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Response of Hot Pepper Plants (*Capsicum frutescens* L.) to Compost and some Foliar Application Treatments

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ABSTRACT

There is a general trend of using natural plant extracts and bio substances with organic fertilizers for improving plant growth. So, our study aims to investigate the influence of plant compost (plant residues) and foliar spraying with some stimulants on enhancing growth performance, chlorophyll content, fruit yield and quality of hot pepper plants (*Capsicum frutescens* L.) CV Sina Hot. For this purpose, a field trial was carried out at the Experimental Farm of Faculty of Agricultural, Mansoura University during the summer season of 2020. The used experimental design is a split-plot design with three replicates included four compost rates *i.e.* control (without compost addition), 5, 10 and 15 m^3 compost fed^{-1} are arranged in main plots and four foliar applications *i.e.* tap water (control), seaweed extract at 0.5 gL^{-1}, yeast extract at 5 gL^{-1} and liquorice extract at 10 gL^{-1} are arranged in subplots. Findings show that all growth parameters *i.e.* plant height (cm), No. of leaves $plant^{-1}$, leaf area (cm^2 $plant^{-1}$), fresh and dry weights (g $plant^{-1}$),chlorophyll content *i.e.* Chl *a*, Chl *b* and Chl *a+b* (mg g^{-1} F.W), fruit yield *i.e.* average fruit weight (g), No. of fruits $plant^{-1}$ and total yield (metric ton fed^{-1}) and fruit quality parameters *i.e.* phenol and vitamin C (mg $100g^{-1}$), carotene (mg g^{-1} F.W), dry mater, TSS, N, P, K (%) and Fe (mg kg^{-1}) of hot pepper plants significantly increase with the increase of added compost rate. Also, among the stimulants, it was found that 'seaweed extract ' is the best one. The yeast extract comes in the second-order followed by liquorice extract and lately tap water (control).

Keywords: Plant compost, seaweed extract, yeast extract, liquorice extract and hot pepper plants.

INTRODUCTION

Hot pepper (*Capsicum frutescens* L.) belongs to Solanaceae family and considers one of the traditional plants, which has so many pharmacology. Hot pepper is an important global vegetable plant. It is well recognized for its high bioactive content (Popelka *et al.* 2017 and Aly *et al.* 2019). Compost considers a wealthy source of organic matter (O.M). The soil addition of compost before planting enhances plant growth, crop yield and quality due to its positive influences on the soil physical properties *i.e.* water holding capacity structure, hydraulic conductivity, porosity, bulk density, compression strength and water permeability and soil chemical properties such as soil content of organic matter and nutrients (Wahdan *et al.* 2009,Tahir *et al.*2011, Mohamed *et al.* 2020 and El-Hadidi *et al.* 2020).Seaweeds also known as marine macroalgae have been used as a source of organic matter and mineral nutrients for centuries (Khan *et al*. 2009, Craigie, 2011 and Renaut *et al.* (2019). Liquid seaweed extracts were developed since 1950 to concentrate plant growth-stimulating compounds, increase their effectiveness and facilitate their usage (Milton, 1952). It plays a role as an activator of cell division, gives rise to antioxidants levels for protection against environmental stress. Unlike modern chemical fertilizers, seaweed extracts come from a renewable resource and consider biodegradable, non-toxic, Thus, they represent an attractive tool for sustainable crop management programs (Renaut *et al.* (2019). yeast foliar application has a positive influence on plant development, output and chemical structure. Yeast extract is an excellent source of thiamine, riboflavin, niacin, pyridoxine, vitamins (*i.e.* B_1, B_2, B_3, B_{12}), cytokinins, nucleic acid, protein, carbohydrates and lipids (Mohamed, 2005).One of the natural plant extracts is liquorice extract. This extract is a vegetarian alternative to extract natural growth regulators to the improvement of plant growth and production. It also contains the important glycyrrhizin substance, it is the calcium and potassium salts of glycyrrhizic acid and trihydroxy acid (Newall *et al.* 1996). Foliar application of 3.0 g L^{-1} liquorice root extract led to a significant increase in the lettuce vegetative growth such as plant length, leaf area, leaf number and head circumference (Marie and Al-Allaf, 2012). While, on the local red onion, spraying with 15 g L^{-1} liquorice root extract significantly increased length of the tallest leaf, plant height and number of leaves (Babilie *et al.* 2015).

Therefore, this investigation aims to study the effect of different compost rates [zero (control), 5, 10 and 15 m^3 compost fed^{-1}] and different foliar applications of stimulants [*i.e.* tap water (control), seaweed extract, yeast extract and liquorice extract] and their interactions to determine the optimum compost rate and stimulant required for enhancing hot pepper production .*i.e* the highest fruit yield and quality.

MATERIALS AND METHODS

A field trial was carried out at the Experimental Farm of Faculty of Agricultural, Mansoura University during the summer season of 2020 to evaluate the influence of different rates of plant compost (25% rice straw + 25% wheat straw + 50% other plant residues) and foliar spraying with some stimulants on improving growth performance, fruit yield and quality of hot pepper (*Capsicum frutescens* L.) plants

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grown on a clay soil. The combined influences of compost and stimulants were investigated by combining four compost rates [zero(control), 5, 10 and15m^3 compost fed^{-1} two weeks before planting] and four foliar applications of stimulants *i.e.* tap water (control), seaweed extract at 0.5 gL^{-1}, yeast extract at 5 gL^{-1} and liquorice extract at10 gL^{-1} . Sixteen treatments were arranged in a split-plot design in a randomized complete block design, the compost rates represented the main plots while the different stimulants were allocated in the subplots. The treatments of the field trial were 4 "compost rates" × 4 "stimulants" each treatment was done in 3 replicates. Thus, the total number of experimental units used was 48.

Hot pepper seedlings (CV Sina Hot) were planted on 19th of April, in four ridges of 0.70 m wide and 9.6 m long. Each ridge was divided into 4 parts, each representing a different compost rate. Also, each ridge represented a different stimulate treatments. The normal agricultural practices were used for the hot pepper production according to the Ministry of Agri. and Land Rec (MALR). Mineral fertilization was done as recommended by MALR. Compost was applied to the soil before plowing in a single application at above mentioned rates. Each experimental plot was mixed with compost and irrigated up to saturation percentage.

According to Dewis and Fertias (1970), the soil of experimental site was analyzed before sowing as a routine work. Table 1 shows some properties of the experimental soil and chemical analysis of the experimental plant compost.

Table 1. Some characteristics of the experimental soil and plant compost used.

Soil properties				**Plant compost properties**	
Physical analyses		**Soluble cations, meq L^{-1}**		**Chemical analyses**	
C. Sand%	3.10	Ca^{++}	5.30	pH (1:10)	6.140
F. Sand%	18.6	Mg^{++}	2.70	EC (1:10) (dSm^{-1})	3.550
Silt%	27.0	K^{+}	2.20	OM%	37.10
Clay%	51.3	Na^{+}	4.80	Organic carbon%	22.41
Textural class	Clay	Soluble anions, meq L^{-1}		C/N ratio	14.94
Chemical analyses		CO_3^-	---------	Available micronutrients and heavy metals (mg kg^{-1})	
EC dSm^{-1*}	1.50	HCO_3^-	0.90	Iron	52.92
pH**	8.17	Cl^-	7.50	Manganese	23.40
$CaCO_3$ %	2.15	SO_4^-	6.60	Copper	4.990
O.M %	1.25	Available element, mg kg $^{-1}$		Zinc	16.45
Hydro physical analyses		Nitrogen	59.00	Lead	5.050
F.C %	36.0	Phosphorus	8.700	Nickel	0.740
S.P %	72.0	Potassium	215.6	Cadmium	1.859
				Total Nutrients (%)	
				Nitrogen	1.50
				Phosphorus	0.52
				Potassium	0.83

*** Soil Electrical Conductivity (EC) and soluble ions were determined in saturated soil paste extract.**

**** Soil pH was determined in soil suspension (1: 2.5).**

Plant compost (plant residues) was prepared in the experimental site according to the method described by El-Hammady *et al.* (2003).

Seaweed extract (from Tiba Company for Trading) contained N (5.8. %), K (4.6%), B (0.17%), alganic acids (6.5%), P (3%) and seaweeds (20.5%).

Preparation of yeast solution was done according to El-Ghamriny *et al.* (1999).Yeast extract contained protein (47%), carbohydrates (33%), minerals (8%), nucleic acid (8%) and lipids (4%).

Liquorice root extract: Liquorice root was extracted by the weighting 10 g of liquorice roots dried and soaked in a liter of water at 50°C for 24 h and then filtered and supplement the final volume to liter. Liquorice root extract (on dry mass; DM basis) contains antioxidants and osmoprotectants *i.e.* free proline (35 g Kg^{-1} DM), soluble sugars(146 g Kg^{-1} DM), glutathione (30 g Kg^{-1} DM), DPPH-radical scavenging (83.9%) and selenium (0.78 mg Kg^{-1} DM), Phytohormones *i.e.* Total auxins (4.0 mg Kg^{-1} DM) and total gibberellins (5.0 mg Kg^{-1} DM)] and mineral nutrients [*i.e.* N(20 g kg^{-1} DM),P (20 g kg^{-1} DM), K(49 g kg^{-1} DM), Ca(2.5 g kg^{-1} DM) and Fe(0.85 g kg^{-1} DM).

The hot pepper plants were sprayed with stimulants (seaweed extract, yeast extract and liquorice root extract) by hand sprayer until saturation point at three times during the experiment, 20, 35 and 50 days after transplanting.

Vegetative samples were taken after 75 days from transplanting to record growth parameters [*i.e.* plant height (cm), No. of leaves plant^{-1}, leaf area (cm^2 plant^{-1}), fresh and dry weights (g plant^{-1})] and chlorophyll content [Chl *a*, Chl *b* and Chl *a+b* (mg g^{-1} F.W)] as the method described by Sadasivam and Manickam (1996).The fruits were harvested four times when having attained full size for fresh use. The following characteristics were inspected:

- **Fruit yield:** Average fruit weight (g), No. of fruits plant^{-1} and total yield (metric ton fed^{-1})] were recorded.
- **Fruit quality:** Dry Matter (%) and vitamin C (mg 100g^{-1}) were determined according to (AOAC, 2000). Carotene (mg100g^{-1}) content of hot pepper fruits was measured spectrophotometrically as described by Ranganna (1997). Total phenolic (mg 100g^{-1}) of fruits was determined using the modified Folin-Ciocaltue colorimetric method according to (Eberhardt *et al.* 2000).Fruits samples were oven dried at 68°C for 72 hours, then fine grinded and used to determine mineral contents on a dry weight basis as N, P, K% and TSS% according to the method described in the (AOAC 2000), Fe concentration (mg kg^{-1}) was determined according to Chapman and Pratt (1978).

The obtained data of experiment were subjected to the statistical analysis of variance procedure and means were compared using the LSD method at 5% level of significance according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data illustrated in Tables 2 and 3 show the influence of various soil addition rates of compost *i.e.* control (without soil addition of compost), 5, 10 and15 m^3 compost fed^{-1}, some *stimulants* *i.e*. tap water (control), seaweed extract, yeast extract and liquorice extract and their interactions on growth parameters *i.e.* plant height (cm), No. of leaves plant^{-1}, leaf area (cm^2 plant^{-1}), fresh and dry weights (g plant^{-1}), chlorophyll content [Chl *a*, Chl *b* and Chl *a+b* (mg g^{-1} F.W)], fruit yield [average fruit weight (g), No. of fruits plant^{-1} and total yield (metric ton fed^{-1})] and fruit quality parameters [phenol and vitamin C (mg 100g^{-1}), carotene (mg g^{-1} FW), dry matter, TSS, N, P, K (%) and Fe (mg kg^{-1})] of hot pepper plants.

Table 2. Effect of compost, foliar spraying with seaweed, liquorice and yeast extracts on growth, yield parameters as well as chlorophyll content of hot pepper plants.

Treatments		Plant height (cm)	No. of leaves plant^{-1}	Leaf area cm^2 plant^{-1}	Fresh weight (g plant^{-1})	Dry weight (g plant^{-1})	*Chl a* (mg g^{-1} F.W)	*Chl b* (mg g^{-1} F.W)	*Chl a+b* (mg g^{-1} F.W)	Average fruit weight (g)	No. of fruits plant^{-1}	Total yield (metric ton fed^{-1})
Organic fertilization												
Control (without compost)		53.05	219.42	1487.08	29.55	4.64	0.661	0.497	1.157	29.07	10.83	5.09
Compost 5 m^3 fed^{-1}		62.63	249.25	1638.11	32.55	5.42	0.689	0.520	1.209	31.45	13.67	8.18
Compost 10 m^3 fed^{-1}		72.84	279.42	1782.27	34.72	6.18	0.734	0.543	1.277	33.83	15.92	10.24
Compost 15 m^3 fed^{-1}		82.62	310.58	1924.32	37.19	6.93	0.781	0.568	1.349	36.17	19.75	13.59
LSD $_{\text{at 5\%}}$		0.28	2.58	3.51	0.31	0.07	0.010	0.004	0.009	0.45	0.49	0.33
Foliar application												
Control (tap water)		63.97	254.00	1651.97	32.90	5.49	0.702	0.523	1.225	31.71	13.92	8.53
Seaweed extract		71.52	276.58	1761.22	33.86	6.09	0.730	0.541	1.272	33.52	16.25	10.53
liquorice extract		66.62	260.50	1691.93	33.04	5.70	0.711	0.529	1.240	32.33	14.75	9.22
Yeast extract		69.03	267.58	1726.67	34.21	5.88	0.721	0.535	1.255	32.94	15.25	9.71
LSD $_{\text{at 5\%}}$		0.23	1.70	6.36	0.27	0.06	0.008	0.007	0.009	0.37	0.53	0.27
Interaction effect												
Control (without compost)	Control (tap water)	49.13	208.33	1430.97	28.27	4.31	0.652	0.488	1.140	28.20	10.00	5.36
	Seaweed extract	56.69	231.33	1541.20	30.19	4.94	0.669	0.506	1.175	29.92	11.67	6.63
	liquorice extract	51.96	215.67	1473.00	28.88	4.55	0.659	0.493	1.152	28.79	10.67	5.83
	Yeast extract	54.42	222.33	1503.17	30.85	4.75	0.662	0.500	1.162	29.34	11.00	6.13
Compost 5 m^3 fed^{-1}	Control (tap water)	58.91	238.33	1579.93	32.91	5.13	0.676	0.512	1.188	30.56	12.67	7.35
	Seaweed extract	66.48	261.67	1690.73	31.53	5.72	0.704	0.528	1.232	32.35	14.67	9.01
	liquorice extract	61.32	244.67	1620.43	32.18	5.32	0.682	0.517	1.199	31.14	13.33	7.89
	Yeast extract	63.81	252.33	1661.33	33.57	5.50	0.692	0.523	1.215	31.73	14.00	8.44
Compost 10 m^3 fed^{-1}	Control (tap water)	69.02	269.67	1726.60	34.24	5.89	0.717	0.535	1.252	32.91	15.00	9.38
	Seaweed extract	76.57	291.67	1836.60	35.52	6.46	0.750	0.551	1.301	34.73	17.33	11.44
	liquorice extract	71.61	274.33	1765.23	34.21	6.09	0.728	0.540	1.268	33.50	15.33	9.76
	Yeast extract	74.16	282.00	1800.63	34.92	6.26	0.740	0.545	1.285	34.16	16.00	10.39
Compost 15 m^3 fed^{-1}	Control (tap water)	78.82	299.67	1870.37	36.18	6.63	0.762	0.557	1.319	35.18	18.00	12.03
	Seaweed extract	86.34	321.67	1976.33	38.20	7.24	0.797	0.581	1.378	37.09	21.33	15.03
	liquorice extract	81.60	307.33	1909.03	36.87	6.84	0.776	0.564	1.340	35.88	19.67	13.41
	Yeast extract	83.72	313.67	1941.53	37.51	7.02	0.788	0.571	1.359	36.51	20.00	13.87
LSD $_{\text{at 5\%}}$		0.47	3.41	12.72	0.53	0.13	0.015	0.013	0.017	0.74	1.06	0.54

Compost effect:

Data in Tables 2 and 3 show that the values of growth parameters and chlorophyll content at 75 days from transplanting as well as yield and quality parameters of fruits at harvest stage significantly increase as the rate of compost increases, where the highest values of all aforementioned traits are realized for the hot pepper plants treated with15 m^3 compost fed^{-1} compared to other treatments. The plants treated with 10m^3 compost fed^{-1} come in the second order, then the plants treated with 5 m^3 compost fed^{-1}, while the hot pepper plants untreated with compost before planting records the lowest values of all aforementioned traits. This primitive influence of studied plant residues compost may be due to compost supplies hot pepper plants with nutrient and improves physical properties and fertility of the studied soil. The high organic materials content in compost is a good explanation of its influence on soil properties, where the increasing addition rate causes increasing the positive effect on soil properties, therefore, improvement of hot pepper plants growth as well as quality and yield of fruits. These results are in harmony with the obtained findings of Wahdan *et al.* (2009) who studied the effect of compost on some hydrophysical properties and found a significant effect for improving physical soil properties such as the values of soil bulk density, total porosity, hydraulic conductivity and available water range. Also, Tahir *et al*. (2011) reported that compost enhanced the microbiological activity in soil. In this respect, Mohamed *et al.* (2020) reported that the beneficial impact of compost on soil characteristics may be due to its content of nutrients which release during compost decomposition, also compost soil addition led to decrease of soil pH value, where the promotive influence of composting on reducing soil pH value is mainly due to the releasing of organic acids through the decomposition of compost. Besides of El-Hadidi *et al*. (2020) mentioned that the use of compost can be beneficial to improve fertility and organic matter status, due to compost is rich source of nutrients with high organic matter content.

Foliar applications effect.

Tables 2 and 3 show the individual effect of foliar applications of some stimulants *i.e.* tap water (control), seaweed extract, yeast extract and liquorice extract on growth parameters and chlorophyll content after 75 days from transplanting as well as on yield and quality parameters of hot pepper fruits at harvest stage. The statistical analysis of the obtained data indicates that the difference within different foliar applications treatments is significant at 5% level. It can be shown that the foliar applications of seaweed extract, yeast extract and liquorice extract give more vigorous plant growth and best yield and quality parameters of hot pepper fruits as compared to tap water treatment. In this respect, the highest values of all studied parameters of hot pepper plants were obtained by plants received seaweed extract followed in descending order by that supplied with yeast extract, liquorice extract and lately tap water.

It could be concluded that investigated seaweed extract is superior more than other treatments due to its high contents from N (5.8. %), K (4.6%), B (0.17%), alganic acids (6.5%), P (3%), seaweeds (20.5%).These results are in harmony with the findings of Yildiztekin *et al.* (2018) who studied the effects of seaweed extract as a foliar application on growth of certain pepper plants grown under saline conditions (100 mM) and found that the treatment of seaweed improved vegetative growth of the pepper plant at all concentration levels applied under salinity conditions. Also. Eris *et al*. (1995) investigated the effect of foliar applications of three different rates of seaweed extract at five different stages of growth on yield and quality criteria in peppers, where each treatment led to an increase in fruit yield compared with control. Fruit length and fruit diameter significantly increased as seaweed extract rate increased.

Table 3. Effect of compost, foliar spraying with seaweed, liquorice and yeast extracts on quality parameters of hot pepper plants.

Treatments		Phenol	VC	Carotene	Dry matter	TSS	N	P	K	Fe
		mg/100g		mg/g F.W			(%)			(mg kg^{-1})
Organic fertilization										
Control (without compost)		72.73	127.91	0.238	15.72	5.52	2.05	0.140	2.27	28.69
Compost 5 m^3 fed^{-1}		79.09	131.23	0.269	17.13	5.79	2.30	0.166	2.53	29.89
Compost 10 m^3 fed^{-1}		85.48	134.65	0.300	18.63	6.08	2.53	0.190	2.81	31.11
Compost 15 m^3 fed^{-1}		91.82	137.96	0.329	20.00	6.34	2.75	0.215	3.09	32.32
LSD at 5%		0.26	0.07	0.005	0.08	0.01	0.04	0.004	0.05	0.54
Foliar application										
Control (tap water)		79.87	131.70	0.272	17.34	5.83	2.32	0.168	2.57	30.07
Seaweed extract		84.66	134.22	0.296	18.38	6.03	2.49	0.187	2.78	30.95
liquorice extract		81.52	132.48	0.280	17.69	5.90	2.38	0.175	2.64	30.34
Yeast extract		83.08	133.35	0.288	18.08	5.97	2.44	0.180	2.70	30.66
LSD at 5%		0.30	0.51	0.003	0.09	0.02	0.03	0.002	0.03	0.33
Interaction effect										
Control (without compost)	Control (tap water)	70.28	126.64	0.225	15.15	5.40	1.96	0.129	2.17	28.26
	Seaweed extract	75.13	129.17	0.251	16.16	5.62	2.14	0.150	2.38	29.11
	liquorice extract	71.99	127.50	0.235	15.57	5.49	2.02	0.138	2.23	28.52
	Yeast extract	73.54	128.32	0.242	15.97	5.56	2.09	0.143	2.30	28.86
Compost 5 $m^3 fed^{-1}$	Control (tap water)	76.70	129.94	0.259	16.55	5.69	2.21	0.157	2.44	29.45
	Seaweed extract	81.46	132.55	0.279	17.65	5.89	2.38	0.175	2.64	30.30
	liquorice extract	78.30	130.82	0.266	16.98	5.77	2.27	0.163	2.50	29.75
	Yeast extract	79.90	131.62	0.272	17.36	5.83	2.33	0.168	2.55	30.06
Compost 10 m^3 fed^{-1}	Control (tap water)	83.09	133.47	0.288	18.12	5.98	2.45	0.181	2.71	30.63
	Seaweed extract	87.88	135.85	0.312	19.15	6.17	2.60	0.200	2.91	31.61
	liquorice extract	84.64	134.14	0.295	18.46	6.05	2.50	0.188	2.76	30.93
	Yeast extract	86.32	135.13	0.304	18.76	6.10	2.56	0.193	2.84	31.25
Compost 15 m^3 fed^{-1}	Control (tap water)	89.40	136.74	0.318	19.52	6.25	2.68	0.206	2.97	31.92
	Seaweed extract	94.19	139.29	0.342	20.54	6.43	2.84	0.224	3.21	32.76
	liquorice extract	91.15	137.48	0.325	19.75	6.31	2.73	0.213	3.06	32.15
	Yeast extract	92.55	138.31	0.333	20.21	6.37	2.78	0.218	3.13	32.45
LSD at 5%		0.60	1.02	0.006	0.18	0.05	0.05	0.004	0.06	0.66

While yeast extract is superior treatment compared to liquorice extract and tap water treatments due to yeast is as a natural source of vitamins, nutrients, cytokines and protein might improve cell division, thus increasing the leaf surface area as well as improving the accumulation of soluble metabolites (Aly *et al.* 2019). Generally, foliar application of yeast extract causes the synthesis of protein, nucleic acid and chlorophyll. All of these promoting substances by yeast extract produced highly improvement of different growth parameters *i.e.* plant height (cm), No. of leaves plant^{-1}, leaf area (cm^2 plant^{-1}), fresh and dry weights (g) and chlorophyll content [Chl *a*, Chl *b* and Chl *a*+*b* (mg g $^{-1}$ F.W)], which exhibited on high values of fruit yield [average fruit weight (g plant^{-1}), No. of fruits plant^{-1} and total yield (metric metric ton fed-1)] and fruit quality parameters [phenol and V.C (mg100g^{-1}), carotene (mg g^{-1} F.W), dry matter, TSS, N, P, K (%) and Fe (mg/kg)] of hot pepper plants. The findings are in agreement with the obtained results by Shafeek *et al.* (2014) and Aly *et al.* (2019) who stated that all growth parameters of hot pepper as well as fruits yield and quality were gradually and substantially enhanced by raising the yeast extract rate in spraying solution from 2 gL^{-1}up to 4 gL^{-1}. Beside, Dawa *et al.* (2017) reported that foliar application of yeast extract at rate of 10 g L^{-1} significantly increased the vegetative growth, early and total yield of cucumber plants compared to plants treated with tap water.

As for liquorice root extract, it is superior treatment compared to tap water treatment due to its contents of many different important compounds *i.e*. glycyrrhizin, vitamins, polysaccharide, mevalonic acid that is the initiator in the synthesis of gibberellins in plants, and many nutrients which are mainly needed in hot pepper plant growth (Zadeh *et al.* 2013 and Ghaloom and Faraj, 2012). These results are in harmony with the findings of Elrys and Merwad (2017) who investigated the influence of liquorice root extract on yield and nutrients uptake by pea plants and found that these characteristics increased with increasing concentration of liquorice root extract where the foliar application of 5 g L^{-1}

liquorice extract gave values higher than the application of 2 g L^{-1} liquorice extract. Also, Dawood (2010) reported that the foliar application of liquorice root extract at rate of 4.0 g L^{-1} caused a significant increase in total chlorophyll content and growth parameters of two strawberry varieties.

Interactions effect.

The interaction effect of compost and foliar applications under study are presented in Tables 2 and 3. It could be observed that the values of growth parameters *i.e*. plant height (cm), No. of leaves $plant^{-1}$, leaf area (cm^2 $plant^{-1}$), fresh and dry weights (g $plant^{-1}$), chlorophyll content [Chl a, Chl b and Chl a +b (mg g^{-1} F.W)], fruit yield [average fruit weight (g), No. of fruits $plant^{-1}$ and total yield (metric ton fed^{-1})] and fruit quality parameters [phenol and vitamin C (mg $100g^{-1}$), carotene (mg g^{-1} F.W), dry matter, TSS, N, P, K (%) and Fe (mg kg^{-1})] of hot pepper plants are significantly affected due to the addition of all investigated treatments, where the combination of compost soil addition at rate of 15 m^3fed^{-1} and foliar application of seaweed extract at rate of 0.5 gL^{-1} record the highest values of all aforementioned traits, while the lowest values are recorded at control treatment (plants treated with tap water without soil addition of compost).

As shown in the same Tables, it could be observed that; any foliar application under soil addition of compost at rate of 15 m^3fed^{-1} give the highest values of all aforementioned traits compared to the same foliar application under other compost treatments due to the rising rate of compost added to the soil causes more improvement in soil properties and consequently reflected on the hot pepper plants status. On the other hand, under each compost treatment, the highest values of all aforementioned traits of hot pepper plants are recorded with plants treated with seaweed extract followed by yeast extract followed by liquorice extract and lately tap water. The present results agree with those obtained by Wahdan *et al.* (2009); Zuhair (2010); Tahir *et al*. (2011); Ghaloom and Faraj (2012); Zadeh *et al.* (2013); Shafeek *et al.* (2014); Dawa *et al.* (2017); Elrys and Merwad (2017); Yildiztekin *et al.* (2018) ; Aly *et al.* (2019) El-Hadidi *et al*. (2020) and Mohamed *et al.* (2020).

CONCLUSION

According to the obtained results, hot pepper' Sina Hot variety' plants treated with compost (plant residues) before planting at rate of 15 m^3 fed^{-1} and sprayed with seaweed extract at 0.5 gL^{-1} is the best treatment that could be recommended to improve fruit quality of hot pepper plant and obtain the highest yield.

Using natural plant extracts and bio substances cause improve plant growth and may decrease the usage of chemical fertilizers when plants are treated with concentrations of studied stimulants more than investigated rates under soil addition of compost.

It can be concluded that studied stimulants represent an attractive tool for sustainable crop management programs**.**

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استجابة نباتات الفلفل الحار للكمبوست وبعض الإضافات الورقية

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هناك اتجاه عام لاستخدام المستخلصات النباتية الطبيعية والمواد الحيوية مع الأسمدة العضوية لتحسين نمو النبات. لذلك، تهدف دراستنا إلى معرفة تأثير الكمبوست (من بقايا نباتية) والرش الورقي ببعض المنشطات على تحسين النمو ومحتوى الكلوروفيل ومحصول ثمار نباتات الفلفل الحار وجودتها .لهذا الغرض تم إجراء تجربة حقلية بالمزرعة التجريبية بكلية الزراعة بجامعة المنصورة خلال موسم صيف 2020 وكان التصميم التجريبي المستخدم عبارة عن تصميم قطع منشقه مع تكرار المعاملات ثلاث مرات وتتضمن أربعة معدلات كمبوست وهي الكنترول (بدون كمبوست)، 5 و10 و 15 م ^{3} من الكمبوست للفدان كمعاملات رئيسية وأربع إضافات رش ورقي وهي الكنترول (ماء الصنبور) ومستخلص الطحالب بمعدل 0.5 جرام /اللتر ومستخلص الخميرة بمعدل 5 جرام /لتر ومستخلص عرق السوس بمعدل 10 جرام / لتر كمعاملات تحت رئيسية. تظهر النتائج أن جميع مدلولات النمو مثل ارتفاع النبات (سم)، عدد أوراق النبات، المساحة الورقية (سم ^{2} /نبات)، الأوزان الطازجة والجافة (جم /النبات) و محتوى الكلوروفيل (أ، ب، كلي) و محصول الثمار (متوسط وزن الثمرة بالجرام، عدد الثمار في كل نبات، المحصول الكلي بالطن للفدان) ومعايير جودة الفاكهة مثل الفينولات ، فيتامين سي (ملجم /100 جرام) ، كاروتين (ملجم/جرام) ، مادة جافة ، المواد الصلبة الذائبة ، نيتروجين ،فسفور ،بوتاسيوم%,حديد (ملجم/كجم) الخاصة بنباتات الفلفل الحار تزداد بشكل معنوي مع زيادة معدل الإضافة من الكمبوست. أيضا، من بين المنشطات، "مستخلص الطحالب البحرية" هو الأفضل. يأتي مستخلص الخميرة في المرتبة الثانية يليه مستخلص عرق السوس وماء الصنبور مؤخرًا.