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Impact of Irrigation by Away of Magnetized Water and Spraying by Bio-Activators on Efficiency and Quality of Lettuce

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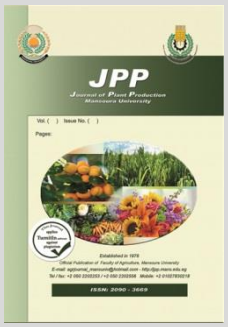

ABSTRACT

Toward reading the impact of treating by away of magnetized water and spraying through various bio-activators on productivity and chemical composition of lettuce, two 2 trials were done at the Experimental Station Farm, Faculty of Agriculture, Mansoura University, Egypt, throughout 2015/2016 and 2016/2017 years. The field experimentations were done in a strip-plot design by way of 4 replicates. The greatest averages of plant fresh and dry heaviness, entire yield/fed, chlorophyll (chlo.) a, chlo. b and entire chlo., TSS (TSS) %, entire carbohydrates %, crude protein % and entire sugars % , vit-C and vit-E contents in addition to the minimum averages of nitrate and nitrite contents were registered because of irrigation by away of magnetized water. Spraying by away of yeast extract (100 ml/liter) produced the highest standards of plant fresh and dry heaviness, entire yield/fed, chlo. a, b and entire chlo., TSS %, entire carbohydrates %, protein % and entire sugars %, vit-C and vit-E contents in addition to the minimum averages of nitrate and nitrite contents. It can be accomplished that irrigation lettuce plants by away of magnetized water in addition spraying by away of yeast extract (100 ml for each liter water) or liquid humic acid (1.0 ml for each liter water) to achieve towering growth, output and ingredients of lettuce (Balady cultivar) over the ecological circumstances of Mansoura district, Dakahlia Governorate, Egypt.

Keywords: Lettuce, magnetized irrigation water, yeast extract, chitosan, humic acid, algae.

INTRODUCTION

Lettuce (*Lactuca sativa* L.) is a wealthy resource of antioxidants, some vitamins (vit-a and vit-c), phytochemicals, fiber, carbohydrates, protein, and a miniature quantity of fat, and minerals largely found in the leaves.

Magnetic water equipment was used to diminish the outcome of salt awareness and to trim down the amounts of irrigation water. It progress the superiority of irrigation water for instance outside nervousness, conductivity, solvability of salts and pH. As well, augmented rate of germination, root development and canopy systems, photosynthesis, capacity and superiority of give way. There are many studies that indicate that magnetic management of irrigation water has provided a lot of benefits within agriculture for example: increasing water saving and fertilizer efficiency, early crop maturity, reducing plant diseases, improving crop quality, yield and productivity and lowering the cost of agricultural operations. In this regard, Putti *et al.* (2015) mentioned that irrigated lettuce plants containing magnetic treated water showed supplementary positive outcome when weigh against plants irrigated by away of control water. The irrigated green heavinessby away of magnetized water exposed a production greater than or equivalent to that of irrigated by away of control stations, in the two cycles, by away of an approximate increase of 63%. Abdel-Aziz *et al.* (2017) revealed that the ingredients standards values for the lettuce plant increased by away of increasing levels of the magnetic field and the applied irrigation water systems.

They suggested that using magnetic water technology could be considered a promising technology for improving crop productivity and conserving irrigation water. Abdel Nabi *et al.* (2017 a) reported that the greatest resources for the leaf area entire / 5 external leaves, entire output / feed, dry matter ratio in internal and external leaves, TSS %, entire sugars %, entire carbohydrates %and raw protein % and content of chlorophylls, besides lowest standards of NO_3 and NO_2 in head lettuce from irrigation head stations by away of magnetic water. Zlotopolski (2017) indicated that the significant increases in yields of lettuce and entire chlorophyll and the concentrations of some macronutrients in plants treated by away of magnetic water processing compare irrigation by away of plain waste.

Spraying by away of a little vital stimulants for instance yeast extract, chitosan, humic acid and algae has a very imperative role in humanizing the fruit collection, productivity and ingredients of vegetables. Abdelgawad *et al.* (2018) found that lettuce plants in foliar spray head by away of many bio-stimulant products increased the content of chlorophyll leaves, N, P, entire phenol, entire amino acids, head stability and entire sugar.

Yeast extract former optional to contribute in a advantageous role throughout vegetative along by away of reproductive augmentation by humanizing flower arrangement and flowering in a little plants caused by its towering substance of oxin in addition to cytokinin moreover promoting gathering of carbohydrates. Also, its catalytic belongings on cell separation and spreading out, protein as well as DNA synthesis and chlorophyll

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construction have been reported, in addition to its expression of grief protection factor such as sugars, protein and amino acids as well as many vitamins. Also, the yeast extract that is environmentally friendly, nutritious, and comfortable to use, has advantages over common plant growth regulators and soil conditioners. It has a beneficial effect on both promoting seedling growth and improving soil. El-Sagan (2015) revealed that the highest significant increases in plant extent, plant heaviness, average leaf area, fruit weight, number of fruits / plants, output and chemical content were recorded by away of cucumber plants using foliar spray using a yeast extract at an average of 7.5 g / l in all growing years. Abdel Nabi *et al.* (2017 b) reported that the second best processing for foliar spray after treating humic acid was foliar spray by away of yeast extract (100 mL / L water), followed by spraying by away of algae (1.0 g / L water) regarding its effect on the vegetative augmentation personalities and its chemical components and components In artichoke containers. Morsy *et al.* (2018) reported that spraying watermelon plants by away of yeast extract gave the highest fresh crop and the best ingredients fruit.

Chitosan is a naturalist polymer mustamidat min deacetylation of chitin. Chitin is readily obtainable from shellfish waste from food processing. It is useful assess compound due to its fungicidal effects and elicitation of defense mechanisms in plant tissues (Shehata *et al.*, 2012). Malerba and Cerana (2016) found that chitosan has been proven to stimulate plant augmentation , to protect the safety of edible products, and to induce abiotic and biotic stress tolerance in various horticultural commodities. Pirbalouti *et al.* (2017) revealed that chitosan is biocompatible, biodegradable, environmentally friendly, and readily available in large quantity. It has been reported to improve augmentation and production of many horticultural crops, but in most of those experimentations chitosan was foliar applied. Xu and Mou (2018) indicated that chitosan at appropriate application rates (0.10%, 0.15% 0.20% and 0.30%) enhanced lettuce augmentation (leaf area, leaf number, leaf fresh and dry heaviness and chlorophyll content) and might have potential to be used for sustainable production of lettuce.

Humic acid is a commercial product recognized as a plant augmentation promoter contains, increase the availability of nutrients, enhancing plant augmentation , and ingredients of crop. Hernandez *et al.* (2015) showed that humates at 15 mg L^{-1} shortened by 21 days the lettuce production cycle, allowing early harvesting without changing quality, while increasing yields expressed as the number of leaves per plant. Humate application also decreased entire carbohydrate, increased protein, nitrate uptake, and stimulated nitrate reductase and phenylalanine ammonia lyase in leaves. Abdel Nabi *et al.* (2017 b) showed that spraying plants of artichoke by away of humic acid (1.5 ml for each liter water) exceeded other spraying processings and gave high productivity and chemical composition, except nitrate content. Raheem *et al.* (2018) found that humic acid foliar application at of 4.5 ml/L recorded highest height of lettuce plant as compared by away of control processing. The highest entire output was obtained by away of processing 1.5 ml humic acid/L as soil application, followed by processing 2.5 ml humic acid/L as foliar application.

Algas extract is bioactive compounds from algae were early considered by away of high potential in plant augmentation stimulation. These compounds affect metabolic processes including photosynthesis, respiration, nucleic acid synthesis and nutrients uptake. Algal extract mixture contain a wide range of active materials including free amino and organic acids, phytohormones, vitamins and enzymes which react as augmentation promoters. Abdel-Wahab (2018) indicated that using algae extract gave a significant increment in the means of head weight, number of leaves per head, head diameter, P and K contents as well as Ca concentration in lettuce leaves as compared by away of the control. Moreover, the best entire output of head lettuce was achieved by away of using algae extract. Kopta *et al.* (2018) revealed that the positive effect of bacterial-algal processing on lettuce yield, entire antioxidant capacity and entire carotenoids confirm that it could be applied for improving romaine lettuce output ingredients and quantity, especially in stress, summer conditions.

So, this investigation aimed to study the impact of treating by away of magnetized water and spraying through various bio-activators on productivity and chemical composition of lettuce (Balady cultivar).

MATERIALS AND METHODS

The field experimentations were carried out in a strip-plot design by away of 4 replications. The vertical-plots were allocated to 2 irrigation water processings *i.e.* normal irrigation water (control processing) and magnetized irrigation water.

The horizontal-plots were included 5 spraying processings by away of some bio-activators *i.e.* without spraying (control processing), spraying by away of yeast extract (100 ml for each liter water), chitosan (2.0 g per liter), liquid humic acid (1.0 ml for each liter water) and algas (2.0 g per liter).

Yeast extract as natural biostimulants was prepared by using a technique modified by Spencer *et al.* (1983).

Chitosan powder was prepared by dissolving a proper amount in 5 % acetic acid solution. Humic acid in the form of uni-humic *i.e.*18.5 % high purity humic acid in liquid form, 1.5% folic acid 0.5 % K_2O and 0.5-1.0 % micronutrients was used. Algas were obtained from Al-Hayah for Agricultural Projects.

Foliar spraying by away of these bio-activators was carried out 2 times at the aforesaid rates after 60 and 80 days from transplanting. Each experimental basic unit (9.0 m^2) included 5 ridges, each of 0.60 m width and 3.0 m length. The soil of experimental site was characterized as a clayey soil in texture by away of an electrical conductivity (EC) of 1.68 dS/m and a pH of 7.69.

The experimental field well prepared for each experiment, then calcium super phosphate (15.5 % P_2O_5) at the rate of 200 kg per fed was applied. Lettuce seedling were immediately planted in the moderately moist soil on 10 and 15th November in the first and second years , respectively. Seedlings were planted in hills (15 cm apart) by hand at 60 cm apart on one side of the ridge. All additional agricultural practices were done according to the

recommendations of Ministry of Agriculture and Land Reclamation, apart from factors over study.

Studied traits :

A. Vegetative augmentation and yield:

After 90 days from the transplanting (at harvest), a samples of five plants were randomly taken from each experimental unit to determine the following parameters:

1. Fresh heaviness of plant. 2. Dry heaviness of plant.
3. Entire yield/fed. It was calculated as the entire heaviness of lettuce plants.

B. Photosynthetic pigments:

Chlorophylls content (Chlorophyll a, b and entire chlorophylls) were colorimetrically indomitable in the leaves of lettuce at 90 days following transplanting according to the methods characterized by Moran and Porath (1982) and calculated as mg/g fresh weight.

C- Ingredients traits :

1- TSS % (TSS %) was measured according to AOAC (1990).
2- Entire carbohydrates % was determined according to Somogy (1952).
3- Crude protein % was calculated by multiplying the entire nitrogen % by the factor (6.25).
4- Entire sugars % was determined according to the method of Forsee (1938).
5- Vitamin-C content (Ascorbic acid): It was determined as mg/g fresh heavinessaccording to the method reported in AOAC (1990).
6- Vitamin-E content was estimated according to Gimeno *et al.* (2000).
7- Nitrate (NO_3-N) and nitrite (NO_2-N) contents (ppm) were determined as methods characterized by Singh (1988).

According the strip-split plot design, all data were statistically analyzed according to the technique of analysis of variance (ANOVA) for as available by Gomez and Gomez (1984) and processing means were contrast using least significant of difference method at 5 % level of probability as characterized by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1- Effect of irrigation water:

Data presented in Tables 1, 2 and 3 show that irrigation water processings (irrigation lettuce plants by away of normal water *i.e.* control processing and magnetized water) had significant effects on vegetative augmentation and output (fresh weight/plant and entire yield/fed), photosynthetic pigments (chlorophyll a, b and entire chlorophylls) and leaves ingredients traits (TSS, entire carbohydrates, crude protein and entire sugars % , vitamin-C, vitamin-E, nitrate and nitrite contents) in the two growing years. On the other hand, dry weight/plant of lettuce in the 2 growing years as well as entire carbohydrates % in the second season only were insignificantly affected by irrigation water processings.

From obtained results it could be observed that the maximum means of fresh and dry heaviness of plant, entire yield/fed, chlorophyll a, b and entire chlorophylls, TSS, entire carbohydrates, crude protein and entire sugars % , vitamin-C and vitamin-E contents as well as the minimum values of nitrate and nitrite contents were recorded as a result of irrigation lettuce plants by away of magnetized water in both years.

These outcomes possibly ascribed to that magnetic water technology has been used to change some of the physical and chemical characteristics of water, mainly hydrogen bonding, polarity, surface tension, conductivity, pH and solubility of salts, these changes in water characteristics possibly capable of affecting the augmentation of plants. Also, plants irrigated by away of magnetized water are more vigorous than those irrigated by away of untreated water, and might potentially curtail the application of insecticides, fungicides or herbicides, which are expensive and often damaging to human and environmental health (Aliverdi *et al.*, 2015).While, in soil the benefits of magnetized water including; reducing amount of salts in different depths of the soil (from 1 to 1.5 m) and leaching away of various anions from the soil. These outcomes came in the similar point of view by away of those reported by Putti *et al.* (2015), Abdel-Aziz *et al.* (2017), Abdel Nabi *et al.* (2017 a) and Zlotopolski (2017).

2- Effect of foliar application processings:

The obtained results show that studied foliar spraying processings *i.e.* without spraying (control processing), foliar spraying by away of yeast extract (100 ml for each liter water), chitosan (2.0 g per liter), liquid humic acid (1.0 ml for each liter water) and algas (2.0 g per liter) significantly affected all parameter mentioned previously in both years (Tables 1, 2 and 3).

There were substantial differences in vegetative augmentation and yield, photosynthetic pigments and leaves ingredients traits of lettuce among all foliar spraying processings and control processing in both years. Foliar spraying lettuce plants by away of yeast extract at rate of 100 ml for each liter exceeded other foliar spraying processings and produced the highest values of the measurements in both years, except dry weight/plant and entire carbohydrates in the second season. Even as, foliar spraying lettuce plants by away of liquid humic acid at rate of 1.0 ml for each liter came in the second grade and followed by spraying by away of chitosan at rate of 2.0 g per liter and then spraying by away of algas at rate of 2.0 g per liter , whereas the highest values of nitrate and nitrite contents were resulted from control processing (without spraying) in both years.

These outcomes possibly ascribed to get better plant augmentation through supplying of plant nutrients and ecological health and soil productivity. Where, foliar application by away of yeast had stimulatory effects on cell division and enlargement as well plant augmentation due to its a wealthy resource of phytohormones, especially cytokinins, vitamins, enzymes, amino acids and minerals (Castelfranco and Beale, 1983). In addition, positive effects of humic acid on soil fertility and crop productivity owing to their unique physiochemical and biochemical properties, and play a vital role in establishing biotic and abiotic interactions within the plant rhizosphere, which was return on increases in plant augmentation traits. Also, chitosan has a strong positive charge and it attracts negatively charged molecules in addition, it stimulates plant augmentation . Algae products have been widely used as amendments in crop production systems due to the presence of a number of plant augmentation -stimulating

compounds. These outcomes were parallel by away of those reported by Kim *et al.* (2005), Hernandez *et al.* (2015), Abdel-Wahab (2018), Kopta *et al.* (2018), Raheem *et al.* (2018) and Xu and Mou (2018).

3. Effect of interaction:

The obtained results indicate that there was significant effect due to the interaction between irrigation water and foliar application processings on all studied traits of vegetative augmentation , output and ingredients in both years (Tables 1, 2 and 3).

The highest values of fresh and dry heaviness of plant, entire yield/fed, chlorophyll a, b and entire chlorophylls, TSS, entire carbohydrates, crude protein and entire sugars % , vitamin-C and vitamin-E contents and the lowest values of nitrate and nitrite contents of lettuce were resulted from irrigation lettuce plants by away of magnetized water in addition spraying two times by away of yeast extract at rate of 100 ml for each liter in both years (Tables 1, 2 and 3). Irrigation lettuce plants by away of magnetized water as well spraying by away of liquid humic acid at rate of 1.0 ml for each liter considered as the second best interaction processing, followed by irrigation lettuce plants by away of untreated water by away of magnetic field and spraying two times by away of yeast extract at rate of 100 ml for each liter in both years. While, irrigation lettuce plants by away of normal water without spraying by away of any processing resulted in the lowest values of measured traits and the highest values of nitrate and nitrite contents in both years.

Table 1. Fresh, dry heaviness/plant and entire yield/fed of lettuce as affected by water processings and foliar application processings as well as their interaction throughout 2016/2017 (1st) and 2017/2018 (2nd) years .

Traits		Fresh heaviness(g/plant)		Dry heaviness(g/plant)		Entire output (t/fed)	
Processings		1st	2nd	1st	2nd	1st	2nd
A- Water processings:							
Normal		472.0	494.3	42.00	57.32	13.302	13.345
Magnetic		492.9	510.8	42.13	58.33	13.419	13.785
F. test		*	*	NS	NS	*	*
B- Foliar application processings:							
Without		433.2	477.9	38.36	53.49	12.118	13.088
Yeast extract		545.3	540.0	47.87	61.62	14.720	14.577
Chitosan		458.4	481.8	39.49	56.80	12.880	13.062
Humic acid		534.7	534.4	45.68	63.09	14.435	14.427
Algas		440.5	478.8	38.94	54.14	12.648	12.670
LSD at 5 %		22.3	23.2	2.19	2.39	0.436	0.456
C- Interaction:							
	Without	434.9	446.3	36.28	49.66	12.043	12.050
	Yeast extract	542.7	535.6	47.97	63.11	14.650	14.457
Normal	Chitosan	436.1	490.8	40.44	58.62	12.970	13.247
	Humic acid	526.8	528.0	43.26	58.68	14.220	14.253
	Algas	419.5	449.4	37.70	52.43	12.057	12.130
	Without	446.2	472.9	38.17	54.54	12.193	12.093
	Yeast extract	548.0	551.9	48.10	67.51	14.790	14.900
Magnetic	Chitosan	480.6	511.2	40.81	58.97	13.240	14.127
	Humic acid	542.6	533.3	47.78	60.13	14.650	14.397
	Algas	446.9	506.4	40.19	54.63	12.790	13.993
LSD at 5 %		28.5	33.5	6.33	7.01	0.438	0.478

Table 2. Chlorophyll a, b and entire chlorophylls in lettuce leaves as affected by water processings and foliar application processings as well as their interaction throughout 2016/2017 (1st) and 2017/2018 (2nd) years .

Traits		Chlorophyll a (mg/g FW)		Chlorophyll b (mg/g FW)		Entire chlorophylls (mg/g FW)	
Processings		1st	2nd	1st	2nd	1st	2nd
A- Water processings:							
Normal		0.577	0.626	0.406	0.449	0.984	1.075
Magnetic		0.604	0.642	0.431	0.464	1.035	1.106
F. test		*	*	*	*	*	*
B- Foliar application processings:							
Without		0.569	0.597	0.401	0.425	0.970	1.022
Yeast extract		0.613	0.666	0.436	0.485	1.050	1.152
Chitosan		0.590	0.639	0.419	0.462	1.009	1.100
Humic acid		0.602	0.652	0.427	0.471	1.029	1.124
Algas		0.578	0.615	0.410	0.440	0.989	1.055
LSD at 5 %		0.006	0.007	0.006	0.005	0.006	0.007
C- Interaction:							
	Without	0.555	0.593	0.389	0.420	0.944	1.013
	Yeast extract	0.601	0.656	0.424	0.479	1.035	1.135
Normal	Chitosan	0.577	0.631	0.406	0.452	0.982	1.083
	Humic acid	0.590	0.638	0.414	0.460	1.005	1.098
	Algas	0.564	0.612	0.399	0.437	0.963	1.048
	Without	0.583	0.601	0.412	0.430	0.995	1.031
	Yeast extract	0.626	0.677	0.449	0.492	1.075	1.169
Magnetic	Chitosan	0.604	0.646	0.432	0.471	1.024	1.118
	Humic acid	0.614	0.666	0.440	0.483	1.054	1.149
	Algas	0.593	0.619	0.422	0.444	1.014	1.063
LSD at 5 %		0.010	0.011	0.008	0.008	0.011	0.015

Table 3. TSS (TSS), entire carbohydrates, crude protein, entire sugars % , vitamin-C (VC), vitamin-E (VE), nitrate (NO_3-N) and nitrite (NO_2-N) contents in lettuce leaves as affected by water processings and foliar application processings as well as their interaction throughout 2016/2017 (1st) and 2017/2018 (2nd) years .

Traits / Processings		TSS (%)		T. carbohyd -rates (%)		C. protein (%)		T. sugars (%)		VC (mg /100 g FW)		VE (mg /100 g FW)		NO_3-N (ppm)		NO_2-N (ppm)	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
A- Water processings:																	
Normal		3.66	4.20	8.89	10.60	3.66	5.26	4.97	5.52	16.14	16.83	0.193	0.177	205.7	197.0	2.115	2.193
Magnetic		5.14	4.49	10.13	10.68	4.38	6.15	5.37	5.87	18.05	18.40	0.221	0.197	177.8	170.2	1.721	1.393
F. test		*	*	*	NS	*	*	*	*	*	*	*	*	*	*	*	*
B- Foliar application processings:																	
Without		4.20	3.73	8.59	9.39	2.71	3.58	4.75	5.16	15.85	14.00	0.178	0.145	203.4	194.7	2.058	2.097
Yeast extract		4.55	4.94	10.41	11.37	5.24	7.53	5.60	6.24	18.20	20.75	0.238	0.225	179.9	172.8	1.723	1.472
Chitosan		4.45	4.39	9.47	10.58	3.98	5.96	5.17	5.75	17.23	18.08	0.206	0.193	192.5	186.2	1.983	1.877
Humic acid		4.44	4.66	10.03	11.95	4.70	6.73	5.38	6.00	17.75	19.45	0.220	0.208	185.9	177.9	1.805	1.630
Algas		4.36	4.01	9.04	9.91	3.47	4.72	4.95	5.33	16.46	15.81	0.193	0.166	197.0	186.3	2.022	1.892
LSD at 5 %		0.13	0.10	0.10	0.16	0.30	0.35	0.16	0.18	0.67	0.79	0.007	0.005	3.6	3.1	0.089	0.078
C- Interaction:																	
	Without	3.49	3.66	8.04	9.27	2.36	3.37	4.54	4.92	14.90	13.56	0.165	0.140	217.6	208.4	2.233	2.503
	Yeast extract	3.83	4.78	9.69	11.10	4.92	7.02	5.41	6.12	17.20	19.93	0.222	0.214	193.3	186.3	1.887	1.890
Normal	Chitosan	3.64	4.22	8.92	10.31	3.62	5.52	4.96	5.55	16.33	17.13	0.192	0.180	206.3	196.7	2.323	2.187
	Humic acid	3.77	4.40	9.33	12.55	4.27	5.92	5.18	5.77	16.76	18.16	0.206	0.193	199.5	191.3	1.987	2.030
	Algas	3.58	3.93	8.46	9.79	3.14	4.46	4.75	5.25	15.53	15.36	0.180	0.160	211.6	202.2	2.147	2.357
	Without	4.92	3.80	9.13	9.52	3.06	3.79	4.96	5.41	16.80	14.43	0.192	0.149	189.3	181.0	1.883	1.690
	Yeast extract	5.26	5.10	11.14	11.64	5.56	8.05	5.79	6.37	19.20	21.56	0.254	0.235	166.4	159.4	1.560	1.053
Magnetic	Chitosan	5.08	4.55	10.02	10.85	4.35	6.40	5.38	5.94	18.13	19.03	0.220	0.205	178.8	175.7	1.720	1.597
	Humic acid	5.12	4.92	10.72	11.36	5.14	7.55	5.58	6.24	18.73	20.73	0.234	0.223	172.4	164.6	1.623	1.230
	Algas	5.33	4.08	9.63	10.04	3.79	4.98	5.16	5.41	17.40	16.26	0.206	0.172	182.3	170.4	1.820	1.397
LSD at 5 %		0.25	0.15	0.16	0.24	0.40	0.37	0.19	0.22	0.89	0.91	0.008	0.10	4.8	4.0	0.108	0.090

CONCLUSION

From obtained results of that study, it can be concluded that irrigation lettuce plants by away of magnetized water in addition spraying two period after 60 and 80 days from transplanting by away of yeast extract (100 ml for each liter) or liquid humic acid (1.0 ml for each liter) in order to obtain high augmentation , output and ingredients of lettuce Balady cultivar over the ecological circumstances of Mansoura district, Dakahlia Governorate, Egypt

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تأثير الري بالماء الممغنط والرش الورقي ببعض المنشطات الحيوية على إنتاجية وجودة الخس

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لقد أجريت تجربتان حقليتان فى محطة التجارب والبحوث الزراعية بكلية الزراعة – جامعة المنصورة لموسمى 2016/2015 و 2017/2016 لدراسة تأثير الري بالماء الممغنط (الرى بالماء العادى والرى بالماء الممغنط) والرش الورقي ببعض المنشطات الحيوية (بدون رش ورقي والرش بمستخلص الخميرة (100 مل / لتر ماء)، الشيتوزان (2 جم / لتر ماء) ، حمض الهيومك (1.0مل / لتر ماء) والطحالب (2.0 جم ماء / لتر) وكذلك التفاعل بينهما على النمو والمحصول ومكوناته والتركيب الكيميائي وصفات الجودة للخس (الصنف البلدى) تحت ظروف المنصورة، محافظة الدقهلية، مصر. وقد أجريت التجربة في تصميم الشرائح المتعامدة فى ثلاث مكررات. وتشير النتائج المتحصل عليها أن أقصى القيم لصفات ارتفاع النبات ، عدد الأوراق / نبات ، الوزن الطازج للأوراق النبات ، قطر النبات ، قطر الساق ، الوزن الطازج والجاف للنبات ، المحصول الكلي / فدان ، كلوروفيل أ ، ب والكلوروفيل الكلي ، محتوة النيتروجين ، الفوسفور ، البوتاسيوم ، النسبة المئوية المواد الصلبة الذائبة الكلية ، الكربوهيدرات الكلية ، البروتين الخام ، السكريات الكلية ، محتوي فيتامين C وفيتامين E ، وكذلك أدنى القيم لمحتوي الصوديوم والكالسيوم والنترات والنتريت نتجت من ري نباتات الخس بالماء الممغنط في كلا الموسمين. تفوقت نباتات الخس التى تم رشها ورقياً بمستخلص الخميرة (100 مل / لتر ماء) رش على معاملات الرش الورقي الأخرى تحت الدراسة وأنتجت أعلى القيم للصفات المذكورة سابقاً وأدنى القيم أيضاً لصفات محتوي الصوديوم والكالسيوم والنترات والنتريت في كلا الموسمين. توصى نتائج هذه الدراسة برى نباتات الخس الصنف البلدى بالماء الممغنط بالإضافة إلى الرش الورقى مرتين بعد 60 و 80 يومًا من الشتل بمستخلص الخميرة (100 مل / لتر) أو حمض الهيومك السائل (1.0 مل / لتر ماء) من أجل الحصول على أفضل النتائج لصفات النمو الخضري ، المحصول ومكوناته، المكونات الكيميائية بالأوراق وصفات جودة الأوراق تحت الظروف البيئية بمنطقة المنصورة ، محافظة الدقهلية ، مصر.