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Comparing Response of Melon (*Cucumis melo*) to Foliar Spray of Some Different Growth Stimulants under Two Nitrogen Fertilizer Forms

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A field experiment was conducted on melon (*Cucumis melo* var. *reticulatus* Naud, cv. Rodin hybrid) grown in a sandy loam soil during the two successive seasons of 2015 and 2016 in a private farm at EL-Sadat City, Minofia Governorate, Egypt to assess the response to foliar spray with four treatments i.e., distilled water (DW), yeast extract (YE), Lithovit® (micronized calcium carbonate) (LV) and Delfan® (amino acids) (DF), and two treatments of nitrogen application i.e., N_1: 50% of the recommended N as mineral-N + 50% of the recommended N as organic manure (compost), and N_2: 100% of the recommended rate as mineral-N. The recommended rate of N is 170 kg N ha^{-1}. Lithovit gave the highest increase in plant length, leaf area, weight of shoots per plant, total chlorophyll, fruit diameter, fruit weight, fresh yield, nutrient uptake, total sugar, and total soluble solids. For some plant traits (fruit diameter, fruit weight, fresh yield, nutrient uptake, total sugar and total soluble solids) YE gave the second highest increase. N_1 treatment was superior to N_2 in nearly all traits. Spraying with both LV or YE gave the highest fresh yield and the best fruit quality. The highest values were obtained when LV was sprayed either with 50% mineral-N + 50% organic-N or 100% mineral-N, or when YE was sprayed with 50% mineral-N + 50% organic-N. These increases for the above mentioned treatments reached 28.78, 27.27 and 26.30% as an average in both seasons for total yield, as compared with plants supplied with 170 kg mineral-N and sprayed with the distilled water (control).

Keywords: Yeast extract, Calcite carbonate, Amino acids, Organic manure, Compost, Nutrient uptake.

Introduction

Melon (*Cucumis melo*) is an important vegetable crop in temperate, subtropical and tropical regions and has a widespread popularity (Teppner, 2004). It is low in fat and sodium, with no cholesterols and contains essential elements and vitamins (Lester, 1997 and Grubben et al., 2004). Decreasing the use of synthetic fertilizers and chemicals and increasing the use of natural materials to fertilize vegetable crops is preferred for human health (Roy et al., 2006). Yeast extracts are natural substances suggested for spraying edible crops to increase their yield and improve their quality (Abou-El-Nasr et al., 2001, Kabeel et al., 2005 and Fawzy, 2007) since they are rich in minerals, amino acids, enzymes, vitamins and phyto-hormones, especially cytokinins (Barnett et al., 1990, Fathy and Farid, 1996 and Khedr and Farid, 2002). Such extracts stimulate division and enlargement of cells as well as synthesis of proteins, nucleic acid and chlorophyll (Kraig and Haber, 1980, and Castelfranco and Beale, 1983) and participate beneficially against stress conditions due to their contents of cytokinins (Barnett et al., 1990). Increased growth and productivity of vegetable crops upon foliar spraying with yeast extracts were noticed by many researchers; on tomatoes (Fathy et al., 2000), beans (Amer, 2004), peas (El-Desuki and El-Greadly, 2006), eggplants (El-Tohamy et al., 2008), and potatoes (Ahmed et al., 2011 and Malash et al., 2014).

Amino acids are precursors or activators of phyto-hormones which are fundamentals in protein synthesis (Pratelli and Pilot, 2007 and Marschner, 2012). Their sprays proved beneficial for vegetable crops such as strawberry (Abo-Sedera et al., 2010) and tomatoes (El-Desouky et al., 2011). Amino acids participate in synthesis of compounds including purines, pyrimidines,

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alkaloids, terpeniods and are important for pollination and fruit formation (Stitt et al., 2002). Delfan© is a commercial brand name of a liquid organic nitrogen fertilizer designed for foliar N application for nutrition of plants, particularly under abiotic stress conditions. The liquid contains N mainly in amino acid forms. It is produced by Trade Corporation International Company, Spain.

Most cultivated plants achieve maximum photosynthesis in environment having contents of around 0.1% (by volume) CO_2 (Scott, 2008). Some fertilizer sprays providing CO_2 to vegetable crops can increase crop yield as well as crop's beneficial traits (Raven, 2003 and Cai et al., 2009). One of such fertilizers is Lithovit©. It is a commercial fertilizer produced by Zeovita GmbH, Germany and can be used under field and greenhouse conditions. It is a natural solid organic calcite carbonate mined from deposits of natural limestone and used as foliar fertilizer. It is in very minute particles < 10 µm Ø, which breaks down and release CO_2 inside plant tissues, all of which increase crop productivity (Raven, 2003, Cai et al., 2009 and Grover et al., 2012, Nassef and Nabeel, 2012, Byan, 2014 and Abo-Sedera et al., 2016). It contains silica, magnesium carbonate and calcium carbonate, all of which can enter through the leaf stomata of plants when applied through foliar spray. Magnesium, which is the central element in chlorophyll molecule, causes a positive effect on photosynthesis, and silica plays an important role in plants exposed to drought stress, mainly with respect to water relations and photosynthesis (Raven, 2003) and also to plants exposed to pathogens and pests (Cai et al., 2009). Calcium carbonate would decompose inside the plant into calcium oxide and carbon dioxide, and this increases the intensity of photosynthesis. Byan (2014) used Lithovit through foliar spray on snap beans (*Phaseoulus vulgaris*) which improved the values of green pod characters as well as the vegetative growth compared with the control (distilled water). Abo-Sedera et al. (2016) found that foliar application of snap beans (*Phaseoulus vulgaris*) using micronized calcium carbonate in the form of Lithovit with mineral fertilizer or rabbit manure increased growth, chemical composition and productivity as well as improved the quality of the pods.

Organic manures benefit vegetable crops due to their nutrients and other growth materials (Mahmoud, 2007 and Hirel et al., 2011) particularly when combined with biofertilizers (Zaki et al., 2008 on sweet pepper and Shams, 2012 on Kohlrabi).

Materials and Methods

Plant material, experimental design and treatments

A field experiment was conducted to evaluate the response of melon (*Cucumis melo var. reticulatus* Naud, cv. Rodin hybrid) to foliar spraying with some growth stimulants under two nitrogen applications during the two successive seasons of 2015 and 2016 in private farm at EL-Sadat City, Minofia Governorate, Egypt.

A randomized complete block design with three replicates was used. The treatments included:

Four treatments of foliar spraying: yeast extract, Delfan, Lithovit and distilled water as control.

Two applications of nitrogen: N_1: 50% of the recommended N as mineral-N + 50% of the recommended N as organic manure (compost), and N_2: 100% of the recommended rate as mineral-N. The recommended rate of mineral N is 170 kg N ha^{-1} (as ammonium nitrate; 330 g N kg^{-1}). The added rates of organic-N and mineral-N fertilizers were calculated on basis of N % in both of them.

The organic manure and phosphate fertilizers were added to each experimental plot during the soil preparation, meanwhile N and K fertilizers were added weekly through the drip irrigation system. Phosphorus (100 kg P ha^{-1}) and potassium (287 kg K ha^{-1}) fertilizers, being ordinary Ca-super-phosphate, 70 g P kg^{-1} (16% P_2O_5) fertilizer; and K-sulphate, 400 g K kg^{-1} (48% K_2O) fertilizer, were added to all treatments. Plot size was 10.5 m^2 (one ridge, 1 m wide and 10.5 m long). Transplants were transplanted on one side of the ridge, 50-cm apart on the first week of March in the two growing seasons. Soil analyses were determined according to methods cited by Page et al. (1982) and Klute (1986). Tables 1 to 5 show analyses of the soil and the materials used in the study.

Yeast extract was prepared by using a technique allowed yeast cells to be grown and multiplied efficiently during conducive aerobic and nutritional conditions that allowed to produce beneficial bio-constituents (carbohydrates,

proteins, hormones, etc.), then these constituents could be released out of yeast cells in readily form by two cycles of freezing and thawing for disruption of yeast cells and releasing their content. Such technique for yeast preparation referred to Spencer et al. (1983). Chemical analysis of yeast extract according to Mahmoud (2001) is presented in Table 2. Spray solution was prepared by adding 50 mL of the stock solution per one liter water.

Lithovit® is a commercial name of a natural organic calcite carbonate mined from deposits of natural limestone and used as foliar fertilizer; it is produced in Germany and is distributed by Filmchem Ltd. Lithovit spraying solution was prepared by adding 3 g of the solid material L^{-1} water.

Delfan® is an organic nitrogen fertilizer designed for the nitrogen nutrition of plants, particularly in the case of abiotic stress. it contains N mainly in forms of amino acids. Delfan spraying solution was prepared by adding 3 mL of the liquid material L^{-1} water. Foliar spraying was done in 4 times (each at 250 L ha^{-1}); the first one was 15 days after transplant and the other three ones were applied at 10-day intervals.

Data recorded

Three plants from each plot were taken at 45 days after transplanting to record plant length, leaf area per plant, shoot fresh and dry weights and total chlorophyll. Plant samples were dried at 70^0 C then grounded and N, P, K, Ca and Mg were analyzed and uptake of them were calculated according to Chapman and Pratt (1961). Fruit diameter of individual fruits of the third picking was measured, while total yield was estimated by weighing all the harvested ripe fruits.

Sugar content was determined colormetrically in the ripe fruits by the method described by Nelson (1974). Vitamin C, beta-carotene and total soluble solids were determined according to AOAC (2000).

Statistical analysis

All the obtained data were statistically analyzed according to Gomez and Gomez (1984). The differences among means of both main and interaction effects were separated using the least significance difference (LSD). All statistical determinations were made at $p \leq 0.05$.

Results and Discussion

Vegetative growth

Table 6 reveals that nitrogen forms did not affect the plant length and total chlorophyll content. Application of 50% mineral N+50% manure N (N_1) improved significantly the leaf area of the grown plants as compared with 100% mineral-N (N_2); however, the dry weights of plants amended with N_2 were significantly higher than those amended with N_1. Fresh weight also increased significantly in plants treated with N_2 as compared to those received N_1in the first season; yet such increases seemed to be insignificant in the second one.

Applications of foliar spray particularly Lithovit (LV) or Delfan (DF) significantly increased the recorded plant traits comparing to the other treatments (Table 6). In this concern, LV spray recorded more significantly effect than DF spray. The effect of yeast extract spray (YE) seemed to have no significant effect on the investigated vegetative growth except for plant length. It caused slight significant increases of 3.8 and 5.6 % occurred in the first season and second season, respectively comparing to DW. There was no significant difference between DF and YE on plant length and total chlorophyll in both seasons, and leaf area per plant in the first season. The main response pattern was LV > DF > YE >DW. The micro-size particles of LV allow it to be easily absorbed by plant as well as its Mg content which increases total chlorophyll in plant and finally the release of carbon dioxide in plant tissues due to decomposition of calcium carbonate (Raven, 2003, Cai et al., 2009 and Abo-Sedera et al., 2016) leading to increased photosynthesis which could explain the positive effect of LV on vegetative growth. The DF effect is attributed to its content of amino acids which is important in hormones production and synthesis of protein (Marschner, 2012).

The highest values for plant length, leaf area per plant and plant dry weight were obtained by Lithovit spray in a presence of the N_1 fertilizer treatment (of 50% mineral N+50% manure N). The superior effect of N_1 over N_2 in leaf area per plant and total chlorophyll could be attributed to the presence of organic matter which improves soil chemical, physical and biological properties (Mahmoud, 2007). The combination of LV and N_1 (adding N in mineral and organic form evenly) significantly gave the highest vegetative growth except for plant length of first season under

N_1. On the other hand, DF and N_1 combination significantly increased plant length, plant dry weight and total chlorophyll in both seasons and leaf area per plant in the second season, while this combination had no significant effect compared on plant fresh weight in both seasons, and leaf area per plant in the first season. These results are similar with those reported by Zaki et al. (2008) on sweet paper.

TABLE 1. Physical and chemical analysis of the soil.

Particle size distribution (%)				pH*	EC**	$CaCO_3$	Organic matter
Sand	Silt	Clay	Texture		dS m^{-1}	g kg^{-1}	
70.0	26.0	4.0	Sandy loam	7.2	4.52	5.5	8.0

Available NPK (mg kg^{-1})			Cations (mmole L^{-1})				Anions (mmole L^{-1})			
N	P	K	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO^{--}	HCO_3^-	Cl^-	SO_4^{--}
25	14	80	16.1	9.8	17.1	2.2	0.0	8.0	23.0	14.1

*pH of 1:2.5 w:v water soil suspension and **EC of paste extract

TABLE 2. Chemical analysis of the yeast extract stock solution (according to Mahmoud, 2001).

				Macronutrients (g L^{-1})						Micronutrients (mg L^{-1})					
TC* (g kg^{-1})	TP** (g kg^{-1})	IAA*** (mg ml^{-1})	GA**** (mg ml^{-1})	N	P	K	Ca	Mg	Na	Fe	Mn	Zn	Cu	B	Mo
47	53	0.5	0.3	12	1.3	3	0.20	0.13	0.1	0.13	0.07	0.04	0.04	0.02	Traces

TC: total carbohydrates, **TP: total protein, ***IAA: indole acetic acid and ****GA: gibberellic acid

TABLE 3. Main properties of the Lithovit© fertilizer material.

Contents of substances in the solid matter (g kg^{-1})						
$CaCO_3$	$MgCO_3$	Fe	Mn	K_2O	Na	SiO
750	40.0	5.0	0.1	1.0	0.15	50

TABLE 4. Main properties of the Delfan© liquid material.

pH	Specific gravity	Organic matter (g kg^{-1})	Free amino acids (g kg^{-1})	Total N (g kg^{-1})
5.5	1.12	184	100	60

TABLE 5. Main properties of the used compost.

pH	EC (dSm^{-1})	Total N	Total P	Organic matter	C/N ratio	NH_4-N	NO_3-N	Total Soluble N
		g kg^{-1}				mg kg^{-1}		
8.1	8.2	12.1	9.1	416	10.4	275	50	325

Yield parameters

The N_1 application was significantly superior to N_2 in both seasons, reflecting the positive effect of adding organic matter on yield (Table 7). Such a result was confirmed by Mahmoud (2007) on spinach and Hirel et al. (2011) on many vegetable crops. Spray treatments significantly increased fruit diameter, fruit fresh weight and total yield in both seasons.

As for the effect of growth stimulants, the highest increases in the fruit diameter and weight and fruit yield were recorded for LV followed by YE then by DF. Average fresh yield increases in the first and second seasons were 32.5 and 19.5% respectively for LV and 24.0 and 14.1% respectively for YE. Respective increases resulting from DF were 9.5 and 5.0 % (the latter being not statistically significant). Similar results reported the positive effect of yeast extract on vegetable plants e.g. the seed yield of kidney beans (Nassar et al., 2011), total yield of potato (Malash et al., 2014) and the fruit weight and diameter of cucumber (Nassef and El-Aref, 2016). Likewise, LV improved significantly the yield of broccoli (Nassef and Nabeel, 2012) as well as the seed production of onion (Abdel Ghafar et al., 2016).

The highest fruit diameter, fruit fresh weight and total yield of sprayed plants in both seasons were obtained by LV under N_1 (same trend as in vegetative growth in Table 6), while the lowest values were obtained by DW under N_1. It is worthy to mention that the highest total fruit yield was obtained when LV was sprayed either with 50% mineral-N + 50% organic-N or 100% mineral-N, or when YE was sprayed with 50% mineral-N + 50% organic-N. The corresponding increases for the above mentioned treatments reached 28.78, 27.27 and 26.30% as an average in both seasons for total yield, as compared with plants supplied with 170 kg mineral-N and sprayed with the distilled water (control).

Nutrient uptake

Table 8 shows that the N_1 treatment was superior to N_2 on the uptake of the investigated nutrients in both seasons except for Mg in the first season. This might be attributed to the positive effect of the organic manure on the physical and chemical characteristics of soils besides it improves the availability of the macro- and micro- nutrients for plant uptake (Magdoff and Weil, 2004).

Regarding the effect of growth stimulants spraying, all spray applications significantly increased nutrient uptake in both growing seasons. The highest increases were attained by LV followed by YE then by DF. The highest nutrient uptake was occurred by LV with N_1 conditions, while the lowest ones were occurred by DW with N_1 conditions; except for K and Ca uptake where the lowest uptake was by DW with N_2 conditions in both seasons. There was no significant increase in Ca uptake due to DF under conditions of N_2 in the second season. All nutrient uptakes showed no significant difference between N_1 and N_2 under DW except for P uptake in the second season or in Mg uptake in both seasons, where the N_2 was significantly superior to N_1. The correlation data in Table 9 seem that the uptake of NPK resulted in significant increases in plant leaf area. Likewise, the chlorophyll content in plants was significantly correlated with Mg uptake. Mg is considered the central nutrient in the structure of chlorophyll (Scott, 2008). Thus, there is no wonder to find that the fruit yield was significantly correlated with N, P, K and Mg uptake by plants.

Total sugar, total soluble solids (TSS), Vitamin C and beta-carotene

Application of N1 increased significantly total sugars and beta-carotene contents in melon fruits in the first season, and also increased significantly total soluble solids and vitamin C in both growing seasons compared with N2 application (Table 10). These results are similar to those found by Magdoff and Weil (2004) indicating the importance of organic matter in improving soil properties in addition of being the N source in organic form. Moreover, Zaki et al. (2008) recorded that amending soils with 50% organic-N and 50% mineral form increased significantly the total sugar and vitamin C content in sweet pepper when comparing with 100% N added in mineral form.

All foliar sprays using growth stimulators increased significantly total sugar and vitamin C in both seasons. The highest increases were obtained by LV followed by YE then by DF.

In both seasons, the highest total sugar and TSS and Vitamin C content occurred in LV under N_1, while the lowest was in DW under N_1. On the other hand, N source had no effect on vitamin C content when spraying with YE and DF. Neither N-application nor foliar spray gave a significant effect on beta carotene. It seems that the application of YE and DF did not change significantly beta-carotene in presence of either N_1 or N_2. Also under N_2 fertilization there was no significant difference between LV and YE in vitamin C and beta-carotene.

TABLE 6. Effect of foliar spray with some growth stimulants and nitrogen application on some vegetative growth and total chlorophyll in melon in 2015 and 2016 seasons.

Treatments		Plant length (cm)		Leaf area (cm^2)		Plant fresh weight (g)		Plant dry weight (g)		Total chlorophyll (mg/100g FW)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Nitrogen fertilizer forms*											
N_1		110.3	112.2	2104.0	2211.1	321.5	338.6	67.0	68.2	153.3	164.4
N_2		110.7	111.8	2017.8	2134.3	331.6	338.9	68.9	70.1	149.3	163.6
$LSD_{0.05}$		n.s	n.s	58.3	51.8	9.74	n.s	1.1	1.01	n.s	n.s
Growth stimulants											
Yeast extract		112.2	111.5	1972.6	2028.1	312.0	314.1	66.2	67.5	145.3	147.2
Delfan		110.1	111.4	2037.1	2157.2	329.3	339.1	68.2	69.5	145.5	155.6
Lithovit		113.6	117.9	2241.0	2421.0	348.1	369.9	71.5	72.5	190.3	202.5
Distilled water		106.2	107.4	1992.8	2084.5	316.8	331.8	65.8	67.2	124.0	150.7
$LSD_{0.05}$		2.59	2.91	84.13	72.37	15.21	18.43	1.59	1.61	22.48	17.80
Nitrogen fertilizer forms × Growth stimulants											
N_1	Yeast extract	111.4	110.4	2055.6	2086.7	306.3	308.9	63.2	64.6	133.4	134.0
	Delfan	110.7	115.5	2030.7	2180.2	324.1	344.8	68.9	70.2	164.3	182.7
	Lithovit	113.8	118.6	2341.4	2526.4	348.5	369.5	71.9	72.6	194.7	202.5
	Distilled water	105.4	104.4	1988.3	2051.3	307.2	331.2	64.1	65.5	120.9	138.5
N_2	Yeast extract	113.0	112.5	1889.7	1969.5	317.8	319.3	69.3	70.5	157.3	160.5
	Delfan	109.5	107.3	2043.6	2134.2	334.6	333.4	67.5	68.8	126.7	128.6
	Lithovit	113.5	117.2	2140.6	2315.7	347.8	370.4	71.2	72.5	186.0	202.6
	Distilled water	107.0	110.4	1997.4	2117.8	326.4	332.5	67.6	68.9	127.2	163.0
$LSD_{0.05}$		3.6	4.3	118.2	103.5	19.5	23.6	2.2	2.0	30.4	22.7

* N_1 and N_2 are half of the recommended N as mineral + half of the recommended N as organic manure (compost) and all of the recommended
N as mineral N respectively (N recommended rates is 170 kg N ha^{-1}).
ns: not significant.

TABLE 7. Effect of foliar spray with some growth stimulants and nitrogen application on fruit diameter, fruit weight and total fruit yield in melon in 2015 and 2016 seasons.

Treatments		Fruit diameter (cm)		Fruit weight (g)		Total fruit yield (ton ha^{-1})	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
Nitrogen fertilizer forms*							
N_1		15.13	15.62	976.1	1052.5	23.886	24.559
N_2		14.57	15.09	909.8	957.5	22.729	23.656
$LSD_{0.05}$		0.11	0.16	22.38	19.81	0.609	0.619
Growth stimulants							
Yeast extract		15.28	15.80	961.7	1072.0	24.833	25.108
Delfan		14.35	14.74	895.8	937.5	21.925	23.097
Lithovit		15.79	16.61	1064.0	1144.5	26.487	26.265
Distilled water		13.96	14.29	850.5	866.0	19.986	21.960
$LSD_{0.05}$		0.18	0.21	27.73	27.81	0.572	0.987
Nitrogen fertilizer forms × Growth stimulants							
N_1	Yeast extract	15.83	16.44	1022	1182	25.973	26.037
	Delfan	14.59	14.85	900.6	947	22.386	23.758
	Lithovit	16.38	17.06	1144	1235	26.731	26.338
	Distilled water	13.72	14.16	838	846	20.457	22.103
N_2	Yeast extract	14.74	15.16	901.4	962	23.693	24.179
	Delfan	14.12	14.64	891	928	21.465	22.436
	Lithovit	15.21	16.17	984	1054	26.244	26.193
	Distilled water	14.21	14.42	863	886	19.516	21.818
$LSD_{0.05}$		0.21	0.31	41.6	32.5	0.819	1.232

*N_1 and N_2 are half of the recommended N as mineral + half of the recommended N as organic manure (compost) and all of the recommended
N as mineral N respectively (N recommended rates is 170 kg N ha^{-1}).
ns: not significant.

TABLE 8. Effect of foliar spray with some growth stimulants and nitrogen application on N, P, K, Ca and Mg uptakes of plant melon in 2015 and 2016 seasons.

Treatments	N		P		K		Ca		Mg	
	Uptake (kg ha^{-1})									
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Nitrogen fertilizer forms *										
N_1	116.7	121.1	107.3	109.0	135.7	141.7	93.6	92.5	14.4	14.6
N_2	109.0	112.2	101.9	105.1	122.5	127.2	88.4	84.1	14.1	13.9
LSD $_{0.05}$	1.8	2.3	2.8	2.5	4.3	2.3	2.3	1.6	n.s	0.1
Growth stimulants										
Yeast extract	129.0	130.7	118.4	115.4	151.6	156.4	94.7	89.3	16.0	16.0
Delfan	93.7	104.2	96.1	100.4	115.6	121.2	75.4	74.8	12.9	13.0
Lithovit	153.1	144.4	130.8	126.6	175.3	176.8	127.6	118.2	17.9	16.9
Distilled water	75.5	87.0	73.1	85.8	73.8	83.5	66.4	70.9	10.2	10.9
LSD $_{0.05}$	2.5	3.1	3.7	3.3	6.2	5.7	3.1	2.2	0.7	0.2
Nitrogen fertilizer forms × Growth stimulants										
N_1 Yeast extract	128.8	134.3	125.2	120.4	156.3	161.8	97.8	95.4	16.6	17.2
N_1 Delfan	105.0	116.3	100.4	104.9	129.7	140.6	77.0	79.4	13.3	13.6
N_1 Lithovit	156.4	147.3	133.2	128.8	181.4	182.8	131.5	124.00	18.5	17.4
N_1 Distilled water	76.4	86.4	70.4	81.9	75.3	81.5	68.1	71.4	9.4	9.9
N_2 Yeast extract	129.1	127.2	111.7	110.4	146.9	151.0	91.5	83.3	15.3	14.9
N_2 Delfan	82.5	92.1	91.8	95.8	101.5	101.7	73.7	70.2	12.5	12.4
N_2 Lithovit	149.7	141.6	128.5	124.3	169.2	170.8	123.6	112.4	17.3	16.5
N_2 Distilled water	74.8	87.7	75.8	89.8	72.3	85.4	64.8	70.4	11.1	11.8
LSD $_{0.05}$	3.7	4.7	5.5	5.0	9.4	8.5	4.6	3.2	1.0	0.3

*N_1 and N_2 are half of the recommended N as mineral + half of the recommended N as organic manure (compost) and all of the recommended
N as mineral N respectively (N recommended rates is 170 kg N ha^{-1}).
ns: not significant.

TABLE 9. Correlation coefficient among N, P, K and Mg uptake of melon plants, leaf area, chlorophyll content and the outcome fruit yield.

	Leaf area	Chlorophyll content	Fruit yield	N-uptake	P-uptake	K-uptake
Chlorophyll content	0.725**					
Fruit yield	0.587*	0.662**				
N-uptake	0.540*	0.743**	0.963**			
P-uptake	0.557*	0.684**	0.972**	0.971**		
K-uptake	0.546*	0.719**	0.953**	0.981**	0.976**	
Mg-uptake	0.521*	0.634**	0.941**	0.960**	0.984**	0.966**

*$P<0.05$ ** $P<0.01$

TABLE 10. Effect of foliar spray with some growth stimulants and nitrogen application on total sugar, total soluble solids, vitamin C and beta-carotene in melon fruits in 2015 and 2016 seasons.

Treatments		Total sugar (mg/g FW)		TSS (%)		Vitamin C (mg/100g FW)		Beta-carotene (µg/g FW)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Nitrogen fertilizer forms *									
N_1		53.2	54.0	12.6	12.8	27.0	27.4	26.847	26.90
N_2		52.4	53.9	12.1	12.2	26.8	27.0	24.172	26.60
$LSD_{0.05}$		0.64	n.s	0.14	0.18	0.15	0.25	1.38	n.s
Growth stimulants									
Yeast extract		55.4	55.6	13.0	13.1	27.4	27.8	26.70	27.02
Delfan		51.4	54.0	11.8	11.9	26.6	26.9	26.28	26.39
Lithovit		56.5	56.8	13.2	13.7	28.1	28.1	26.83	27.39
Distilled water		48.0	49.5	11.5	11.4	25.7	26.0	22.22	26.21
$LSD_{0.05}$		0.99	1.88	0.26	0.23	0.24	0.31	2.11	2.29
Nitrogen fertilizer forms × Growth stimulants									
N_1	Yeast extract	56.4	56.1	13.4	13.7	27.5	28.4	26.8	27.40
	Delfan	52.5	54.5	11.9	12.3	26.7	27.1	26.44	26.45
	Lithovit	56.6	57.3	13.7	13.9	28.8	28.5	27.00	27.60
	Distilled water	47.5	48.3	11.5	11.4	25.3	25.6	27.15	26.16
N_2	Yeast extract	54.4	55.2	12.6	12.5	27.3	27.3	26.60	26.64
	Delfan	50.3	53.6	11.8	11.6	26.5	26.8	26.12	26.34
	Lithovit	56.4	56.3	12.8	13.5	27.4	27.7	26.67	27.18
	Distilled water	48.5	50.8	11.5	11.5	26.1	26.5	17.30	26.27
$LSD_{0.05}$		1.08	2.02	0.27	0.35	0.3	0.4	2.77	3.43

*N_1 and N_2 are half of the recommended N as mineral + half of the recommended N as organic manure (compost) and all of the recommended N as mineral N respectively (N recommended rates is 170 kg N ha^{-1}).
ns: not significant.

Conclusion

It can be concluded that applying N as 50% mineral-N + 50% organic-N (the recommended dose of nitrogen is 170 kg N ha^{-1}) and spraying with Lithovit or yeast extract, gave the highest yield with the best fruit quality of melon (*Cucumis melo* var. *reticulatus* Naud, cv. Rodin hybrid) grown in a sandy loam soil.

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مقارنة استجابة الكنتالوب للرش الورقى ببعض منشطات النمو المختلفة تحت صورتين من التسميد النيتروجينى .

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أجريت تجربة حقلية على الكنتالوب (*Cucumis melo var. reticulatus* Naud, cv. Rodin hybrid) النامى فى تربة طميية رملية فى موسمين متتاليين ٢٠١٥ ، ٢٠١٦ في مزرعة بالقرب من مدينة السادات ، محافظة المنوفية ، جمهورية مصر العربية لتقييم استجابة الرش الورقي بأربع معاملات: الماء المقطر (DW)، مستخلص الخميرة(YE))، الليثوفيت ® (كربونات الكالسيوم) (LV) و الدلفان ® (الأحماض الأمينية) (DF) بالتفاعل مع معاملتين للنيتروجينN_1- إضافة ٥٠٪ من النيتروجين الموصى يه على الصورة المعدنية + ٥٠ ٪ من النيتروجين الموصى به على الصورة العضوية (سماد الكمبوست) ، N_2- إضافة ١٠٠٪ من النيتروجين الموصى به على الصورة المعدنية فقط والمعدل الموصى به للنيتروجين هو ١٧٠ كجم نيتروجين للهكتار.

أعطى الرش بالليثوفيت (LV) أعلى زيادة في طول النبات ، المساحة الورقية، وزن العرش للنبات، الكلوروفيل الكلي، قطر الثمرة، وزن الثمرة، المحصول الطازج، امتصاص العناصر الغذائية، السكريات الكلية، والمواد الصلبة الذائبة الكلية. وفي بعض الصفات النباتية (قطر الثمار، وزن الثمرة، المحصول الطازج ، وامتصاص المغذيات، والسكريات الكلية والمواد الصلبة الذائبة الكلية) أعطى الرش بمستخلص الخميرة (YE) ثاني أعلى زيادة.

كما تفوق إستخدام N_1 (إضافة ٥٠٪ من النيتروجين الموصى يه على الصورة المعدنية + ٥٠٪ من النيتروجين الموصى به على الصورة العضوية) على N_2 (إضافة ١٠٠٪ من النيتروجين الموصى به على الصورة المعدنية فقط) في جميع الصفات النباتية تقريبًا. الرش بكل من الليثوفيت و مستخلص الخميرة أعطى أعلى محصول وأفضل مواصفات جودة. الرش بالليثوفيت كان الأعلى إما مع إستخدام ٥٠ ٪ نيتروجين معدنى + ٥٠٪ نيتروجين عضوى أو مع إستخدام ١٠٠ ٪ نيتروجين معدنى، بينما الرش بمستخلص الخميرة كان أعلى مع إستخدام ٥٠ ٪ نيتروجين معدنى + ٥٠٪ نيتروجين عضوى. وقد بلغت هذه الزيادة ٢٨,٧٨ و ٢٧,٢٧ و ٢٦,٣٠ ٪ كمتوسط في كلا الموسمين وذلك بالمقارنة بمعاملة الكنترول والتى أخذت ١٧٠ كجم نيتروجين معدنى مع الرش بالماء المقطر (كنترول).