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Response Growth, Yield, and Quality of Celery Plants to Foliar Spray with some Organic Extracts

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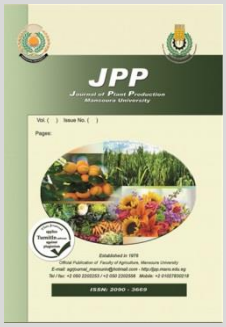

ABSTRACT

The application spray of some organic extracts considers a suitable nutrient supplement to the utilization of chemical fertilizers. So, it needs to more study led to obtain the great quantitative and qualitative characteristics of vegetative crops. An experimental study was conducted at the Central Laboratory of Agricultural Climate (CLAC), Agricultural Research Center, Dokki, Egypt. Celery plants were planted into a net house during the two successive winter seasons of 2018/2019 and 2019/2020. This studied the effect of foliar application of poultry manure tea, vermicompost tea, and algae extract on the vegetative growth, productivity, and quality of celery plants. The trial design was a randomized complete blocks design with three replications. Nine treatments of organic extracts as spray were applied using two concentrations (10, 20 ml/l) for (algae extract, poultry manure tea, and vermicompost tea) and with additional 5ml/l molasses for (poultry manure tea and vermicompost tea) compared with control (water spray). A mixture of poultry manure tea at 20 ml/l + 5ml/l molasses recorded the best parameters of vegetative growth, yield, chemical and quality characteristics followed by a mixture of vermicompost tea at 20 ml/l + 5ml/l molasses with no significant differences between them. Conversely, the least parameters of vegetative growth, yield, chemical, and quality characteristics were obtained by spraying water (control) in both seasons.

***Keywords*:** celery, poultry manure tea, vermicompost tea, algae extract, molasses, essential oil percentage.

INTRODUCTION

Celery (*Apium graveolens* L.) is a biannual plant and is widely grown as an annual plant for its nutritious leafstalks. The optimal conditions for celery production are a lengthy, chilly, humid growth season with a consistent supply of moisture (Bouzo, *et al.* 2007). Celery is cultivated in Egypt as a leafy vegetable crop or medicinal herb crop. Also, excess fertilizer inputs can cause nutrient salt accumulation in growing media. This may have increased the salinity in growing media, which can inhibit vegetable crop growth and reduce nutritional quality. Throughout, the total cultivated area in 2017/2018 year was 106 feddans, and the yield was 6.6 tons/fed with a total production of 702 tons according to the Egyptian Ministry of Agriculture Statistics, 2017- 2018.

Although a laboratory examination revealed that raw poultry manure tea is not a full fertilizer solution. But it still contains enough amounts of nitrogen, phosphorous, potassium, and zinc (Price and Duddles 1984). The superior application of poultry manure with mineral fertilizers, where it is very richer than other manures (Tuhy *et al*., 2013). In addition, Jandaghi, *et al.* (2020) obtained that all traits were enhanced by the application of chicken manure tea (75%) with chemical fertilizer. Foliar spray of poultry litter extract may be used as an alternative environment-friendly means and increased crop growth and yield with maximum profit (Islam, *et al.* 2013). When treated correctly, poultry manure is the most useful of all animal manures. According to Adekiya and Agbede (2009), the application of poultry manure (PM) for tomato development and productivity is essential for maintaining soil fertility. The addition of PM to the soil increased organic matter, N, P, K, Ca, and Mg in the soil (Adekiya and Agbede, 2017).

When using poultry manure, consider into account the crop's requirements and the manure's speed of decomposition and nutrient release, as well as its nutrient concentration. So, it needs to be mineralized to become available to the plants. Nutrition, namely N delivery to the production system, is one of the key barriers to the use of organic manures in crop production (Javier *et al.*, 2002; Masunga *et al.*, 2016). Furthermore, vermicompost teas generally were prepared by three methods, non-aerated, aerated, and augmented with a microbial enhancer. All extraction techniques increased plant growth, total carotenoids, and mineral nutrients; however, organic fertilization had the strongest effects (Pant, *et al.* 2009). Arancon and Edwards (2005) found that using vermicompost can increase the growth, flowering, yields, and quality of vegetable and ornamental crops. Therefore, the effects of vermicompost on plants are attributable to the quality of the mineral nutrition as well as the provision of other growth-regulating elements including humic acids and plant growth hormones. Vermicompost leachates applied topically to strawberry plants dramatically increased their leaf area, dry matter, and fruit yield as compared to controls (water spray only), according to Singh *et al.*, 2010.

Algae are classified into three groups; namely green, brown, and red based on their pigments. Various types of algae have reportedly had positive benefits on some vegetable crops (Abdel-Mawgoud *et al.*, 2010; Nawar and Ibraheim, 2014). Due to the biological origin of the substance, they are environmentally beneficial (Tuhy *et al.*, 2013). Using algae foliar spray application {whether Blue-green algae (BGA)} or seaweed extract leads to improve the physiological status of plants. The application of algae (seaweed) extract is available as an organic bio-stimulant and a powder system. It helps

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plants to become more disease resistant and helps expand rapid root development. BGA are photosynthetic nitrogen fixers and are free living. Additionally, cyanobacteria are advantageous as potential biodegrading organisms because they can absorb a variety of contaminants. As a result, after their death and decomposition, growth-promoting chemicals such as hormones (auxin, gibberellins), vitamins, and amino acids are available in soil biomass (El Sayed *et al.*, 2015). Marine algae are the most important type of organisms that can be widely exploited in plant nutrition, according to researchers (Tuhy *et al.*, 2013). Also, Nawar and Ibraheim, (2014) showed that 75 or 100% of the nitrogen recommended rate (NRR) combined with foliar application with 10 or 15% algae extract were the best interaction treatments for maximizing yield and improving the quality of peas. A positive effect of improving vegetative growth and quality of spinach was obtained by using the 80% NRR combined with foliar application algae extract (Abo-Basha *et al*., 2019). Nevertheless, the foliar application seaweed extract (Kelpak) of the level 4ml L^{-1} was the highest effect on most vegetative growth parameters and mineral content leaves of mandarine seedlings (Al-Falahy and Al-Janabi, 2015).

Accordingly, Molasses or black treacle is a viscous by-product during refining sugarcane or sugar beets into sugar and is especially valued for its iron substance and is organic fertilizer for eco-friendly farming (Singh *et al*., 2021). It considers a carbon source combined with composted poultry litter in anaerobic soil disinfestation, a substrate for producing microorganisms by liquid fermentation (Papavizas, *et al*., 1984, Butler, *et al*., 2012; Expósito, *et al*., 2022). Also, it contains different amounts of humic, fulvic, and amino acids which, stimulates agriculture nutrient elements uptake efficiency. (Samavat and Samavat, 2014; Singh *et al*., 2021 and Gaafar *et al.* 2019). Diluted molasses is slightly acidic and contains a fairly good amount of calcium, magnesium, and other essential nutrients like sodium potassium, chlorides, carbonates, bicarbonates, and sulphates from its physicochemical analysis (Thakare, *et al.* 2013). however, a spray of 6% molasses decreased the quantity of mineral fertilization by 25% and increased the yield and led to high net income for the growers (Gaafar *et al.* 2019). Moreover, Şanlı *et al.* (2015) found that molasses applications (3 times during the vegetation period) significantly increased sugar beet yield and its quality.

Therefore, the superior use of technology to improve crop productivity, crop health, and environment-friendly is using a foliar spray application of compost tea alternative to solid compost application to the soil. A foliar spray of organic extracts application works to supply plants with nutrients available to absorb. It reduces the accumulated salinity inside the soil throughout the growing season or decreases the quantity of fertigation each time irrigation. It improves the air conditions or provides suitable conditions for growth. So, this study was to know the impact of the type of spraying organic extracts (vermicompost tea, Poultry manure tea, and algae) compere with control (water spray) on celery production under substrate culture.

MATERIALS AND METHODS

An experimental study was carried out at a net house located in the Central Laboratory of Agricultural Climate (CLAC), Agricultural Research Center, Dokki, Giza Governorate, Egypt. It was during the two successive winter seasons of 2018/2019 and 2019/2020. This studied the effect of foliar application of poultry manure tea, vermicompost tea, and algae extract on celery plants' vegetative growth, productivity, and quality.

Seeds of Celery (*Apium gravealens* var. rapeceum) F_1 hybrid imported from Takii and Co., LTD (Kyoto, Japan) were sown in polystyrene trays in the Middle of September. The seedlings were transplanted on 1st, and 15th November 2018 and 2019 in plastic pots (5 liters in volume) filled with peat moss: perlite (v/v) substrate culture. A balanced fertilizer solution was used to irrigate it on terraces in the net house with drainage capabilities until true leaves appeared. The experimental substrate culture physical and chemical analyses are in Table (A).

Table A.Physical and chemical properties of sand substrates.

Substrate	Physical				Chemical	
	Bulk density g/l	Total pore space %	Water holding capacity %	Air porosity %	E.C mmhos-1	pH
Peatmoss: Perlite (1:1 v/v)	390	63	47.6	16	0.50	7.3

Experimental design

The experiment contains nine treatments arranged in a randomized complete blocks design with three replicates. The entire plot was included in 16 pots; each pot has a volume of 5L. The space between pots was 25cm in a row. Every 16 pots were on each woody table. Each table was lined with thick black plastic with a drain. Dimensions of the woody table were 1 x 1 x 1m dimension. Whereas the space between woody tables was 50 cm (Figure 1).

Figure 1. Represent celery plants at the start of the transplanting process during the two seasons (A and B).

The plants were sprayed with different concentrations of organic extracts (poultry manure tea, vermicompost tea, and algae extract) compared with the control (water spray), after three weeks of transplanting. the started spray treatments were after 21 days of transplanting then two times per two weeks.

The physical and chemical properties of different organic fertilizers concentered are in Table (B). The nutrient solution was pumped via a submersible pump (110 watts) with water dilution in a tank of 100L. The fertigation was programmed for working 8 times/day in an open system of substrate culture. Moreover, the electrical conductivity (EC) of the nutrient solution was adjusted by using an EC meter to the required level (1:2 ds/m-1) according to the vegetable crop and growth stage. pH maintained between (6 - 6.5). The chemical nutrient solution (El-Behairy, 1994) was applied to all treatments, were shown in Table (C).

Table B. Physical and chemical properties of different organic fertilizers concentrated

Organic fertilizer	EC(dS / m)	pH	N (%)	P (%)	K (%)
Poultry manure tea	8.25	7.61	2.8	3.55	1.9
Vermicompost tea	4.67	6.27	1.56	1.27	1.33

Table C. The chemical composition of the applied nutrient solution.

Nutrient solution	Macronutrients (ppm)					Micronutrients (ppm)					
	N	P	K	Ca	Mg	Fe	Mn	Zn	B	Cu	Mo
Chemical nutrient solution	200.3	45	300	178.9	60	2.9	0.8	0.4	0.5	0.26	0.02

The experimental treatments

The following nine treatments were used:

1- Poultry manure tea at 10ml/l.
2- Poultry manure tea at 20ml/l.
3- Poultry manure tea at 20ml/l + 5 ml/l molasses.
4- Vermicompost tea at 10ml/l.
5- Vermicompost tea at 20ml/l.
6- Vermicompost tea at 10ml/l+ 5 ml/l molasses.
7- Algae extract at 10ml/l.
8- Algae extract at 20ml/1.
9- Control (water spray).

The vermicompost tea

The vermicompost tea was prepared from the vermicompost. The vermicompost was purchased from a commercial vermicompost source Agricultural Research Center, agricultural organic, Giza. a suitable dilution was obtained with 10 and 20ml/L (tap water) from the stock solution of vermicompost tea.

Poultry manure tea

Poultry manure was obtained from a chicken production farm at the Experimental and Production Station, Faculty of Agriculture, Ain Shams University. Poultry manure tea was prepared by soaking chicken droppings in water with a ratio of 2: 10 (w/v) in a tank of 200 liters for a period of two days. The tank was kept in a shaded area to allow the nutrients in the chicken droppings to combine in the water. Afterward, the poultry manure prepared was filtered through cheesecloth before application to remove suspended particles to obtain the devoid solution of chicken droppings. Poultry manure tea was freshly prepared for each time of application. The chemical properties of poultry manure tea are presented in Table A. The suitable dilution was made with 10 and 20ml/L (tap water) from the stock solution of poultry manure tea.

Algae extract

Algae extract was made from the National Research Center of Egypt. The suitable dilution was prepared with 10 and 20 ml/L (tap water) from the stock solution of algae extract. The commercial product (UAD X-oligo) as seaweed contains some nutrients and growth regulators.

The measurements

The vegetative growth and yield parameters:

Three plants were extirpated from each experimental plot during the two seasons of 2018/2019 and 2019/2020. All samples were taken to determine all growth parameters. Thus, all growth parameters were plant height (cm), leaves number per plant, fresh weight (g), dry matter %, stem diameter (cm) (under leaves petioles), total chlorophyll content (Spad), stalks (petioles without leaves) and harvest (petioles with leaves) (kg/m2). Also, all chemical and quality parameters: N, P, K, protein (%), essential oil (ml/plant), and vitamin C (mg/100g) after 70 days of transplanting. The temperatures of the daily data were taken by the Agricultural Weather Station at the Central Laboratory of Agricultural for Climate, Dokki, Egypt during the two study seasons (Figure 2).

The Chemical analysis and quality characteristics:

The total nitrogen, total phosphorus, total potassium, and Vitamin C of celery plants at the harvest stage were determined according to A.O.A.C (1990). In addition, crude protein was calculated as mineral nitrogen multiplied by the protein factor, which is 6.25.

Essential oil (%):

Hydro-distillation determined the quantitative of essential oil obtained from different treatments. Which, continued from 2.5 to 3 hours after the water boiling till no further increase in the oil volume was observed from the distillation of 100g fresh leaf samples. Then, the oil volume (ml/plant) was calculated as oil percentage X leaves fresh weight (g/plant).

The statistical analysis:

Experimental data were statistically analyzed using Mstatic (M.S.) software. Analysis of Variance (ANOVA) was achieved according to Snedecor and Cochran (1982), and the comparison between means was performed according to Duncan's (1955) method at a probability of 5%.

RESULTS AND DISCUSSION

Results

Temperature is the main factor that affects the different stages of plant growth. Climate change and the potential events of more changes in temperature will influence plant productivity (Hatfield and Prueger, 2015). Also, the temperature affects the chemical process of the photosynthetic process at high light intensities and a diffusion process at low light intensities when the photochemical process becomes limiting (Went, 2003). Data in Figure (2) showed that the average air temperature of the first season increased compared with the second season from November to January, but it decreased compared with the second season from January to March. on the shape showed that the low air temperature in the second season compared with the first season did not negatively affect the yield of the celery crop. These results indicated that using the organic spray provided suitable air conditions and increased yield. Moreover, it was expanded that microbial activity tends to high temperatures reached during thermophilic composting (Najafabadi, 2014). Everything in environmental conditions affected the growth of plants. Climate control is essential to maximize the photosynthetic process and growth of plants. Maintaining optimal relative humidity levels in a net house, ensure optimal plant transpiration.

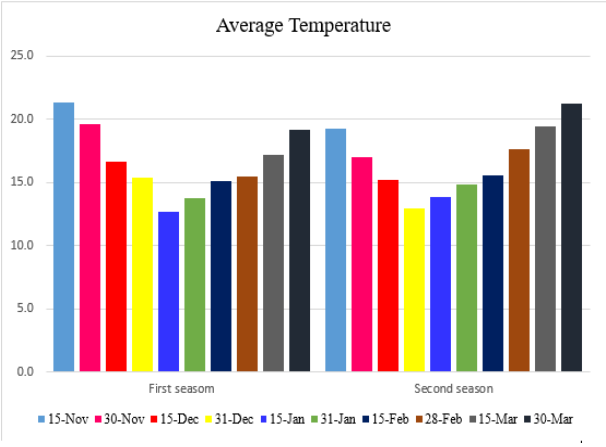

Figure 2. The average air temperature every 15 days during the 2018/2019 and 2019/2020 seasons.

Effects of foliar spray with some organic extracts on vegetative growth of celery plants.

Data in Table (1) and Figure (3) showed that different organic extracts spray significantly gave better vegetative growth and yield than the control (water spray) treatment. The best parameters for plant height, number of leaves, leaf area, total plant fresh weight and plant dry matter, stem diameter, and total chlorophyll content of celery plants were obtained from applying poultry manure at 20 ml/l+5ml/l molasses in the two seasons. Then, the same result on plant height was achieved by spraying vermicompost tea at 20 ml/l+5ml/l molasses and algae extract at 20 ml/l during the two study seasons, but vermicompost tea at 20 ml/l+5ml/l molasses gave the best values of stem diameter in the second season. In reverse, the control treatment recorded the lowest values in all parameters during the two seasons. Then, the lowest values of (leaves number, dry matter, and stem diameter) were resulted from applying poultry manure tea at 10 ml/l, 20 ml/l, vermicompost tea at 10ml/l, 20ml/l and algae extract at 10ml/l), except, the least parameters of plant height were recorded with poultry manure tea at 10 ml/l in two seasons. Also, applying algae extract at 20ml/l gave the same negative significantly on dry matter and stem diameter in the second season and two seasons, respectively.

Table 1. Effects of foliar spray with some organic extract on vegetative growth and total chlorophyll of celery plants at 70 days after planting during 2018/2019 and 2019/2020 seasons.

Treatment spray	Plant height (cm)		Leaves number/plant		Leaves fresh weight (g/plant)		Dry matter (%)		Stem diameter (cm)		Total chlorophyll content (Spad)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control (water)	52.2^{f}	51.4^{f}	18.7^{c}	21.8^{c}	142.68^{i}	161.3^{h}	11.4^{e}	10.1^{c}	4.0^{c}	3.3^{c}	46.33^{g}	44.97^{f}
Poultry manure tea at 10 ml/l	53.3^{ef}	52.7^{ef}	18.8^{c}	22.1^{c}	157.18^{h}	176.14^{g}	11.6^{de}	10.2^{c}	4.1^{c}	3.4^{c}	53.66^{f}	47.88^{e}
Poultry manure tea at 20 ml/l	53.9^{de}	53.0^{de}	18.9^{bc}	22.3^{bc}	163.71^{g}	184.08^{f}	11.7^{c-e}	10.3^{bc}	4.2^{c}	3.4^{c}	54.53^{e}	49.67^{d}
Poultry manure teaat20m/l+5g/l molasses	58.9^{a}	58.3^{a}	21.1^{a}	24.5^{a}	245.35^{a}	265.92^{a}	12.8^{a}	11.7^{a}	5.8^{a}	4.6^{a}	59.47^{a}	55.80^{a}
vermicompost tea at 10ml/l	54.0^{cd}	52.8^{cd}	19.2^{bc}	22.4^{bc}	198.36^{e}	217.69^{d}	11.8^{cd}	10.6^{bc}	4.3^{c}	3.6^{c}	55.90^{cd}	50.07^{d}
Vermicompost tea at 20 ml/l	54.1^{bc}	52.9^{bc}	19.4^{bc}	22.5^{bc}	204.11^{d}	222.08^{d}	11.8^{b-d}	10.6^{bc}	4.4^{c}	3.7^{c}	56.20^{c}	50.71^{cd}
vermicompost tea at 20 ml/l +5g/l molasses	56.5^{a}	55.4^{ab}	19.8^{b}	23.1^{b}	238.82^{b}	257.47^{b}	12.1^{b}	11.0^{b}	5.2^{b}	4.4^{ab}	58.03^{b}	53.32^{b}
Algae extract at 10 ml/l	52.3^{cd}	51.4^{cd}	19.2^{bc}	18.7b^{c}	181.72^{f}	200.34^{e}	11.7^{cd}	10.3^{bc}	4.1^{c}	3.5^{c}	55.28^{de}	49.80^{d}
Algae extract at 20 ml/l	55.3^{ab}	54.2^{ab}	19.8^{b}	18.8^{b}	210.78^{c}	229.83^{c}	11.9^{bc}	10.7^{bc}	4.6^{c}	3.9^{bc}	56.47^{c}	51.88^{c}

Figure 3. Represent celery plants after 70 days of transplanting during the two seasons. (A and B).

Effects of foliar spray with some organic extracts on yield of celery plants.

The results in Table (2) showed that the best parameters of harvest and stalks (edible) were recorded from applying poultry manure tea at 20 ml/l+5ml/l molasses compared with control was the least parameters during the two study seasons. the spraying of vermicompost tea at 20 ml/l+5ml/l molasses was followed by poultry manure tea at 20 ml/l+5ml/l molasses to obtain the highest yield in the first season.

Table 2. Effect of foliar spray with some organic extracts on yield of celery plants during 2018/2019 and 2019/2020 seasons.

Treatment spray	Yield kg/m^2			
	Harvest		Stalks	
	1st Season	2nd Season	1st Season	2nd Season
Control (water)	2.28^{h}	2.58^{h}	1.14^{f}	1.29^{g}
Poultry manure tea at 10 ml/l	2.51^{g}	2.82^{g}	1.26^{e}	1.41^{f}
Poultry manure tea at 20 ml/l	2.62^{f}	2.95^{f}	1.31^{e}	1.47^{f}
Poultry manure tea at 20 m/l+5g/l molasses	3.93^{a}	4.25^{a}	1.96^{a}	2.13^{a}
vermicompost tea at 10ml/l	3.17^{d}	3.48^{d}	1.59^{c}	1.74^{d}
vermicompost tea at 20 ml/l	3.27^{d}	3.55^{d}	1.63^{bc}	1.78^{cd}
vermicompost tea at 20 ml/l +5g/l molasses	3.82^{b}	4.12^{b}	1.91^{a}	2.06^{b}
Algae extract at 10 ml/l	2.91^{e}	3.21^{e}	1.45^{d}	1.60^{e}
Algae extract at 20 ml/l	3.37^{c}	3.68^{c}	1.69^{b}	1.84^{c}

Effects of foliar spray with some organic extracts on the quality of celery plant.

Table (3) explained the effect of poultry manure tea, vermicompost tea, and algae extract treatments on vitamin C and essential oils percentage of celery. There were significant differences among different organic extracts sprayed on quality characteristics. Application of poultry manure tea at 20 ml/l+5ml/l molasses gave the highest values of vitamin C and essential oil, followed by vermicompost tea at 20 ml/l +5ml/l molasses no significant differences between them. While the least parameters were recorded in the control treatment in both seasons. Then, the lowest values of (vitamin C and essential oils percentage) were resulted from applying poultry manure tea at 10 ml/l, except, applying algae extract at 20 ml/l gave the least parameters of vitamin C in the first season. Also, the lowest values of (vitamin C and essential oils percentage) were resulted from applying poultry manure tea at 10 ml/l, 20 ml/l and algae extract at 10ml/l, except, applying algae extract at 20ml/l and vermicompost tea at 20ml/l gave the least parameters of vitamin C in the second season.

Table 3. Effect of foliar spray with some organic extracts on quality of celery plants at 70 days after planting during 2018/2019 and 2019/2020 seasons.

Treatment spray	Quality characteristics			
	Vitamin C (mg/100g)		essential oil (ml/plant)	
	1st Season	2nd Season	1st Season	2nd Season
Control (water)	5.20^{d}	4.98^{c}	0.103^{e}	0.103^{d}
Poultry manure tea at 10 ml/l	5.71^{bcd}	5.02^{c}	0.115^{de}	0.113^{d}
Poultry manure tea at 20 ml/l	5.76^{bc}	5.07^{c}	0.121^{cd}	0.120^{d}
Poultry manure tea at 20 m/l+5g/l molasses	7.56^{a}	8.50^{a}	0.238^{a}	0.290^{a}
vermicompost tea at 10ml/l	5.81^{bc}	6.10^{b}	0.149^{c}	0.170^{b}
vermicompost tea at 20 ml/l	6.23^{b}	5.22^{c}	0.163^{b}	0.149^{c}
vermicompost tea at 20 ml/l +5g/l molasses	7.34^{a}	8.10^{a}	0.224^{a}	0.268^{a}
Algae extract at 10 ml/l	5.76^{bc}	5.07^{c}	0.134^{cd}	0.130^{d}
Algae extract at 20 ml/l	5.62^{cd}	5.27^{c}	0.158^{c}	0.156^{c}

Effect of foliar spray with some organic extracts on the chemical composition of celery plants.

Regarding leaf mineral contents, data in Table (4) illustrated that leaf mineral contents were enhanced by different organic extract spray treatments. Data showed that the highest values of nitrogen, protein, phosphorous, and potassium percentage were obtained from using poultry manure tea at 20 ml/l+5ml/l molasses treatment followed by vermicompost tea d11 at 20 ml/l +5ml/l molasses without significant differences between them. Then, the treatment of algae extracts at 20 ml/l gave the highest parameters of nitrogen and protein percentage in the first season. However, the least parameters were obtained using the control plants, in the two seasons. Then, the lowest values of (N, protein, P, and K percentage) were resulted from applying poultry manure at 10 ml/l in the two seasons except applying algae extract at 20 ml/l gave the least parameters of P% in the first season.

Table 4. Effect of foliar spray with some organic extracts on chemicl characteristics of celery plants at 70 days after planting during 2018/2019 and 2019/2020 seasons.

Treatment spray	N (%)		Protein (%)		P(%)		K(%)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Control (water)	1.3^{f}	1.5^{f}	8.3^{f}	9.5^{f}	0.40^{e}	0.48^{d}	2.47^{f}	2.27^{f}
Poultry manure tea at 10 ml/l	1.6^{ef}	1.7^{ef}	9.7e^{f}	10.4e^{f}	0.45^{de}	0.50^{d}	2.81^{ef}	2.49^{ef}
Poultry manure tea at 20 ml/l	1.7^{de}	1.7^{de}	10.6^{de}	10.8^{de}	0.48^{de}	0.57^{c}	2.96^{de}	2.58^{de}
Poultry manure tea at 20 m/l+5g/l molasses	2.4^{a}	2.1^{a}	15.2^{a}	13.2^{a}	0.88^{a}	0.73^{a}	3.93^{a}	3.16^{a}
vermicompost tea at 10ml/l	1.9^{cd}	1.8^{c-e}	12.1^{cd}	11.1^{c-e}	0.65^{c}	0.62^{c}	3.14^{c-e}	2.66^{c-e}
vermicompost tea at 20 ml/l	2.0^{bc}	1.8^{b-d}	12.8^{bc}	11.6^{b-d}	0.73^{c}	0.64^{bc}	3.30^{b-d}	2.77^{b-d}
vermicompost tea at 20 ml/l +5g/l molasses	2.3^{a}	2.0^{ab}	14.6^{a}	12.4^{ab}	0.84^{ab}	0.70^{ab}	3.57^{ab}	2.98^{ab}
Algae extract at 10 ml/l	1.8^{cd}	1.8^{c-e}	11.3^{c-e}	11.0^{c-e}	0.54^{d}	0.58^{c}	3.06^{c-e}	2.63^{c-e}
Algae extract at 20 ml/l	2.2^{ab}	1.9^{bc}	13.9^{ab}	12.0^{bc}	0.75^{bc}	0.64^{bc}	3.44^{bc}	2.87^{bc}

Discussion

The results of the experiment illustrated that celery plants were improved with different organic extract sprays. A higher level of poultry manure tea + molasses was the best in growth enhancement, yield, and improved quality followed by higher levels of vermicompost tea+ molasses without significant differences between them. These results are the same as those obtained by Singh *et al.*, 2010, Uko, *et al.*, 2013 and Shuyan *et al.*, 2017. In this connection, the choice of fertilizer may differently influence improve crop production

and nutritional quality (Chen, 2006; Oyedeji *et al.*, 2014; Abbas *et al.*, 2019). According to Porto *et al*. (1999), the lettuce plots with the best plant weight and the number of leaves per plant were those where the organic fertilizer had the highest amount of chicken manure. As a more sustainable option, compost tea foliar spray can be used to increase crop development and production while maximizing potato crop profits (Islam *et al*., 2013). The increase in vegetative growth and production of bean plants was more clearly affected by the application of dilute chicken manure tea (Shaheen *et al*., 2018). However, the use of chicken manure tea was diluted and added advantageous and efficient microbes that could replace inorganic fertilizers entirely or partially for sustainable crop production, which is a suitable and useful agricultural application as well as a friend environmental (Shaheen *et al*., 2018). It is crucial to state that the increased photosynthetic capacity and efficiency could account for the beneficial effects of chicken manure tea in combination with efficient microorganisms on plant growth (Xu, 2000; Xu *et al*., 2000), enhance nodulation, which led to an increase in the biological nitrogen fixation process (Sangakkara and Higa, 1994), preserve soil fertility and enhance the physical, chemical, and biological properties of the soil (Hawke and Summers, 2006; Ayoola and Maknide, 2009; Alabadan *et al*., 2009; Demir *et al*., 2010) and supply readily available plant nutrients in the rhizosphere (Gross *et al*., 2008; Feleafel and Mirdad, 2014). Additionally, mixtures of advantageous microorganisms and organic manure played a significant and effective function in fostering plant growth and boosting nutrient availability and uptake (Higa, 2004). These effects may be related to the activation of a variety of helpful microorganism species that produced growth stimulants and other beneficial compounds in the root zone. Similar reactions to the vermicompost tea spray were seen in several growth traits and all chemical and quality criteria of the celery crop. Regardless of the availability of nutrients, the presence of plant growth regulators in the teas may affect plant development (Arancon *et al., 2*007). Available soluble mineral nutrients and microbial secondary products in vermicompost tea may balance nutrients simplified for plants, improve nutrient uptake from the soil, and promote foliar uptake of nutrients. (Xu *et al*., 2001, Ingham, 2005 and Najafabadi, 2014). According to the results of previous studies, vermicompost tea favorably improved plant growth and the concentration of minerals in plants (Sanwal *et al*., 2006; Hargreaves *et al*., 2008). Additionally, compared to traditional thermophilic composts, vermicompost has a considerably greater microbial diversity and activity because the earthworm-fractured organic wastes have a larger surface area and can support a greater amount of microbial activity (Najafabadi, 2014). as illustrated from the results that spraying of algae extract was superior in some parameters (plant height, nitrogen, and protein percentage) due to containing some nutrients and growth regulators, which agrees with Al-Falahy and Al-Janabi, (2015) on mandarine seedlings and Abo-Basha *et al*., (2019) on spinach.

On the other hand, the addition of molasses in poultry manure tea and vermicompost tea improved the growth, yield, and quality of plants. It contains different amounts of nutrient elements, is considered a substrate for producing microorganisms, and increases the uptake of agricultural nutrient elements. The same results were obtained by Rani and Vastava (1990) on the chlorophyll content of peas, Chandraju (2008) on the yield of cabbage plants, Şanlı *et al.* (2015) on the yield and quality of sugar beet, and Gaafar *et al.* (2019) on the vegetative growth and fruits yield with the best quality of sweet pepper plants. molasses increased NPK uptake due to improving yields (Vitosh, 1996; Abo-Baker, 2017).

CONCLUSION

From the results mentioned above, it is possible to enhance that spraying poultry manure and/ or vermicompost tea with molasses is regarded as a practical agricultural technique and environmentally responsible method for organic farming's sustainable crop production. Therefore, the best parameters of vegetative growth, yield, and quality growth characteristics of celery plants were concluded with the application of higher levels of poultry manure tea with additional molasses. Generally, using poultry manure or vermicompost tea at 20 ml/l with additional 5 ml/l molasses gave the same obtained results. From here, we find that it is necessary to work continuously to improve the use of vermicompost and algae.

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استجابة نمو ومحصول وجودة نباتات الكرفس للرش الورقى ببعض المستخلصات العضوية

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الملخص

يعتبر رش بعض المستخلصات العضوية مكمل غذائي مناسب لاستخدام الأسمدة الكيماوية. لذلك ، فهي تحتاج إلى مزيد من الدراسة للوصول لأفضل الخصائص الكمية والنوعية لمحاصيل الخضر. أجريت دراسة تجريبية بالمعمل المركزى للمناخ الزراعى، مركز البحوث الزراعية، الدقى، مصر. زرعت نباتات الكرفس داخل صوبة شبكية خلال موسمين شتويين متتاليين 2019/2018 و 2020/2019. دراسة تأثير تطبيق الرش الورقى للمستخلص الدواجن و الفيرميكمبوست و الطحالب) على النمو الخضرى والإنتاجية وجودة نباتات الكرفس. وكان تصميم التجربة قطاعات العشوائية الكاملة بثلاثة مكررات. تم تطبيق تسعة معاملات رش من المستخلصات العضوية باستخدام تركيزين 10 و 20ملى/لتر لكل مستخلص (الطحالب ، الدواجن و الفيرميكمبوست) ومع إضافه 5 ملى/لتر مولاس لمستخلاص الدواجن و الفيرميكمبوست مقارنة بالكنترول (رش بالماء). سجل خليط مستخلص الدواجن 20ملى/لتر+ 5 ملى/لتر مولاس أعلى قياسات النمو الخضري والمحصول والتحاليلات الكيميائية والجودة يليها خليط مستخلص الفيرميكمبوست 20ملى/لتر+ 5 ملى/لتر مولاس دون أي فروق معنوية بينهما. وعلى العكس من ذلك ، تم الحصول على أقل قياسات النمو الخضري والمحصول والتحاليلات الكيميائية والجودة مقارنة بالكنترول في كلا الموسمين.

الكلمات الدالة : الكرفس و منقوع مخلفات الدواجن و منقوع فيرميكمبوست و مستخلص الطحالب و المولاس و النسبة المئوية للزيت المستخلص.