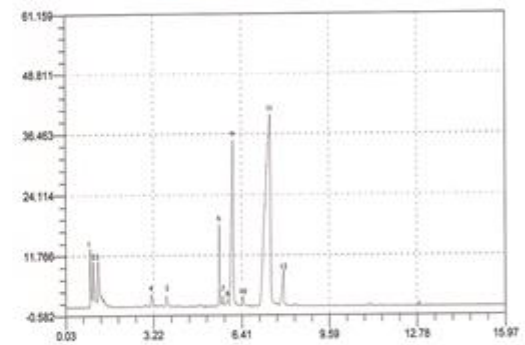
FYM (6t./fed) x Bio



FYM (6t./fed) x Yeast



FYM (6t./fed) x S.mix+ bio+ yeast



1= α– pinene 2= Myrcene 3= B- pinene 4= B- phellandrene
5= ρ Cymene 6= α– Terpinene 7= Linalool 8= α– p- Dimethylstrene
9= 1,3,8- p – menthatriene 10= Elemene 11= Myristicin 12= Apiol
***= Unknown compounds**

Figures 2. Effect of FYM rates and biofertilizers (9-16) on the essential oil components (%) of parsley during 2015/2016 season.

Active constituents: (Total carbohydrates %, Vitamin C (mg/100g) and Total Chlorophylls (mg/g).

From data in Tables (7) and (8) it can be noticed that FYM rates, biofertilizers and their interaction significantly affected on constituents fresh leaves constituents for two cuts of consecutive growing seasons. The highest percentage of total carbohydrates (15.82 and 16.69%) and (16.18 and 16.09%) for the first and second cut during the two seasons respectively were obtained from plants received 6 t. fed FYM.

On the other hand, the highest vitamin c content (135.99and 128.40 mg/100g) and (138.50 and 130.27 mg/100g) and total chlorophylls (1.209 mg/g and 1.346 mg/g) and (1.249 and 1.321 mg/g) were obtained from plants those received the highest FYM dose in both cuts of the two seasons, respectively.

In addition, biofertilizers treatments significantly raised values of the most previous constituents. The favorable treatment that gave the highest values (15.34 and 16.17% total carbohydrates, 133.86 and 125.56 mg/100g vitamin c and 1.164 and 1.304 mg/g total chlorophylls) was (S. mix+ bio+ yeast) treatment in the first cut of the both seasons. The second cut had the same trend of the first one.

Moreover, data in Tables (7) and (8) detected that the best interaction treatment for total carbohydrates, vitamin c and total chlorophylls contents, was combination with 6t./fed FYM and (S. mix+ bio+ yeast) bio fertilization. Also it could be noticed that all combinations in the third FYM rate had the superiority when compared to NPK control and other interaction treatments.

Table 7. Effect of FYM rates, biofertilizers and S.mix on parsley quality characters in the 1st cut during 2014/2015 and 2015/2016 seasons.

1st cut

Treatments		T. carbohydrates%		VC mg/100g		Total chlorophyll (mg/g)	
		1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Organic fertilization							
FYM 2 t/fed.		13.77c	14.59c	127.89c	117.34c	1.040c	1.181c
FYM 4 t/fed.		14.85b	15.72b	131.86b	123.17b	1.128b	1.269b
FYM 6 t/fed.		15.82a	16.69a	135.99a	128.40a	1.209a	1.346a
Bio-fertilization							
0		14.34e	15.14e	129.96e	120.43e	1.085e	1.225e
S.mix		14.60d	15.48d	131.07d	121.82d	1.110d	1.248d
Bio		14.80c	15.66c	131.90c	122.92c	1.127c	1.267c
Yeast		14.99b	15.87b	132.79b	124.12b	1.144b	1.282b
S.mix+bio+yeast		15.34a	16.17a	133.86a	125.56a	1.164a	1.304a
Interaction							
NPK		15.24f	15.09k	121.43o	118.43k	1.186de	1.151o
FYM 2t/fed.	0	13.37n	14.11o	126.37n	115.17m	1.005o	1.148o
	S.mix	13.56m	14.38n	127.13mn	116.13m	1.025n	1.163n
	Bio	13.74l	14.59m	127.83lm	117.30l	1.042m	1.183m
	Yeast	13.98k	14.82l	128.57kl	118.50k	1.057l	1.197l
	S.mix+bio+yeast	14.18j	15.04k	129.53jk	119.60j	1.071k	1.212k
FYM 4t/fed.	0	14.42i	15.24j	130.17ij	120.73i	1.090j	1.228j
	S.mix	14.62h	15.47i	130.83hi	121.83h	1.108i	1.250i
	Bio	14.83g	15.66h	131.63gh	122.93g	1.124h	1.267h
	Yeast	14.97g	15.87g	132.47fg	124.13f	1.143g	1.283g
	S.mix+bio+yeast	15.44e	16.34e	134.20de	126.23e	1.175e	1.318e
FYM 6t/fed.	0	15.22f	16.07f	133.33ef	125.40e	1.159f	1.299f
	S.mix	15.63d	16.60d	135.23cd	127.50d	1.197d	1.332d
	Bio	15.83c	16.73c	136.23bc	128.53c	1.214c	1.351c
	Yeast	16.03b	16.91b	137.33ab	129.73b	1.231b	1.366b
	S.mix+bio+yeast	16.40a	17.13a	137.83a	130.83a	1.245a	1.383a

- Means having the same letter (s) in a column are not significant at 5% level.

In the same manner, Rahimie *et al.;* (2019) on Syrian Cephalaria (*Cephalaria syriaca)* reported that total chlorophylls contents influenced by organic and biofertilization . Jahanshahi *et al.;* (2014) on dill and Toaima *et al.; (*2014) on parsley revealed the same observations.

Chemical constituents: N, P and K percentages

Data in Tables (9) and (10) demonstrated that percentages of N, P and K were affected by different FYM doses, biofertilizers and their interaction treatments. N, P and K percentages were increased by increasing FYM rate to reach the minimum value with 6t./fed rate (N% 3.27 and 3.62, P% 0.509 and 0.599 and K% 4.03 and 4.24) for first cut in the both seasons, respectively). As well as, the similar trend gained by the biofertilizers treatments, which significantly raised NPK values compared to each other and NPK control. The second cut had the same trend of first cut in both seasons.

Table 8. Effect of FYM rates, biofertilizers and S. mix on parsley quality characters in the 2nd cut during 2014/2015 and 2015/2016 seasons.

2nd cut							
Treatments		**T. carbohydrates%**		**VC mg/100g**		**Total chlorophyll**	
		1st Season	**2nd Season**	**1st Season**	**2nd Season**	**1st Season**	**2nd Season**
Organic fertilization							
FYM 2 t/fed.		14.04c	14.30c	131.41c	119.49c	1.080c	1.154c
FYM 4 t/fed.		15.15b	15.22b	135.14b	125.16b	1.169b	1.241b
FYM 6 t/fed.		16.18a	16.09a	138.50a	130.27a	1.249a	1.321a
Bio-fertilization							
0		14.60e	14.78e	133.39e	122.39e	1.124e	1.200e
S.mix		14.90d	15.02d	134.38d	123.89d	1.148d	1.220d
Bio		15.11c	15.20c	134.89c	124.92c	1.168c	1.239c
Yeast		15.35b	15.39b	135.91b	126.17b	1.185b	1.256b
S.mix+bio+yeast		15.65a	15.63a	136.51a	127.51a	1.206a	1.277a
Interaction							
NPK		14.39k	14.58k	129.93h	134.63a	1.151i	1.136k
FYM 2t/fed.	0	13.62o	13.95o	130.03h	117.20k	1.044o	1.121k
	S.mix	13.85n	14.13n	130.70h	118.47j	1.060n	1.134k
	Bio	14.05m	14.27m	130.77h	119.47j	1.082m	1.154j
	Yeast	14.23l	14.51l	132.43g	120.77i	1.102l	1.172i
	S.mix+bio+yeast	14.45k	14.62k	133.10fg	121.57i	1.113k	1.189h
FYM 4t/fed.	0	14.67j	14.82j	134.00ef	122.83h	1.127j	1.205g
	S.mix	14.87i	15.02i	134.07ef	123.93g	1.148i	1.219g
	Bio	15.09h	15.19h	135.03de	124.73g	1.170h	1.238f
	Yeast	15.36g	15.34g	136.10cd	126.10f	1.185g	1.258e
	S.mix+bio+yeast	15.75e	15.74e	136.50c	128.20de	1.218e	1.286d
FYM 6t/fed.	0	15.52f	15.57f	136.13cd	127.13ef	1.201f	1.274d
	S.mix	15.98d	15.90d	138.37b	129.27d	1.235d	1.308c
	Bio	16.20c	16.12c	138.87ab	130.57c	1.252c	1.324b
	Yeast	16.45b	16.31b	139.20ab	131.63c	1.267b	1.339b
	S.mix+bio+yeast	16.74a	16.54a	139.93a	132.77b	1.289a	1.358a

- Means having the same letter (s) in a column are not significant at 5% level.

Table 9. Effect of FYM rates, biofertilizers and S. mix on parsley NPK content in the 1st cut during 2014/2015 and 2015/2016 seasons.

1st cut							
Treatments		**N%**		**P%**		**K%**	
		1st Season	**2nd Season**	**1st Season**	**2nd Season**	**1st Season**	**2nd Season**
Organic fertilization							
FYM 2 t/fed.		2.39c	2.74c	0.421c	0.510c	3.02c	3.42c
FYM 4 t/fed.		2.85b	3.22b	0.467b	0.557b	3.62b	3.88b
FYM 6 t/fed.		3.27a	3.62a	0.509a	0.599a	4.03a	4.24a
Bio-fertilization							
0		2.64e	2.98e	0.444e	0.533e	3.39c	3.65e
S.mix		2.76d	3.09d	0.458d	0.546d	3.52bc	3.76d
Bio		2.83c	3.21c	0.465c	0.556c	3.60ab	3.85c
Yeast		2.93b	3.29b	0.474b	0.565b	3.69a	3.93b
S.mix+bio+yeast		3.03a	3.40a	0.487a	0.576a	3.58ab	4.05a
Interaction							
NPK		1.80l	1.89p	0.457i	0.461m	2.59i	2.67n
FYM 2t/fed.	0	2.22k	2.54o	0.402o	0.491l	2.98h	3.24m
	S.mix	2.30j	2.65n	0.412n	0.501k	3.07h	3.31l
	Bio	2.39i	2.74m	0.421m	0.511j	3.17gh	3.43k
	Yeast	2.48h	2.83l	0.428l	0.518j	3.25gh	3.53j
	S.mix+bio+yeast	2.56g	2.94k	0.439k	0.528i	2.65i	3.61i
FYM 4t/fed.	0	2.66f	3.02j	0.447j	0.537h	3.41fg	3.68h
	S.mix	2.76e	3.10i	0.457i	0.543h	3.54ef	3.77g
	Bio	2.83e	3.22h	0.465h	0.557g	3.60ef	3.88f
	Yeast	2.94d	3.30g	0.473g	0.565f	3.68def	3.94f
	S.mix+bio+yeast	3.09c	3.45e	0.492e	0.582d	3.87bcd	4.13d
FYM 6t/fed.	0	3.03c	3.38f	0.483f	0.572e	3.78cde	4.04e
	S.mix	3.23b	3.53d	0.503d	0.592c	3.96abc	4.21c
	Bio	3.28b	3.66c	0.510c	0.600b	4.04abc	4.23c
	Yeast	3.39a	3.74b	0.521b	0.612a	4.14ab	4.32b
	S.mix+bio+yeast	3.45a	3.82a	0.529a	0.619a	4.23a	4.41a

- Means having the same letter (s) in a column are not significant at 5% level.

Table 10. Effect of FYM rates, biofertilizers and S. mix on parsley NPK content in the 2nd cut during 2014/2015 and 2015/2016 seasons.

2nd cut							
Treatments		**N%**		**P%**		**K%**	
		1st Season	**2nd Season**	**1st Season**	**2nd Season**	**1st Season**	**2nd Season**
Organic fertilization							
FYM 2 t/fed.		2.27c	2.61c	0.409c	0.498c	2.97c	3.33c
FYM 4 t/fed.		2.74b	3.08b	0.454b	0.545b	3.44b	3.80b
FYM 6 t/fed.		3.13a	3.49a	0.496a	0.588a	3.84a	4.21a
Bio-fertilization							
0		2.51e	2.84e	0.431e	0.522e	3.22e	3.57e
S.mix		2.63d	2.97d	0.443d	0.535d	3.32d	3.68d
Bio		2.72c	3.06c	0.451c	0.543c	3.42c	3.78c
Yeast		2.80b	3.16b	0.462b	0.552b	3.51b	3.87b
S.mix+bio+yeast		2.91a	3.27a	0.476a	0.566a	3.62a	3.99a
Interaction							
NPK		1.85m	1.98n	0.481d	0.471m	2.41n	2.53p
FYM 2t/fed.	0	2.10l	2.42m	0.391m	0.481l	2.82m	3.14o
	S.mix	2.19k	2.52l	0.399l	0.489k	2.86m	3.23n
	Bio	2.28j	2.61k	0.407k	0.498j	2.97l	3.34m
	Yeast	2.35j	2.72j	0.418j	0.507i	3.05k	3.42l
	S.mix+bio+yeast	2.43i	2.78j	0.428i	0.513i	3.15j	3.51k
FYM 4t/fed.	0	2.53h	2.88i	0.433i	0.525h	3.25i	3.62j
	S.mix	2.62g	2.98h	0.442h	0.533g	3.33h	3.68i
	Bio	2.72f	3.05g	0.450e	0.544f	3.43g	3.79h
	Yeast	2.82e	3.16f	0.461f	0.551f	3.51f	3.87g
	S.mix+bio+yeast	2.99d	3.35e	0.482d	0.575d	3.68d	4.04e
FYM 6t/fed.	0	2.89e	3.21f	0.469d	0.560e	3.60e	3.95f
	S.mix	3.08c	3.42d	0.488d	0.582cd	3.77c	4.14d
	Bio	3.16b	3.51c	0.497c	0.588c	3.87b	4.21c
	Yeast	3.23a	3.61b	0.506b	0.598b	3.97a	4.32b
	S.mix+bio+yeast	3.30a	3.69a	0.518a	0.611a	4.02a	4.41a

- Means having the same letter (s) in a column are not significant at 5% level.

In addition, data in the same tables showed that there was significant effect by combination with different FYM rates and biofertilizers treatments as well as S. mix foliar application on the different chemical compositions for the two cuts in both seasons.

In these regards, Azzaz *et al.;*(2009) revealed that supplying fennel plants with N P K + bio-fertilizer, followed by N P K or the high level of organic manure (40 m 3 /fed) + bio- fertilizer compared to other treatments in comparison with other combination ones. In addition, Jahanshahi *et al.;*((2014) on dill found an increasing in NPK percentages were on account of organic and biofertilizers applications. Moreover, Rahimie *et al.;* (2019) worked on (*Cephalaria syriaca)* and revealed that mineral contents influenced by bio and organic fertilization.

Finally, the extensive use of chemical fertilizers in agricultural production systems in Egyptian soils has increased different crops productivity but compromised quality especially when we talked about medicinal and aromatic plants as a functional food or pharmaceutical therefore, that are not acceptable for export. So, using organic manures and biofertilizers become an important target for crops production and improving soil physical and chemical properties.

CONCLUSION

We could conclude that organic manures (6t./fed FYM) and biofertilization improved parsley plant growth, yield and essential oil percentage. Moreover, they are considered an organic field inputs as they are environmentally benign and could be recommended as a safe system for the crops production and humans health.

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إستجابة نبات البقدونس للتسميد العضوى والحيوى وبعض مواد الرش

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جاءت هذه الدراسة علي نبات البقدونس كمحاولة لتقليل أو إستبدال الأسمدة الكيماوية المستخدمة فى إنتاج البقدونس بالأسمدة العضوية والحيوية. وفي هذا الصدد تم دراسة ثلاث معدلات من السماد العضوى (2، 4 ، 6 طن / فدان). كما تم دراسة أربع معاملات للتسميد الحيوى (بدون إضافة – إضافة مخلوط من الأسمدة الحيوية – الرش بمستخلص الخميرة – إضافة مخلوط الأسمدة الحيوية والرش بكل من السوبر ميكس و الخميرة) وكذلك الرش بالسوبر ميكس ومقارنة الجميع بالمعدل الموصى به من التسميد الكيماوى و ذلك خلال موسمي 2014/ 2015 و 2015/ 2016. ولقد أظهرت النتائج تزايد صفات النمو الخضري وصفات المحصول البذرى والزيت والمحتوى من الكربوهيدرات الكلية وفيتامين c والكلوروفيل الكلى مع الزيادة فى معدل التسميد العضوى حتى وصلت القيم أقصاها باستخدام المعدل 6 طن / فدان. هذا وعلي الجانب الآخر فقد أظهرت معاملات التسميد الحيوى تحسنا ملحوظا في صفات النمو والمحصول ومحتوي الزيت ولكن مع تفوق معاملة إضافة مخلوط الأسمدة الحيوية والرش بكل من السوبر ميكس و الخميرة في التأثير خلال موسمي النمو. وعلي ذلك يمكن التوصية بإضافة 6 طن/ فدان من السماد العضوى و إضافة مخلوط الأسمدة الحيوية والرش بكل من السوبر ميكس و الخميرة للوصول لأفضل نمو خضرى ومحصول بذري ومحتوي من الزيت الطيار وكذلك تقليل التلوث والحفاظ علي الصحة العامة.

الكلمات الداله : العائلة الخيمية ، الأسمدة العضوية ، الأسمدة الحيوية، البقدونس ، المحصول ، محتوى الزيت.