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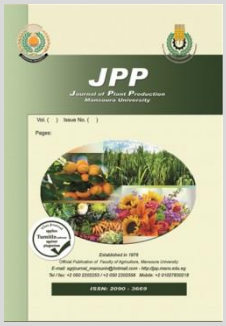
Effect of Ground Treatments (Vermicompost) and Foliar Application with some Plant Growth Stimulants on Growth, Chemical Composition, and Oil Yield of Italian Basil (*Ocimum basilicum* L. var. Genovese)

Hekmat Y. A. Massoud; M. M. Abd El-Baset and Alaa B. B. Abd El-Hady

Vegetables & Floriculture Department, Faculty of Agriculture, Mansoura University, Egypt.



ABSTRACT

This study was conducted during the 2019/2020 and 2020/2021 seasons at one of the agricultural nurseries in Dakahlia Governorate, Egypt to recognize how ground treatments and foliar application with some plant growth stimulants influenced the growth, chemical composition, and oil yield of Italian basil. The experimental plan for each ground treatment of vermicompost: clay soil at two rates (25:75 and 50:50%) (1:3 and 1:1v/v) in a separate experiment that used a randomized complete block design with four replications. Thirteen foliar spraying treatments using some plant growth stimulants were used as follows; control treatment, spraying plants with yeast extract at 2, 4, and 6 g/L, seaweed extract at 20, 40, and 60 %, chitosan at 500, 750, and 1000 ppm and vermicompost tea at 250, 500 and 750 ml/L. Growing Italian basil in media consisting of 25 % vermicompost: 75 % soil performed better than other media consisting of 50 % vermicompost: 50 % soil, which produced the highest values of all studied traits. The highest values of all studied traits were formed from foliar spraying Italian basil plants with chitosan at 750 ppm. It can be concluded that using growing media consists of 25 % vermicompost: 75 % clay soil in addition to foliar spraying Italian basil plants with chitosan at 750 ppm or vermicompost tea at 750 ml/L to enhance the growth and chemical composition and oil percentage of Italian basil (*Ocimum basilicum* L. var. Genovese) under the environmental conditions of Dakahlia Governorate, Egypt.

***Keywords*:** *Ocimum basilicum* L. var. *Genovese*, vermicompost, seaweed extract, chitosan, vermicompost tea.

INTRODUCTION

In today's culture, medicinal and aromatic plants are playing a bigger role in agricultural and industrial production. The majority of drugs or active ingredients used in the production of medications come from medicinal plants. The cultivation of a wide variety of plants, the majority of which are export crops like basil, is made possible by Egypt's favorable climate, fertile soil, and technological know-how. The Italian basil *Ocimum basilicum* L. var. "Genovese" is cultivated from the sweet basil. Genovese basil leaves are big, strong leaves that grow to a maximum length of 7:6 cm. Genovese basil plants can grow between 90 and 120 cm tall. Large fresh basil leaves are best for pesto, caprice salad, and other dishes that call for them. The applications of Genovese basil are similar to those of any other basil. Paton *et al*. (1999).

Using good growing media is critical for increasing the growth, yield, quality, and profits of ornamental and medicinal crops. Vermicompost is an organic fertilizer created by the complete decomposition of organic matter following earthworm digestion.

Vermicompost is sufficient to meet the plant's needs for major and minor elements, and the effect of vermicompost is immediate. Vermicompost contains both major and minor plant nutrients such as N, P, K, Ca, S, Fe, Z, Cu, and Mn. It also has a higher nitrogen content than any other organic fertilizer (Lazcano and Martin, 2010). Plant diseases can be avoided by using vermicompost. Celikcana *et al*. (2021) reported that vermicompost applications at 10% and 20% concentrations significantly increased the weight of fresh and dry, the weight of fresh and dry roots, the leaf area of sweet basil, identified essential oil compounds and content of caffeic, the level of Rosmarinus acid, and higher nutrient levels of (*Ocimum basilicum L*.).

The foliar application of some plant growth stimulants like yeast extract, seaweed extract, chitosan, and vermicompost tea has a very important role in improving the growth, chemical composition, and oil yield of medicinal and aromatic plants like Italian basil (*Ocimum basilicum* L. var. Genovese). It also has a beneficial role in the recovery of nutritional and physiological disorders in medicinal and aromatic plants.

Yeast extract is inexpensive and provides safe nutrition for plants. Yeast contains a group of amino acids that help the plant withstand heat stress as well as nutrients (Na, Ca, Fe, K, P, S, Mg, Si, Zn) and cytokinin, which leads to the activation of the cell division process and increases the size of fruits. It also improves reproduction by boosting flower development due to its high level of auxin and cytokinin and increasing carbohydrate accumulation through CO_2, which forms medium vegetation and helps in photosynthesis.

El-Naggar *et al*. (2020) on *Ocimum basilicum* L. plants. Found that the greatest results were obtained when a concentration of 6 g/L of yeast was combined with a concentration of 4 g/L of seaweed extract. Abou El Salehein *et al*. (2021) discovered that the treatment with 8 g/L dry yeast extract had the greatest impact on the plant's vegetative growth traits, oil content, and chemical content of sweet basil (*Ocimum basilicum* L.).

Seaweed extracts are extracted from brown algae (like laminaria, Ascophyllum, and Nodsum) and are widely used

* **Corresponding author.**
E-mail address: mohaned2005@mans.edu.eg
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in growing crops. The chemical composition of seaweed is complex sugars, amino acids, vitamins, hormones, and minerals like Zn, Co, Mo, Mn, and Ni Battacharyya *et al*. (2015). It can help plants increase their resistance to fungi and disease and keep the soil aerated and healthy. It can enhance the resistance by speeding up seed germination, promoting root growth, and absorbing nutrients, and plants can resist stresses such as salt, temperature, and lack of food. It has a significant effect on the height of *Ocimum basilicum* L., and the percentage of essential oil increases regularly El-Naggar *et al*. (2020). Waly *et al*. (2020) found that all characteristics of *Thymus vulgaris* L. were increased by applying seaweed extract topically at a rate of 6 ml/L.

Chitosan is a biological polymer with several industrial, medicinal, and agricultural applications, and it is regarded as one of the world's second most significant polymers. It is non-toxic, safe, and affordable. It's a polysaccharide polymer with unusual biological activity. Chitin, a co-polymer of N-acetyl-D-glucosamine and D-glucosamine that is the primary component of arthropod exoskeletons, produces a linear unbranched polymer of -1,4-D-glucosamine. Chitin may be found in fungi, mollusks, diatoms, and marine and freshwater sponges, among other things. Chitosan is generally used to protect plants from infections, but it also stimulates plant growth, enhances soil fertility, and increases nutrient absorption. It also promotes the plant to develop under stressful circumstances since it is a chemical used to minimize water stress on the growth parameters of two species of basil (*Ocimum ciliatum* and *O. basilicum*), and treatment with chitosan can partially lessen the effect of drought stress in general Pirbalouti *et al.* (2017). Fahmy and Nosir (2021) explained that the concentration of chitosan at 400 ppm resulted in a notable improvement in growth traits (length of the plant, the number of leaves and branches, the weights of the roots, both fresh and dry, and the quantity and length of the roots) when sprayed five times throughout the growing season on lavender (*Lavandula officinalis*, Chaix.).

The application of vermicompost tea improves plant growth and crop production, as it contains quickly absorbed mineral nutrients, organic acids, and growth regulators that have an effect on plant growth, in addition to the microorganisms present in vermicompost tea that stimulate the plant to resist diseases and absorb nutrients Edwards *et al*. (2007) and Pant *et al.* (2009). Javanmardi and Ghorbani (2012) discovered that when CMT or VCT was applied at a 1:10 dilution, the essential oil content in lemon basil (*Ocimum citriodorum* Vis.). reached its greatest point (0.618 %).

Therefore, this study aims to know the effect of the ground treatments and foliar applications with some plant growth stimulants (yeast extract, seaweed extract, chitosan, and vermicompost tea) on the growth, chemical composition, and oil yield of medicinal and aromatic plants like Italian basil (*Ocimum basilicum* L. var. Genovese).

MATERIALS AND METHODS

Throughout two seasons of 2019/2020 and 2020/2021, this study was conducted at one of the agricultural nurseries in Dakahlia Governorate, Egypt to perceive how ground treatments and foliar applications with some plant growth stimulants like yeast extract, seaweed extract, chitosan, and vermicompost tea influenced the growth, chemical composition and oil yield of medicinal and aromatic plants like Italian basil (*Ocimum basilicum* L. var. Genovese).

Experimental design:

The experimental plan for each ground treatment of vermicompost (red wegler worm): clay soil at two rates (25:75 and 50:50%) (1:3 and 1:1v/v) in a separate experiment that used a randomized complete block design (RCBD) with four replications. Thirteen foliar spraying treatments using four different plant growth stimulants were used in each experiment's ground treatments at one of three rates:

1. Control treatment (spraying plants with water only).
2. Spray plants with yeast extract at the rate of 2, 4, and 6 g/L.
3. Spray plants with seaweed extract (*Ascophyllum nodosum* L.) at the rate of 20, 40, and 60%
4. Spray plants with chitosan at the rate of 500, 750, and 1000 ppm.
5. Spray plants with vermicompost tea at the rate of 250, 500, and 750 ml/L.

The Italian basil plants were sprayed with the formerly mentioned foliar spraying treatments by hand sprayer until saturation point at two weeks after transplanting in three batches with two-week intervals between each batch.

Plant material:

Basil seeds were bought from the Gamal Al Daly Nursery in Mania, Egypt, and planted in seedling trays. Basil seeds were planted on the 15th of February and the 1st of March, season one and season two, respectively. When the seedlings have 4-5 leaves and are 10–12 cm tall after 25–30 days, they are ready for transplanting. The seedlings are taken from the nursery and protected from the sun and desiccation. In both seasons, they were planted in 20 cm diameter pots (one plant/pot) filled with vermicompost: clay soil at two rates 25%:75% (v/v) and 50:50% (v/v). Analyses of the studied vermicompost, soil, yeast extract, seaweed extraction, and vermicompost tea were shown in Tables A, B, and C.

Table A. The soil used in both growing seasons was examined physically and chemically.

Soil analysis	Value
A: Physical analysis:	
Coarse sand (%)	23.75
Fine sand (%)	15.68
Silt (%)	19.24
Clay (%)	41.33
Texture	Clayey
B: Chemical analysis:	
Organic matter %	0.61
pH	7.79
EC dS m^{-1} (1: 5) at 25 ºC	0.99

Macronutrients (ppm)		
N	P	K
28.00	11.00	82.00

Cations (meq. /L)			
Na^+	K^+	Mg^{++}	Ca^+
3.80	1.60	2.80	1.70

Anions (meq. /L)		
$SO4^{--}$	$HCO3^-$	Cl^-
3.60	1.80	4.50

Table B. Chemical analysis of applied vermicompost (dry weight basis) according to Hafeez and Ewees (2018).

Content	Value
pH (1:10 water suspension)	7.22
Weight of 1 m^3 (kg)	798.45
EC (dS/m, 1:10 water extract)	1.79
Moisture %	8.35
Organic matter %	34.75
Organic carbon %	20.20
C/N ratio	12.02

macro- and micronutrients combined (%)						
N	P	K	Fe	Mn	Zn	Cu
1.68	1.02	2.53	1.33	0.2328	0.1296	0.1274

macro- and micronutrients that are accessible (mg kg-1)						
N	P	K	Fe	Mn	Zn	Cu
768	273	587	194	72	51	35

Poly-(1.4-B-D-glucopyranosamine;2-Amino-2-deoxy-(1-4)-B-D-glucopyranose, also known as chitosan, was created as a powder by dissolving the appropriate quantity in a 5 % acetic acid solution, and the final target concentration was achieved with distilled water.

Vermicompost tea was based on the extraction method (aerated ACT), was made by combining one kilogram of vermicompost with five liters of tap water (weight/volume) and adding one cup (200 ml) of molasses to stimulate activity and germ growth. This method relies on providing a source of oxygen supply to the compost tea production device during the production process, which results in the production of vermicompost tea in a short period, 12 hours at a minimum, and up to 3 days.

Table C. The chemical composition of yeast extract according to Khedr and Farid (2000), seaweed extracts by Abou El-Yazied *et al*. (2012), and vermicompost tea by Shaaban (2018).

	Macro (g/100 g dry weight)								P2O5			7.23			
									K2O			51.68			
									N			34.39			
	Micro (mg/100 g dry weight)														
	Al	B	Co	Pb	Mn	Sn	Zn	NaO	MgO	Cao	SiO2	SO2	Cl	FeO	NaCl
yeast extract	650.2	175.6	67.8	438.6	81.3	223.9	335.6	0.35	5.76	3.05	1.55	0.49	0.06	0.92	0.30
	Amino acids (mg/100 g dry weight)														
	Arginine	Histidine	Isoleucine	Lysine	Methionine	Phenylalanine	Threonine	Tryptophan							
	1.99	2.63	2.31	2.95	0.72	2.01	2.09	0.45							
	Valine	Glutamic acid	Serine	Aspartic acid	Cystine	Proline	Tyrosine	Leucine							
	2.19	2.00	1.59	1.33	0.23	1.53	1.49	3.09							
	Component	Value	Component	Value	Micronutrients										
	carbohydrates	35%	(Adenine)	2.61%	Cu	12ppm									
	Total amino acid	6%	P2O5	0.03%	Fe	150ppm									
seaweed	Mannitol	4%	IAA	4.71%	Mn	13ppm									
extracts	Betaines	0.04%	K2O	3.56%	Zn	70ppm									
	Organic (N)	3.12%	S	0.25%											
	Alginic acid	10%	Ca	0.58%	B	60ppm									
	Cytokinin	0.02%	Mg	1-6%											
		N%	0.40	Organic matter (%)	4.36										
vermicompost	Macronutrients			Organic carbon (%)	2.53										
tea		P%	0.07	pH	7.72										
		K%	0.08	EC (dS/m)	3.92										
				C/N ratio	6.35										

The harvest is taken when flowering is completed, which occurs in June. During the two growing seasons, the plants were cut leaving about 2 cm above the soil surface.

Measurements of the following characteristics are taken at the rate of 4 plants per treatment during harvesting in both seasons.

Data record:

A. Vegetative growth parameters when flowering begins (10 % blooms):

1. Plant height (cm).

2. Plant leaf area (cm^2): Each plant had ten disks of fresh leaves removed at random using a borer with a known diameter (1 cm). The leaves were then oven dried at 70 ºC until they reached a constant weight, and the leaf area was calculated using the formula of Koller (1972) as follows:

$$\text{Total leaf area } (cm^2) = \frac{\text{Area of the disk } (cm^2) \times \text{Dry weight of leaves/plant(g)}}{\text{Dry weight of disks(g)}}$$

3. Plant fresh weight (g), and plant dry weight (g).

B. Chemical constituents when flowering begins (10 % blooms):

1.Nitrogen content (N %): Using the Kjeldahl method in dried leaves, which was described by Jackson (1967).

2.Phosphorus content (P %): was determined colorimetrically using the chlorostannus reduce molybdous phosphoric blue colors method in the sulphuric system Jackson (1967).

3.Potassium content (K %): was assessed in the digestion of plant materials using a flame photometer by Black (1965).

4.Total chlorophyll, and carotenoids (mg/g FW): were extracted from fresh leaf samples by the method of Moran and Porath (1982), and their concentrations were assessed using a spectrophotometer (UV1101) at wavelengths of 660, 640, and 440 nm while using acetone (80 % of total) as a blank.

5.Total carbohydrate (%): was calculated using the anthrone method, as described by Sadasivam and Manickam (1996)

C. Essential oil percentage (%) when flowering begins (70 % blooms):

1.Essential oil (%): was determined in fresh samples by hydro-distilling leaves in the Clevenger apparatus by the British Pharmacopoeia method (2000). 50g of fresh herb was placed in a flask with a 1000 ml capacity. There was no further increase in the oil after three hours of distillation. The percentage of essential oil was determined by the following formula.:

$$\text{Oil percentage\%} = \frac{\text{Volume of oil in gradated tube (ml)}}{\text{Fresh weight of leaves(g)}} \text{ x100}$$

Fig. 1. *Ocimum basilicum* L. var. Genovese

Statistical analysis:

The MSTAT-C computer program was used to statistically analyze all collected data following the randomized complete block design (RCBD) with four replications for each experiment, as per Gomez and Gomez (1984) published research (ground treatments). A combined analysis was carried out between the ground treatments experiments after the

homogeneity test error mean squares Duncan's multiple range tests, as described by Duncan (1955), were used to compare treatment means at a 5% level of probability.

RESULTS AND DISCUSSION

Results

1.Vegetative growth parameters:

a. Effect of ground treatments:

Data in Table (1) showed that growing Italian basil in media consisting of 25% vermicompost:75 % soil produced the highest values of plant height (79.65 and 83.48 cm), leaf area (382.6 and 389.9 cm^2), plant fresh weight (128.4 and 132.6 g), and dry weight (14.53 and 16.02 g). Using a growing media of (50 % vermicompost: 50 % soil) resulted in the lowest values of plant height (70.98 and 70.44 cm), plant leaf area (313.6 and 317.0 cm^2), plant fresh (107.9 and 107.5 g) and dry weight (10.38 and 10.42 g) in both seasons.

b. Effect of foliar application with some plant growth stimulants:

Plant height (cm):

Table (1) showed that foliar spraying of Italian basil plants with chitosan at 750 ppm exceeded other foliar spraying treatments and produced the highest values of plant height of Italian basil (93.25 and 93.00 cm) respectively, in both seasons with a significant difference compared with each other. The second-best foliar spraying treatment was spraying with vermicompost tea at 750 ml/L (88.50 and 90.25cm). Whereas, the lowest values of plant height of Italian basil (53.37 and 54.50 cm) resulted from the control treatment (without foliar spraying) in both seasons.

Plant leaf area (cm^2):

The same Table (1) revealed the widest values of leaf area of Italian basil plants (411.7 and 441.8 cm^2) with chitosan at 750 ppm in both seasons, respectively. Nevertheless, foliar spraying with vermicompost tea at 750 ml/L came with the same effect as chitosan at 750 ppm in the first season and came in the second rank in the second season, followed by foliar spraying with chitosan at 500 ppm in both seasons. Whereas, the control treatment was accompanied by the lowest widest leaf area of Italian basil plants (227.6 and 232.7 cm^2) in both seasons.

Plant fresh weight (g) and plant dry weight (g):

Data in Table (1) showed the heaviest values of fresh weight of Italian basil plants (150.2 and 155.4 g) and plant dry weight (20.44 and 20.59 g) resulted from foliar spraying plants with chitosan at 750 ppm in both seasons, respectively. with a significant difference when compared with other treatments. The second-best foliar spraying treatment was spraying with vermicompost tea at 750 ml/L, the lightest values of the fresh weight (57.7 and 61.5 g) and plant dry weight (7.06 and 7.29 g) were recorded from the control treatment in both seasons, respectively.

Fig. 2. 25% vermicompost:75% soil 50% vermicompost:50% soil

Table 1. Plant height, plant leaf area, plant fresh and dry weights of Italian basil as affected by ground treatments and foliar application with some plant growth stimulants as well as their interaction during the 2019/2020 and 2020/2021 seasons.

Treatments	Plant height (cm)		Plant leaf area (cm^2)		Plant fresh weight(g)		Plant dry weight(g)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Ground treatment:								
25 % vermicompost: 75 % soil	79.65 a	83.48 a	382.6 a	389.9 a	128.4 a	132.6 a	14.53 a	16.02 a
50 % vermicompost: 50 % soil	70.98 b	70.44 b	313.6 b	317.0 b	107.9 b	107.5 b	10.38 b	10.42 b
F. test	*	*	*	*	*	*	*	*
B- Foliar application with some plant growth stimulants:								
Control treatment	53.37 j	54.50 i	227.6 h	232.7 h	57.7 i	61.5 j	7.06 j	7.29 k
Yeast extract at 2 g/L	59.37 i	63.00 h	262.2 g	273.6 g	80.3 h	85.3 i	9.68 i	10.43 j
Yeast extract at 4 g/L	69.50 h	72.62 g	304.5 f	302.7 f	99.8 g	103.4 h	12.25 h	13.54 i
Yeast extract at 6 g/L	75.62 f	77.50 e	384.4 b	384.9 cd	111.6 f	115.1 f	13.12 g	13.78 h
Seaweed extract at 20 %	77.50 e	78.87 e	368.1 b-d	368.7 de	131.5 d	132.0 d	16.34 e	16.67 e
Seaweed extract at 40 %	76.00 f	78.75 e	361.4 de	366.9 de	119.4 e	121.1 e	14.78 ef	15.35 f
Seaweed extract at 60 %	75.75 f	78.37 e	365.5 c-e	360.8 e	118.5 e	119.8 e	13.37 f	13.79 fg
Chitosan at 500 ppm	85.12 c	85.12 c	404.5 a	397.5 bc	145.4 b	144.5 b	17.68 cd	17.27 cd
Chitosan at 750 ppm	93.25 a	93.00 a	411.7 a	441.8 a	150.2 a	155.4 a	20.44 a	21.59 a
Chitosan at 1000 ppm	68.75 h	71.12 g	295.5 f	308.8 f	107.5 f	108.5 g	12.63 g	13.56 g
Vermicompost tea at 250 ml/L	74.00 g	74.50 f	348.8 e	351.1 e	131.2 d	130.5 d	16.84 d	16.67 d
Vermicompost tea at 500 ml/L	82.37 d	82.87 d	380.9 bc	393.8 bc	138.2 c	138.5 c	17.62 c	17.80 c
Vermicompost tea at 750 ml/L	88.50 b	90.25 b	410.4 a	411.9 b	144.5 b	144.7 b	18.68 b	19.11 b
F. test	*	*	*	*	*	*	*	*
C- Interaction (F. test):								
A ×B	*	*	*	*	*	*	*	*

c. Effect of interaction between ground treatments and foliar application with some plant growth stimulants:

Data in Table (2) obtained results of this study showed that the highest values of plant height of Italian basil (98.50 and 101.50 cm), leaf area (470.2 and 485.6 cm^2), plant fresh weight (157.7 and 172.0 g), and plant dry weight (23.67 and 24.29g) in both seasons, respectively, resulted from using growing media consisting of 25% vermicompost:75 % soil. In addition, used

foliar spraying with chitosan at 750 ppm, with a significant difference when compared with other treatments. The second-best interaction treatment was achieved by using the same growing media (consisting of 25 % vermicompost:75 % soil) and foliar spraying plants with vermicompost tea at 750 ml/L in both seasons. But plant fresh weight was not significantly affected by the interaction between ground treatments and foliar applications with chitosan at 750 ppm and vermicompost tea at 750ml/L and chitosan at 500ppm in both seasons.

2-Chemical constituents:

a.Effect of ground treatments:

Data in Tables (3 and 5) obtained results clearly showed that the highest values of nitrogen (2.432 and 2.679%N), phosphorus (0.301 and 0.319%P), potassium (2.307 and 2.330%K), total chlorophyll (61.21 and 59.06 mg/g FW), carotenoids (11.28 and 11.27mg/g FW), and total carbohydrates (12.00 and 13.38%) content in Italian basil leaves in both seasons, respectively, when growing in media consisting of 25 % vermicompost:75 % soil. However, using a growing media of (50 % vermicompost: 50 % soil) in both seasons resulted in the lowest values of nitrogen (1.950 and 2.214%N), phosphorus (0.265 and 0.312%P), potassium (1.716 and 1.853%K), total chlorophyll (36.32 and 37.05 mg/g FW), carotenoids (3.88 and 3.95 mg/g FW), and total carbohydrates (9.71 and 10.86 %) in both seasons.

Table 2. Plant height, plant leaf area, and plant fresh and dry weights of Italian basil as affected by the interaction between ground treatments and foliar application with some plant growth stimulants during the 2019/2020 and 2020/2021 seasons.

Characters		Plant height (cm)		Plant leaf area (cm^2)		Plant fresh weight (g)		Plant dry weight (g)	
Ground treatment	Plant growth stimulants	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
25 % vermicompost: 75 % soil	Control treatment	53.75 op	58.75 p	223.9 k	229.9 o	57.9 m	61.6 m	7.25 n	7.70 q
	Yeast extract at 2 g/L	63.75 lm	72.50 l	296.3 h	309.0 kl	90.8 ij	97.5 ij	11.43 l	12.10 o
	Yeast extract at 4 g/L	74.50 ij	76.50 ij	338.0 g	336.6 i-k	121.2 g	121.6 g	15.85 j	16.08 kl
	Yeast extract at 6 g/L	77.25 h	79.25 g	378.4 ef	381.3e-g	131.0 ef	132.0 ef	16.31 i	16.42 j
	Seaweed extract at 20 %	90.00 c	93.50 c	423.0 cd	426.7 cd	145.5 b	145.8 b	18.41 ef	18.94 c
	Seaweed extract at 40 %	81.75 f	84.25 e	440.4 bc	446.2 bc	143.6 bc	145.5 bc	18.21 g	17.56 g
	Seaweed extract at 60 %	73.00 j	78.00g~i	419.0 cd	428.2 cd	134.1 d~f	138.9 de	17.08h	17.32 gh
	Chitosan at 500 ppm	90.75 c	94.50 c	451.3 ab	452.4 bc	152.5 a	154.39 a	19.68 c	19.82 bc
	Chitosan at 750 ppm	98.50 a	101.50 a	470.2 a	485.6 a	157.7 a	172.0 a	22.67 a	24.29 a
	Chitosan at 1000 ppm	75.00 i	76.75 h~j	339.4 g	356.2g-i	104.0 h	114.1 h	13.24 i	13.63 g~i
	Vermicompost tea at 250 ml/L	79.25 g	81.75 f	340.4 g	332.9 i-k	134.1 d~f	133.8 de	17.17 d	17.90 d
	Vermicompost tea at 500 ml/L	85.00 e	90.75 d	386.7 e	411.5 de	139.5 b~d	144.9 bc	17.77 d	18.20 c
	Vermicompost tea at 750 ml/L	93.00 b	97.25 b	467.5 a	473.0 ab	157.5 a	161.0 a	19.86 b	22.43 b
50 % vermicompost: 50% soil	Control treatment	53.00 p	50.25 r	231.2 jk	235.5 o	57.5 m	61.3 m	6.37 n	3.89 q
	Yeast extract at 2 g/L	55.00 o	53.50 q	228.2 jk	238.1 no	69.8 l	73.0 l	7.62 m	6.77 q
	Yeast extract at 4 g/L	64.50 l	68.75 m	271.0 hi	268.9 mn	78.4 k	85.3 k	9.65 l	9.78 p
	Yeast extract at 6 g/L	74.00 ij	75.75 j	344.3 g	356.1 g-i	92.2 ij	98.2 ij	10.93 k	11.01 l~n
	Seaweed extract at 20 %	79.00 gh	78.75 gh	349.9 g	341.7 h-j	129.0 f	125.2 f	12.49 ij	11.38 k
	Seaweed extract at 40 %	73.25 ij	73.25 kl	295.7 h	287.7 lm	93.3 i	96.6 i	11.12 k	10.84 m~o
	Seaweed extract at 60 %	61.50 n	63.25 o	279.8 h	269.2 mn	86.3 j	85.2 j	10.27 k	9.40 no
	Chitosan at 500 ppm	77.25 h	76.75 h~j	341.6 g	321.9 jk	133.3 d~f	128.1 d~f	14.18 h	12.82 ij
	Chitosan at 750 ppm	88.00 d	84.50 e	353.2 fg	398.1d-f	143.5 bc	143.6 bc	18.21 e	17.90 e
	Chitosan at 1000 ppm	62.50mn	65.50 n	251.6 ij	261.5m-o	111.1 h	102.9 h	11.15 j	10.49 k~m
	Vermicompost tea at 250 ml/L	68.75 k	67.25mn	357.1 fg	369.2 f-h	128.2 fg	127.3 fg	14.92 h	13.45 hi
	Vermicompost tea at 500 ml/L	79.75 g	75.00 jk	375.1 ef	376.1 fg	136.9 c~e	132.1 c~e	16.57 g	14.40 gh
	Vermicompost tea at 750 ml/L	86.25 de	83.25 ef	397.8 de	397.1 d-f	142.8 bc	138.8 bc	17.70 f	15.80 f
	F. test	*	*	*	*	*	*	*	*

b. Effect of foliar application with some plant growth stimulants:

Nitrogen, phosphorus, and potassium percentage (%):

According to data in Table (3) the highest percentages of nitrogen in leaves (2.631 and 2.986%N), phosphorus (0.319 and 0.346%P), and potassium (2.583 and 2.622%K) were created from foliar spraying with chitosan at 750 ppm in the two seasons, respectively. followed by foliar spraying with vermicompost tea at 750 ml/L and chitosan at 500 ppm, with significant differences among them in both seasons. However, the lowest percentages of nitrogen in leaves (1.358 and 1.346%N), phosphorus (0.228 and 0.230%P), and potassium (1.203 and 1.216%K) resulted from the control treatment (without foliar spraying) in the first and second seasons, respectively.

Total chlorophyll and carotenoids (mg/g FW):

It can be seen in Table (5) that the highest values of total chlorophyll were (61.91 and 55.91 mg/g FW) and carotenoids (7.87 and 8.23 mg/g FW) in fresh leaves were formed from foliar spraying of Italian basil plants with chitosan at 750 ppm in both seasons, followed by spraying with vermicompost tea at 750 ml/L then foliar spraying with chitosan at 500 ppm in both seasons. Whereas, the lowest values of total chlorophyll were (39.98 and 40.46 mg/g FW), and carotenoids were (7.35 and 7.32 mg/g FW) resulted from the control treatment (without foliar spraying) in both seasons.

Total carbohydrates (%):

The obtained data presented in Table (5) showed that studied foliar application with chitosan at 750 ppm exceeded other foliar spraying treatments and produced the highest total carbohydrate percentage in leaves (13.06 and 14.83%), respectively in both seasons. The second-best foliar spraying treatment was spraying with vermicompost tea at 750 ppm in the two growing seasons. Whereas the lowest percentages of total carbohydrates in Italian basil leaves (8.21 and 8.22%) resulted from the control treatment in both seasons.

3- Effect of the interaction between ground treatments and foliar application with some plant growth stimulants:

The obtained results in Tables (4 and 6) clearly showed that the highest values of nitrogen (3.032 and 3.195 %N), phosphorus (0.349 and 0.447%P), potassium (2.902 and 2.875%K), total chlorophyll (83.42 and 73.52 mg/g FW), carotenoids (12.15 and 12.17 mg/g FW), and total carbohydrates (14.39 and 16.12%) were contained in Italian basil leaves in both seasons. The results came from using a growing media consisting of 25% vermicompost:75% soil. In addition, used foliar spraying with chitosan at 750 ppm. The second-best interaction treatment was by using the same growing media (consisting of 25% vermicompost: 75 % soil) besides foliar spraying plants with vermicompost tea at 750 ml/L in both seasons, with a significant difference between them. But nitrogen (N) in the first season was without a significant difference.

Table 3. Nitrogen (N), phosphorus (P), and potassium (K) contents in Italian basil leaves as affected by ground treatments and foliar application with some plant growth stimulants as well as their interaction during the 2019/2020 and 2020/2021 seasons.

Treatments	N%		P%		K%	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Ground treatment:						
25 % vermicompost: 75 % soil	2.432 a	2.679 a	0.301 a	0.319 a	2.307 a	2.330 a
50 % vermicompost: 50 % soil	1.950 b	2.214 b	0.265 b	0.312 b	1.716 b	1.853 b
F. test	*	*	*	*	*	*
B- Foliar application with some plant growth stimulants:						
Control treatment	1.358 f	1.346 j	0.228 f	0.230 b	1.203 k	1.216 k
Yeast extract at 2 g/L	1.958 d	2.210 h	0.292b~d	0.519 a	1.678 h	1.840 h
Yeast extract at 4 g/L	2.221 c	2.533 f	0.247 ef	0.300 b	2.077 e	2.147 f
Yeast extract at 6 g/L	2.448 b	2.747 d	0.261 de	0.334 ab	2.515 b	2.492 c
Seaweed extract at 20 %	2.182 c	2.478 g	0.309a~c	0.296 b	2.022 f	2.082 g
Seaweed extract at 40 %	2.175 c	2.456 g	0.269 de	0.290 b	1.970 g	2.078 g
Seaweed extract at 60 %	2.187 c	2.450 g	0.292b~d	0.294 b	1.963 g	2.098 g
Chitosan at 500 ppm	2.600 a	2.863 c	0.285 cd	0.341 ab	2.538 b	2.492 c
Chitosan at 750 ppm	2.631 a	2.986 a	0.319 ab	0.346 ab	2.583 a	2.622 a
Chitosan at 1000 ppm	2.276 c	2.578 e	0.283 cd	0.305 b	2.117 d	2.205 e
Vermicompost tea at 250 ml/L	1.788 e	2.060 i	0.286 cd	0.257 b	1.482 j	1.687 j
Vermicompost tea at 500 ml/L	1.980 d	2.202 h	0.283 cd	0.270 b	1.638 i	1.800 i
Vermicompost tea at 750 ml/L	2.600 a	2.898 b	0.309a~c	0.341 ab	2.538 b	2.550 b
F. test	*	*	*	*	*	*

Table 4. Nitrogen (N), phosphorus (P), and potassium (K) contents in Italian basil leaves as affected by the interaction between ground treatments and foliar application with some plant growth stimulants during the 2019/2020 and 2020/2021 seasons.

Characters		N%		P%		K%	
Ground treatment	Treatments	1st season	2nd season	1st season	2nd season	1st season	2nd season
25 % vermicompost: 75 % soil	Control treatment	1.380 q	1.355 q	0.226 l	0.228 b	1.177 r	1.195 w
	Yeast extract at 2g/L	2.177 ij	2.457 i	0.292 c~h	0.292 b	2.000 i	2.072 m
	Yeast extract at 4 g/L	2.552ef	2.877 e	0.324 a~d	0.334 b	2.492 d	2.520 g
	Yeast extract at 6 g/L	2.670c~e	2.957 d	0.334 a~c	0.348 b	2.645 c	2.615 e
	Seaweed extract at 20 %	2.717 cd	3.017 c	0.313 a~f	0.344 b	2.687 c	2.667 d
	Seaweed extract at 40 %	2.502fg	2.787 f	0.279 e~j	0.325 b	2.395 e	2.432 h
	Seaweed extract at 60 %	2.105 jk	2.400 j	0.266 g~l	0.288 b	1.925 j	1.900 n
	Chitosan at 500 ppm	2.820 bc	3.090 b	0.331 a~d	0.360 b	2.800 b	2.730 c
	Chitosan at 750 ppm	3.032 a	3.195 a	0.349 a	0.447 a	2.902 a	2.875 a
	Chitosan at 1000 ppm	2.617d~f	2.922 de	0.322 a~e	0.338 b	2.525 d	2.567 f
	Vermicompost tea at 250 ml/L	1.997 kl	2.275 k	0.262 g~l	0.276 b	1.757 l	1.905 o
	Vermicompost tea at 500 ml/L	2.172 j	2.367 j	0.273 f~k	0.284 b	1.862 k	1.935 o
	Vermicompost tea at 750 ml/L	2.882 ab	3.132 b	0.338 ab	0.364 b	2.825 b	2.790 b
50 % vermicompost: 50 % soil	Control treatment	1.337 q	1.337 q	0.230 kl	0.232 b	1.230 q	1.237 w
	Yeast extract at 2g/L	1.740 no	1.962 o	0.246 i~l	0.238 b	1.357 p	1.607 t
	Yeast extract at 4 g/L	1.890 l~n	2.190 l	0.261 g~l	0.266 b	1.662 m	1.775 q
	Yeast extract at 6 g/L	2.335 hi	2.637 g	0.299 b~g	0.309 b	2.230 f	2.255 k
	Seaweed extract at 20 %	2.260 h~j	2.557 h	0.291 c~h	0.305 b	2.120 g	2.175 l
	Seaweed extract at 40 %	1.847 l~n	2.125 m	0.252 h~l	0.256 b	1.545 n	1.725 r
	Seaweed extract at 60 %	1.657 op	1.882 p	0.239 j~l	0.244 b	1.240 q	1.530 u
	Chitosan at 500 ppm	2.380 gh	2.665 g	0.299 b~g	0.318 b	2.252 f	2.310 j
	Chitosan at 750 ppm	2.380 gh	2.777 f	0.301 b~g	0.322 b	2.265 f	2.370 i
	Chitosan at 1000 ppm	1.935 lm	2.235 kl	0.262 g~l	0.272 b	1.710 l	1.842 p
	Vermicompost tea at 250 ml/L	1.580 p	1.845 p	0.233 kl	0.237 b	1.207 qr	1.470 v
	Vermicompost tea at 500 ml/L	1.787m~o	2.037 n	0.250 h~l	0.257 b	1.415 o	1.665 s
	Vermicompost tea at 750 ml/L	2.227 h~j	2.537 h	0.287 d~i	0.297 b	2.072 h	2.137 l
	F. test	*	*	*	*	*	*

4- Essential oil percentage (%):

a. Effect of ground treatments:

Data in Table (5) showed that the maximum means of essential oil percentage of Italian basil (0.134 and 0.136 %) were recorded when using a growing media of 25% vermicompost:75% soil in both seasons, respectively. The minimum means of the essential oil percentage of Italian basil (0.129 and 0.131%) resulted when using growing media of 50% vermicompost: 50 % soil in both seasons, respectively.

Table 5. Total Chlorophyll, Total carbohydrates, carotenoids, and oil percentage in Italian basil leaves as affected by ground treatments and foliar application with some plant growth stimulants as well as their interaction during the 2019/2020 and 2020/2021 seasons.

Treatments	Total Chlorophyll (mg/g FW)		Carotenoids (mg/g FW)		Total carbohydrates (%)		Oil (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Ground treatment:								
25 % vermicompost: 75 % soil	61.21 a	59.06 a	11.28 a	11.27 a	12.00 a	13.38 a	0.134 a	0.136 a
50 % vermicompost: 50 % soil	36.32 b	37.05 b	3.88 b	3.95 b	9.71 b	10.86 b	0.129 b	0.131 b
F. test			*	*	*	*	*	*
B- Foliar application with some plant growth stimulants:								
Control treatment	39.98 g	40.46 i	7.35 b	7.32 b	8.21 k	8.22 l	0.085 j	0.082 h
Yeast extract at 2 g/L	42.53 f	42.91 g	7.44 ab	7.37 b	9.59 h	10.61 i	0.116 i	0.118 g
Yeast extract at 4 g/L	46.52 e	45.17 f	7.46 ab	7.48 b	10.93 f	12.31 f	0.125 gh	0.126 f
Yeast extract at 6 g/L	46.86 e	48.78 d	7.65 ab	7.48 b	11.27 e	12.62 e	0.133 ef	0.134 e
Seaweed extract at 20 %	49.59 d	49.39 d	7.66 ab	7.69 b	10.91 f	12.24 fg	0.143 cd	0.143 c
Seaweed extract at 40 %	46.21 e	47.28 e	7.43ab	7.53 b	10.77 g	12.16 g	0.132 ef	0.135 de
Seaweed extract at 60 %	42.17 f	41.86 h	7.40 ab	7.37 b	10.71 g	11.94 h	0.125 gh	0.124 fg
Chitosan at 500 ppm	55.64 b	52.55 b	7.74 ab	7.70 b	12.68 c	14.12 c	0.149 bc	0.151 b
Chitosan at 750 ppm	61.91 a	55.91 a	7.87 a	8.23 a	13.06 a	14.83 a	0.158 a	0.160 a
Chitosan at 1000 ppm	42.02 f	42.33gh	7.34 b	7.30 b	8.57 j	10.03 k	0.123 hi	0.123 fg
Vermicompost tea at 250 ml/L	49.70 d	51.32 c	7.68 ab	7.68 b	9.46 i	10.36 j	0.132 fg	0.134 de
Vermicompost tea at 500 ml/L	53.64 c	51.35 c	7.70 ab	7.69 b	12.09 d	13.62 d	0.139 de	0.140 cd
Vermicompost tea at 750 ml/L	57.18 b	55.41 a	7.78 ab	7.73 ab	12.90 b	14.52 b	0.152 ab	0.155 ab
F. test	*	*	*	*	*	*	*	*

Table 6. Total Chlorophyll, Total carbohydrates, carotenoids, and oil percentage in Italian basil leaves as affected by the interaction between ground treatments and foliar application with some plant growth stimulants during the 2019/2020 and 2020/2021 seasons.

Characters		Total Chlorophyll (mg/g fresh weight)		Carotenoids (mg/g fresh weight)		Total carbohydrates (%)		Oil (%)	
Ground treatment	Treatments	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
25 % vermicompost: 75 % soil	Control treatment	46.27 i	48.85 j	10.99 b	10.87 b	11.12 b	8.23 v	0.086 o	0.082 i
	Yeast extract at 2g/L	51.04 g	51.17 i	11.05 b	11.12 b	11.10 b	11.75 m	0.121 l~n	0.123 gh
	Yeast extract at 4 g/L	57.52 f	57.06 g	11.06 b	11.14 b	12.66 g	14.25 g	0.127 i~m	0.129 e~g
	Yeast extract at 6 g/L	58.57 f	60.72 f	11.15 b	11.18 b	13.65 d	15.23 d	0.134 f~j	0.135 c~f
	Seaweed extract at 20 %	62.41 e	62.79 e	11.21 b	11.20 b	13.22 e	15.00 e	0.145 c~f	0.145 c
	Seaweed extract at 40 %	56.52 f	54.73 h	11.14 b	11.17 b	12.39 h	13.82 h	0.132 h~l	0.135 c~f
	Seaweed extract at 60 %	49.96gh	49.40 j	11.13 b	11.15 b	10.39 n	11.65 m	0.126j~m	0.123 gh
	Chitosan at 500 ppm	72.07 c	67.41 c	11.45 ab	11.40 b	13.86 c	15.41 c	0.155 a~c	0.157 b
	Chitosan at 750 ppm	83.42 a	73.52 a	12.15 a	12.17 a	14.39 a	16.12 a	0.165 a	0.168 a
	Chitosan at 1000 ppm	48.05hi	45.93 k	11.05 b	11.10 b	9.31 q	11.01 n	0.118 mn	0.119 gh
	Vermicompost tea at 250 ml/L	64.17 e	65.43 d	11.28 b	11.30 b	10.15 o	11.06 n	0.133g~k	0.136 v~e
	Vermicompost tea at 500 ml/L	69.63 d	65.43 d	11.36 b	11.39 b	13.01 f	14.60 f	0.140e~h	0.140 cd
	Vermicompost tea at 750 ml/L	76.12 b	69.37 b	11.63 ab	11.55 ab	14.10 b	15.80 b	0.156 ab	0.159 b
50 % vermicompost: 50 % soil	Control treatment	31.91 p	32.08 s	3.03 c	3.01 d	8.21 u	8.21 v	0.082 o	0.080 i
	Yeast extract at 2g/L	34.09op	34.33 r	3.63 c	3.65 d	8.48 t	9.46 s	0.111 n	0.114 h
	Yeast extract at 4 g/L	34.01op	34.65 r	3.65 c	3.66 d	9.20 q	10.37 p	0.123k~m	0.123 gh
	Yeast extract at 6 g/L	34.47no	36.84 pq	3.67 c	3.75 cd	11.51 j	12.83 k	0.132 h~l	0.133 d~f
	Seaweed extract at 20 %	36.77l~n	37.37op	3.70 c	3.78 cd	11.15 k	12.68 k	0.140 d~h	0.142 c
	Seaweed extract at 40 %	37.20k~m	37.51n~p	3.20 c	3.17 d	9.03 r	10.07 q	0.133 g~k	0.135 c~f
	Seaweed extract at 60 %	38.07 kl	38.73mn	3.18 c	3.15 d	8.17 u	9.25 t	0.123k~m	0.125 gh
	Chitosan at 500 ppm	39.20jk	39.91 m	3.88 c	3.94 cd	11.70 i	13.23 j	0.143 d~g	0.145 c
	Chitosan at 750 ppm	40.40 j	41.45 l	4.58 c	4.29 c	11.73 i	13.54 i	0.151 b~d	0.154 b
	Chitosan at 1000 ppm	34.89m~o	35.60qr	3.00 c	3.03 d	9.54 p	10.64 o	0.128 i~m	0.128 e~g
	Vermicompost tea at 250 ml/L	35.24m~o	37.21op	3.80 c	3.78 cd	7.83 v	9.05 u	0.130 h~l	0.134 d~f
	Vermicompost tea at 500 ml/L	37.66kl	37.69n~p	3.82 c	3.85 cd	8.78 s	9.67 r	0.138 e~i	0.141 cd
	Vermicompost tea at 750 ml/L	38.25j~l	38.31no	3.83 c	3.96 cd	10.95 l	12.24 l	0.147 b~e	0.152 b
F. test		*	*	*	*	*	*	*	*

b. Effect foliar application with some plant growth stimulants:

Data in Table (5) showed that the highest percentage of essential oil in fresh leaves (0.158 and 0.160 %, respectively) was formed from foliar spraying with chitosan at 750 ppm and vermicompost tea at 750 ml/L in the two growing seasons without a significant difference between them. While foliar spraying with chitosan at 500 ppm came in

the second rank. The lowest percentage of essential oil (0.085 and 0.082%) was obtained from the control treatment in the two growing seasons, respectively.

c. Effect of the interaction between ground treatments and foliar application with some plant growth stimulants:

The data presented in Table (6) clearly showed that the highest percentages of essential oil (0.165 and 0.168 %) resulted from growing plants in media consisting of 25% vermicompost: 75 % soil and spraying with chitosan at 750 ppm in the two seasons. Followed by growing plants in media consisting of 25% vermicompost: 75 % soil as well as spraying with vermicompost tea at 750 ml/L, then using the same growing media and spraying plants with chitosan at 500 ppm in both seasons. Growing in media consisting of 50 % vermicompost:50 % soil without spraying with any plant growth stimulants resulted in the lowest percentages of essential oil (0.082 and 0.080%) in both seasons, respectively.

Discussion

The increases in all characteristics of *Ocimum basilicum* L. var. Genovese when using 25% vermicompost:75% clay soil due to the Vermicompost can improve soil fertility by supplying major and minor nutrients (N, P, K, Fe, Mn, Zn, and Cu) to the soil. It also contains organic materials such as fulvic and humic acids, which can retain plant nutrients as simple chelating agents. It has a high concentration of organic matter, such as polyphenols, which promote plant growth and provide nutrients for photosynthesis in the soil. These results are in agreement with Lazcano *et al*. (2009) and Hafeez and Ewees (2018). As well as beneficial soil microorganisms (actinomycetes, nitrogen-fixing bacteria, phosphate solubilizing bacteria). Furthermore, vermicompost can prevent infections not only as bio and organic fertilizers but also as bio-pesticides. compatible with those recorded by Olle (2019). Vermicompost also improves the absorption of Mg, an element required for the formation of the chlorophyll molecule. Mg is also necessary for photosynthesis because it activates many important enzymes involved in carbohydrate metabolism. However, adding vermicompost up to 50% to the growing medium increased soil changes (increased bulk density, decreased soil pores, and easily decreased water amount), which led to root suffocation. This tends to hinder plants' ability to absorb oxygen. Additionally, adding more humic acid to organic matter inhibits plant growth because it makes cell membranes more permeable, which causes cell contents to deposit, raises the level of lipid peroxide, and kills plants. Worm fertilizer concentration increases pH and electrical conductivity, all of which harm plants. These results came from a similar point of view to those reported by Lazcano and Martin (2010) and Celikcana *et al*. (2021). In addition, the increases in all characteristics of *Ocimum basilicum* L. var. Genovese when using foliar applications with chitosan at 750 ppm is due to its role in improving plant growth through supplying plant nutrients and environmental health and soil productivity. Chitosan helps to increase the concentration of amino acids in the plants, which helps the plant, allowing it to resist biotic stress. In addition to containing a high percentage of gibberellin, auxin, and cytokinin in the natural image, it also entails strengthening plants' defense mechanisms against invading microorganisms. These results are in agreement with Waly *et al*. (2020). In addition, vermicompost tea at 750 ml/L has huge potential for crop productivity and protection.

Vermicompost tea provides plants with easily absorbed nutrients. It provides auxins, which are plant growth hormones that can be produced during the fermentation process and may be the reason for the growth increases. It's also high in nitrogen. It also contains actinomycin, an antibiotic and fungicide that increases plant biological resistance to insects and diseases. These results came from a similar point of view to those reported by Edwards *et al*. (2007) and Arancon *et al*. (2012).

CONCLUSION

It can be concluded that using growing media consists of 25 % vermicompost: 75 % clay soil in addition to foliar spraying with chitosan at 750 ppm or vermicompost tea at 750 ml/L two weeks after transplanting in three batches with two weeks of each batch in order to enhance growth, the chemical composition and oil percentage of medicinal and aromatic plants like Italian basil (*Ocimum basilicum* L. var. Genovese) under the environmental conditions of Dakahlia Governorate, Egypt.

REFERENCES

Abou El Salehein, M.; D. Ibraheim and A.E.M. Helal (2021). Effect of NPK, humic acid and dry yeast on growth, oil yield and chemical constituents of sweet basil (*Ocimum basilicum* L.). J. of Prod. and Dev., 26(3): 513-529.

Abou El-Yazied, A.; A.M. El-Gizawy; M.I. Ragab and E.S. Hamed (2012). Effect of seaweed extract and compost treatments on growth, yield and quality of snap bean. J. American Sci., 8(6): 1-20.

Arancon, N. Q.; A. Pant; T. Radovich; N.V. Hue; J.K. Potter and C.E. Converse (2012). Seed germination and seedling growth of tomato and lettuce as affected by vermicompost water extracts (teas). HortScience, 47(12), 1722-1728.

Battacharyya, D.; M.Z. Babgohari; P. Rathor and B. Prithiviraj (2015). Seaweed extracts as biostimulants in horticulture. Scientia Hort.,196: 39-48.

Black, C.A. (1965). Methods of soil analysis. Part 1. Physical andmineralogical. ASA Madison, Wise., USA.

British Pharmacopoeia Commission, Great Britain. Medicines Commission, & General Medical Council (Great Britain). (2000). British Pharmacopoeia (Vol. 1). Bernan Press (PA).

Celikcana, F.; M. Zeki and K.M. Kulak (2021). Vermicompost applications on growth, nutrition uptake and secondary metabolites of *Ocimum basilicum* L. under water stress: A comprehensive analysis. Ind. Crops and Prod., 171: 113973, org/10.1016/j.

Duncan, D.B. (1955). Multiple range and multiple F test. Biometrics, 11: 1-42.

Edwards, C.A.; N.Q. Arancon; E. Emerson and R. Pulliam (2007). Suppressing plant parasitic nematodes and arthropod pests with vermicompost teas. Biocycle, 48(12): 38-39.

El-Naggar, A.H.M.; M.R.A. Hassan and A.M. Saeid (2020). Growth and essential oil analysis of Ocimum basilicum L. plants as affected by seaweed extract and active dry yeast. Sci. J. of Flowers and Ornamental Plants, 7(1): 27-43.

Fahmy, A.A. and W.S. Nosir (2021). Influence of chitosan and micronutrients (Fe+ Zn) concentrations on growth, yield components and volatile oil of lavender plant. Sci. J. of Flowers and Ornamental Plants, 8(1): 87-100.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. 2nd Ed., Jhon Wiley and Sons Inc., New York, pp: 95-109.

Hafeez, A.A. and M.S. Ewees (2018). The effective role of vermicompost, elemental sulphur and ascorbic acid on tomato plants grown on a newly reclaimed calcareous soil at Fayoum depression. Egypt. J. of Soil Sci., 58(2): 255-273.

Jackson, M.L. (1967). Soil Chemical Analysis. Pintic Hall of India, pp. 144-147.

Javanmardi, J. and E. Ghorbani (2012). Effects of chicken manure and vermicompost teas on herb yield, secondary metabolites and antioxidant activity of lemon basil (*Ocimum* x *citriodorum* Vis.). Adv. in Hort. Sci., 26(3-4): 151-157.

Khedr, Z.M.A. and S. Farid (2000). Response of naturally virus infected tomato plants to yeast extract and phosphoric acid application. Ann. Agric. Sci. Moshtohor, 38(2): 927-939.

Koller, H. R. (1972). Leaf area and leaf weight relationships in the soybean canopy. Crop Sci., 12(2): 180-183.

Lazcano, C. and J.D. Martin (2010). Effects of vermicompost as a potting amendment of two commercially-grown ornamental plant species. Spanish J. of Agric. Res., (4): 1260-1270.

Lazcano, C.; J. Arnold; A. Tato; J.G. Zaller and J. Domínguez (2009). Compost and vermicompost as nursery pot components: effects on tomato plant growth and morphology. Spanish J. of Agric. Res., 7(4): 944-951.

Moran R. and D. Porath (1982). Chlorophyll determination in intact tissues using N.N. Dimethyl formamide. Plant Physiol., 69: 1370-1381.

Olle, M. (2019). The influence of vermicompost based substrates on basil growth and nutrient content. J. of Agric. Sci., 1: 36-39.

Pant, A.;T. J. K.,Radovich . ; N. V.,Hue and N. Q.Arancon (2011). Effects of vermicompost tea (aqueous extract) on pak choi yield, quality, and on soil biological properties. Compost Science & Utilization, 19(4), 279-292.

Paton, A.; R.M. Harley and M.M. Harley (1999). Ocimum: an overview of relationships and classification. In: Y. Holm and R. Hiltunen, eds. Medicinal and Aromatic Plants-Industrial Profiles. Harwood Academic, Amsterdam, The Netherlands, pp: 1-8.

Pirbalouti, A.G.; F. Malekpoor; A. Salimi and A. Golparvar (2017). Exogenous application of chitosan on biochemical and physiological characteristics, phenolic content and antioxidant activity of two species of basil (*Ocimum ciliatum* and *Ocimum basilicum*) under reduced irrigation. Sci. Hort., 217: 114-122.

Sadasivam S. and A. Manickam (1996). Biochemical Methods, 2nd Ed., New Age International. India.

Shaaban, K.N. (2018). The production of tomato and strawberry in ecology urban agriculture. J. of Environ. Sci., 44(1): 93-115.

Waly, A.A.; A. El-Fattah; M.A.E. Hassan; E.M. El-Ghadban and A.S. Abd Alla (2020). Enhancing growth, productivity and essential oil percentage of *Thymus vulgaris* L. plant using seaweeds extract, chitosan and potassium silicate in sandy soil. Sci. J. of Flowers and Ornamental Plants, 7(4): 549-556.

تأثير معاملات التربة (الفيرمى كمبوست) والرش الورقي ببعض منشطات النمو على النمو والتركيب الكيميائي وإنتاجية الزيت العطرى للريحان الايطالى

حكمت يحيي مسعود، مهند محمد عبد الباسط و ألاء بدير بدير عبد الهادى

قسم الخضر والزينة، كلية الزراعة ، جامعة المنصورة ، مصر

الملخص

أجريت هذه التجربة في أحد المشاتل بمحافظة الدقهلية، مصر، خلال موسمين متتاليين هما 2020/2019 و2021/2020 وذلك لدراسة تأثير معاملات التربة (الفيرمى كمبوست) والرش الورقي ببعض منشطات النمو النبات الطبيعية نفذت كل معاملة من معاملات التربة (سماد الفيرمى كمبوست : التربة الطينية بنسبتين 25٪: 75٪ و 50٪: 50٪) (3:1 و 1: 1 حجم / حجم) كتجربة منفصلة فى تصميم القطاعات الكاملة العشوائية بأربعة مكررات. حيث احتوت كل تجربة من معاملات التربة على ثلاثة عشر معاملة رش ورقي بأربعة أنواع مختلفة من منشطات نمو النبات الطبيعية بثلاث معدلات على النحو التالي: معاملة المقارنة (رش النبات بالماء فقط)، رش النباتات بمستخلص الخميرة بمعدل 2 ، 4 و6 جرام / لتر، رش النباتات بمستخلص الطحالب البحرية بنسبة 20، 40 و60 ٪، رش النباتات بالشيتوزان بمعدل 500، 750 و1000 جزء في المليون ورش النباتات بشاى الفيرمى كمبوست بمعدل 250 ، 500 و750 مل / لتر. أظهرت النتائج المتحصل عليها أن زراعة نبات الريحان الإيطالي في بيئة تتكون من 25٪ سماد الفيرمى كمبوست : 75٪ تربة طينية كانت أفضل من بيئة النمو الأخرى حيث أنتجت أعلى القيم لجميع الصفات المدروسة في كلا الموسمين بالاضافة الى الرش الورقي لنباتات الريحان الإيطالي بالشيتوزان بمعدل 750 جزء في المليون فى كلا الموسمين. يمكن الاستنتاج أن استخدام بيئة نمو تتكون من 25٪ سماد فيرمى كمبوست : 75٪ تربة طينية بالإضافة إلى الرش الورقي لنبات الريحان الإيطالي بالشيتوزان بمعدل 750 جزء في المليون أو شاى سماد الفيرمى كمبوست بمعدل 750 مل / لتر لتحسين النمو الخضرى والتركيب الكيميائي و الزيت العطرى للريحان الإيطالي (*Ocimum basilicum* L. var. Genovese) تحت الظروف البيئية لمحافظة الدقهلية ، مصر.